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POUR
L'EXPLORATION ET LA
CONSERVATION DE LA NATURE

LEOPOLD III-FONDS
VOOR
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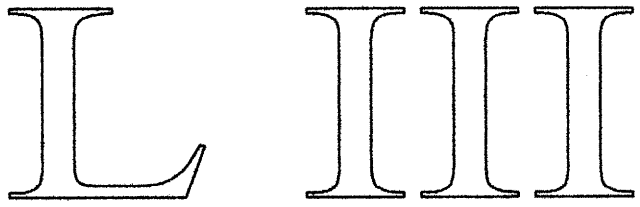
EN NATUURBEHOUD



ACTIVITES DE L'EXERCICE 1999

ACTIVITEITEN TIJDENS HET DIENSTJAAR 1999

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TABLE DES MATIERES - INHOUDSTAFEL

1. Subsides pour recherches à l'étranger
Toelagen voor onderzoekingen in het buitenland

Au cours de l'exercice 1999, le Fonds Léopold III a subsidié six chercheurs dont les rapports succincts sont repris ci-dessous.

In de loop van het dienstjaar 1999 heeft het Leopold III-Fonds aan zes onderzoekers toelagen verstrekt. Hierna volgen hun beknopte verslagen.

1.1. Dhr. J. DUPAIN & Dr. L. VAN ELSACKER (KMDA & UIA)

Bonobo in-situ project, een lange-termijngedragsstudie van bonobo's in het wild, Dem. Rep. Congo.
1995 - ...

Eerste verslag, zie het activiteitenverslag dienstjaar 1998. Het volgende verslag is in voorbereiding.

1.2. Prof. M.C. MILINKOVITCH & Dr J.R. POWELL (ULB & Yale University, Ct, USA)

Génétique des populations des tortues géantes des Galápagos.
Mission scientifique aux Iles Galápagos.
5 janvier - 5 février 1999

Nous avons été récemment approchés par un ancien collaborateur (le Professeur Jeffrey R. Powell, de l'Université de Yale, CT, USA) qui a initié un vaste projet d'analyse des populations des tortues géantes des Galápagos (*Geochelone nigra*). Le Professeur Jeffrey Powell nous a confié la prise en charge d'un volet considérable de ce projet : l'isolement et la caractérisation de marqueurs microsatellites chez cette espèce.

L'équipe du Professeur Powell a effectué de nombreux prélèvements sanguins aux Galápagos ces trois dernières années. Cependant, la caractérisation précise de marqueurs polymorphes pour toutes les populations considérées nécessitait deux campagnes supplémentaires de prélèvement. Suite à l'octroi par le Fonds Léopold III pour l'Exploration et la Conservation de la Nature d'un subside permettant de couvrir nos frais de transport, un de mes étudiants et moi-même avons effectué du 5 au 25 janvier 1999 la première de ces campagnes de prélèvements sur les îles Galápagos. Nous étions accompagnés du Dr. James Gibbs, membre de l'équipe du Professeur Powell. Cette campagne fut couronnée de succès puisque nous avons pu échantilloner plus de deux cents tortues sur quatre sites différents et deux îles (Santa Cruz et Santiago). Il ne reste donc plus que deux sites (Darwin et Wolf sur l'île d'Isabella) à prélever pour que l'échantillonage couvre l'entièreté des sites nécessaires à une étude exhaustive de la génétique des populations de *G. nigra*. Les sites Darwin et Wolf sont particulièrement difficiles et feront donc l'objet d'une campagne de prélèvements ultérieurs (par nos collègues américains ou par nous-même).

Tous les animaux pour lesquels nous avons prélevé du sang ont également été mesurés et localisés par « *Global Positioning System* » (GPS). Ces données pourraient nous être d'une grande utilité lors des analyses de distribution des génotypes inférés par l'utilisation de marqueurs microsatellites.

L'isolement de ces marqueurs est en cours dans mon laboratoire et nous entamerons bientôt la caractérisation de leur polymorphisme.

1.3. Dr J. MALLEFET, S. DUPONT & Y. DEWAEL (UCL)

Physiologie de la bioluminescence chez les échinodermes: aspects comparatifs. Laboratoire Arago, Banyuls-sur-Mer, France.
2 séjours en 1999

- **1er séjour**

Malgré une météo assez défavorable (coup de vent, force 8-9) notre planning de récolte en plongée fut bien respecté grâce à la compétence des marins et aux moyens à la mer mis à notre disposition par la station Arago. Les plongées suivantes (voir tableau ci-dessous) furent effectuées afin de récolter les deux espèces d'ophiures lumineuses, *Ophiopsila aranea* et *Amphipholis squamata*. En outre, des dragages profonds ont permis de récolter d'autres organismes bioluminescents (*Pennatula rubra, Pteroides spinosa, Veretillum cynomorium*); tous ces organismes sont actuellement étudiés au laboratoire de Louvain-la-Neuve.

Date	Site de plongée	Profondeur	Temps
5-2-99	Sainte Catherine sous Béart	21.9 m	40 min.
5-2-99	Sainte Catherine sous Béart	24.7 m	36 min.
7-2-99	Port de Banyuls	8.2 m	50 min.
8-2-99	Sainte Catherine sous Béart	24.5 m	42 min.
8-2-99	Sainte Catherine sous Béart	22.8 m	36 min.
9-2-99	Oulestrelle	25.5 m	36 min.
9-2-99	Oulestrelle	23.1 m	30 min.

Les résultats des recherches réalisées sur l'ophiure *Amphipholis squamata* ont déjà été analysés et un bref rapport est fourni ci-dessous.

1. Amphipholis squamata

Une nouvelle population de l'ophiure lumineuse et polychromatique *Amphipholis squamata* a été découverte à proximité de l'observatoire océanologique de Banyuls-sur-mer. Une caractérisation des paramètres éco-physiologiques (capacités lumineuses, traits d'histoire de vie, etc.) a été entreprise dans le cadre du doctorat de Samuel Dupont consacré à l'utilisation de la bioluminescence pour étudier la microévolution chez les ophiures. Cette population a attiré notre attention pour diverses raisons : d'une part, il s'agit de la première population méditerranéenne ouverte sur la mer a être étudiée; d'autre part, des études génétiques préliminaires indiquent une grande variabilité sur de courtes distances. Les résultats obtenus sur cette population permettront de mieux comprendre les mécanismes impliqués dans la structuration génétique de l'espèce.

Les blocs de *Corallina* contenant les ophiures ont été récoltés en plongée entre 3 et 5 m de profondeurs en 2 stations séparées de 10 m l'une de l'autre. Les ophiures ont été ensuite triées en laboratoire où la mesure des capacités lumineuses a été réalisée à l'aide d'un photomultiplicateur; différents paramètres (taille, coloration, etc.) ont également été relevé sous loupe binoculaire.

Quatre variétés de couleur ont été observées dans cette population : la beige (Be), la brun foncé (F), la noire (N) et la tigrée (T). De plus, chacune de ces variétés produit de la lumière selon une intensité lumineuse qui lui est propre. Cependant de grandes différences ont été observées entre les deux stations de récoltes. Les ophiures sont présentes en densité plus élevée dans la première station de récolte : 181,2 individus par litre d'algue à la première station, contre 112,5 individus/l à la seconde station.
En moyenne, les ophiures de la seconde station de récolte produisent une lumière significativement ($p < 0,001$) plus intense que celles de la première station : 968,44 ± 46,74 Mq/s.mm à la première station contre 1620,85+134,46 Mq/s.mm à la seconde station.

Les différentes variétés sont présentes en proportions différentes dans les deux stations de récoltes (Figure 1). Il est intéressant de remarquer que la variété la plus fréquente à la première station est celle qui produit de la lumière la moins intense, alors que la variété produisant le plus de lumière domine à la seconde station.
Ces résultats confirment ceux obtenus au niveau génétique puisqu'une grande variabilité entre deux stations proches est également observée au niveau des capacités lumineuses.

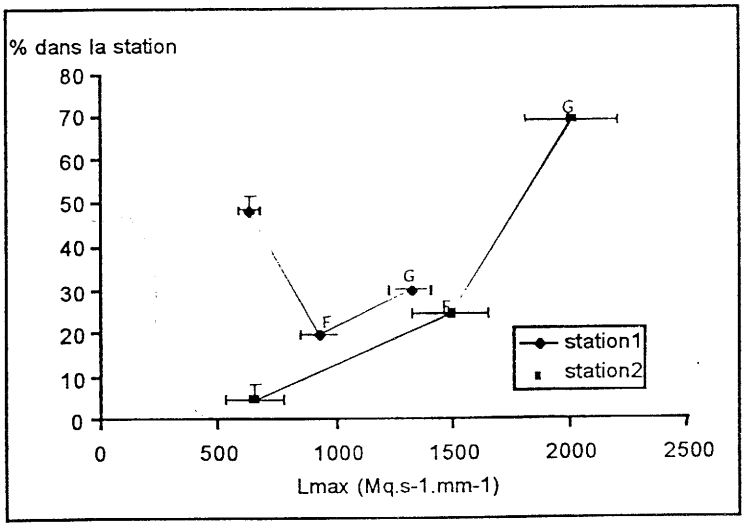


Figure 1
Relation entre l'intensité maximale (Lmax±SEM en Mq/s.mm) de chaque variété de couleur et la fréquence dans la population. Comparaison entre les 2 stations de récolte. (T, variété tigrée ; F, variété brune foncée et G, variété grise).

➢ 2ème séjour

Notre planning de récolte en plongée fut bien respecté grâce à la compétence des marins et aux moyens à la mer mis à notre disposition par la station Arago. Les plongées suivantes (voir tableau ci-dessous) furent effectuées afin de récolter les deux espèces d'ophiures lumineuses, *Ophiopsila aranea* et *Amphipholis squamata*. En outre, des dragages profonds ont permis de récolter d'autres organismes bioluminescents (*Pennatula rubra, Pteroides spinosa, Veretillum cynomorium*); tous ces organismes sont actuellement étudiés au laboratoire de Louvain-la-Neuve.

Les ophiures appartenant à l'espèce *Ophiopsila aranea* sont récoltées en plongée par 20 à 27 mètres de fond sur les sites proches du laboratoire Arago (voir, ci-dessous, le relevé des plongées effectuées). Des blocs de corraligène sont prélevés à l'aide d'un marteau et d'un burin; ils sont ensuite remontés en surface grâce à l'utilisation d'un parachute de levage. Les blocs sont stockés sur le pont du bateau et

transférés à la station Arago où ils sont maintenus dans des bacs contenants de l'eau de mer stagnante. Ce traitement induit, endéans les 12 à 24 heures, la sortie des ophiures enfuis dans le corraligène. Les ophiures sont alors placées dans des bidons de 30 litres alimentés en continu avec de l'eau de mer. Après une semaine de récolte, un stock d'environ 150 à 200 ophiures est constitué; ces animaux sont ramenés au laboratoire de physiologie animale de l'Université catholique de Louvain. Lors du trajet (10 heures en voiture) la température de l'eau est légèrement refroidie grâce à des blocs réfrigérants et l'eau est continuellement oxygénée, traitement qui assure une bonne survie des specimens récoltés. Les ophiures sont ensuite placées dans les aquariums du laboratoire de Physiologie animale dans lesquels circulent en circuit fermé de l'eau de mer naturelle; les paramètres physico-chimiques (T°, pH, S‰, NO2, NO3,...) de cette eau sont régulièrement contrôlés.

Date	Site de plongée	Profondeur	Temps
21-8-99	Banyuls	10 m	55 min.
23-8-99	Oulestrelle	27 m	35 min.
23-8-99	Oulestrelle	26 m	30 min.
24-8-99	Oulestrelle	27 m	40 min.
24-8-99	Oulestrelle	25 m	30 min.
25-8-99	Oulestrelle	26 m	45 min.
25-8-99	Oulestrelle	25 m	40 min.
26-8-99	Oulestrelle	27 m	35 min.

La caractérisation des paramètres éco-physiologiques (capacités lumineuses, traits d'histoire de vie, etc) de la population de l'ophiure *Amphipholis squamata* a été réalisée. Les blocs de *Corallina* contenant les ophiures ont été récoltés en plongée entre 3 et 5 m de profondeur en 4 stations séparées de 10 m l'une de l'autre. Les ophiures ont été ensuite triées en laboratoire où la mesure des capacités lumineuses a été effectuée à l'aide d'un photomultiplicateur; différents paramètres (taille, coloration, etc.) ont également été relevé sous loupe binoculaire. L'analyse des résultats est en cour; signalons que des échantillons ont été congelés en vue de l'étude de la variabilité génétique d'*Amphipholis* par PCR-RAPD.

1.4. Dr. E. VERHEYEN (KBIN)

Fieldwork to study the effect of excessive sedimentation on endemic rock-dwelling cichlid fishes from Lake Tanganyika, Africa: an approach based on conservation genetics. Zambia and Tanzania.

5 weeks in April-May 1999

Introduction

With its estimated age between 9-20 Myr, Lake Tanganyika is by far the oldest East African rift lake. This lake harbours an extraordinary diversity of endemic organisms and its cichlid fish fauna is morphologically, ecologically and behaviourally the most diverse species flock of the African lakes. The rapidly increasing growth of the human population around the lake has meant that its unique freshwater ecosystem is threatened not only by resource overexploitation, such as the depletion of its fish stocks by overfishing, but also by industrial and agricultural pollution (fertilisers, pesticides), and excessive amounts of sedimentation caused by deforestation. As a result of these environmental changes, water quality may soon deteriorate to a degree that

threatens the survival of the unique endemic fish and invertebrate species flocks of the lake, particularly along its extremely species rich rocky littoral habitats.
It is in this context that the fieldwork carried out during this mission was planned and carried out. Most of the time was devoted to setting up an experiment aimed at observing the effects of sedimentation on rock-dwelling organisms. The organisms targeted by this study are the typical rock-dwelling organisms [cichlid fishes, spiny eels and invertebrates (e.g. gastropods)] of the undeep water habitats of Lake Tanganyika.

Activities

The experiment
The negative effects of sedimentation on this fauna are usually evaluated by comparing the species compositions and species abundances in 'naturally' impacted versus 'naturally' unimpacted sites, or by monitoring faunal changes in an environment that is gradually being exposed to more sedimentation. The experimental approach of our study intends to evaluate the effects of increased sedimentation on rock-dwelling fishes and invertebrates by comparing how fast these animals recolonise habitats that are artificially impacted by the introduction of a layer of sandy sediment that in the course of the experimental period will gradually be washed away.
Three comparable experimental sites (where sediment was added) were selected as well as three control sites of $25m^2$ (5x5m) each. Prior to the experiment an inventory of the target organisms was made by visual inspection during about 30 minute long dives that in principle were performed by two divers at the time. These preliminary dives were used to test the ability of the various BIOSS (Biodiversity Special Study) and SSS [Special Study on Sediment (and its consquences)] team members to identify and quantify the target species correctly. The conclusion of this experiment was that the knowledge of the SSS members is insufficient to yield reliable observations. However, the observations of the BIOSS members appear to be reliable for most of the identified taxa. However, even then some species were consequently given different names by different divers. This question was addressed through Rueben Shapola, who was clearly the diver with the most extensive taxonomical knowledge of the BIOSS team. Nevertheless, even Rueben Shapola repeatedly reported the presence of the species *Tanganicodus irsacae*, a species I known does not occur in the Zambian part of the lake.
The protocol to catch all fishes from a given site prior to the beginning of the experiment was as follows: we carefully placed the 30 meter long gill net with 10 mm mesh size around the site and slowly closed the net around the fishes present. Since we found that the removal of all fishes from a site proved to be very difficult, the planned removal of the fishes with gill nets was attempted three times (impacted sites), and subsequenly abandoned (control sites). The reason for this is that the rocky underground of the experimental sites contains so many holes and crevices that many (if not most) of the real rock dwelling species were able to hide and thus escape capture. Alternative methods of capture could not be attempted due to the lack of time, i.e. the Silver Shoal - that we needed to be able to transport the sand bags from the shore to the experimental sites - was only available for one week. Therefore, the planned inventory of the faunas of each site and comparison of species composition (samples for genetic studies on *Eretmodus cyanostictus*, *Tropheus moori* and *Variabilichromis moori*), size distributions in all species, weight per species and total weight as a measure of the carrying capacity of each surface of $25m^2$ were not possible, except for the mollusc study of Ian, for whom we were able to collect virtually all the snails from each site prior to the experiment.
We did not consider the fact that the fishes could not be removed from the sites as a major problem for the success of the experiment itself since the placement of the sandbags seemed to effectively scare away many fishes: the 90 sandbags/site were left on the site overnight before the

sediment was actually spread out over the rocky bottom. Therefore the whole surface of each site was not only effectively covered during that time, but the water was also so murky that it was considered unlikely that the target species would remain on the 'impacted' site for 24 hours.
After the sediment was spread out over the sites the effects on the artificially added sediment on the presence, abundance and behaviour (breeding) of the target species was monitored by visual inspection of the plots at days 2, 4, 7, 10, 14, 21, 28, after the start of the experiment and this monitoring is planned to be continued on a monthly basis.
During the prospective monitoring prior to the experiment itself we noticed that the number of species (and number of fishes/surface area) was influenced by the time of day the monitoring took place. Therefore, it was judged important that the monitoring should take place between 9 and 12 a.m. when the fishes appear to be more active and easily spotted and identified. Unfortunately we were not able to follow this time schedule due to unforeseen problems. In some cases we could not start the monitoring before 12 a.m. because of technical problems (engine, fuel, regulators, vests) but even more often because of the non-availability of the BIOSS and SSS team members on Saturday and Sunday mornings.
Obviously, the duration of the recolonisation of the impacted sites was unknown at the start of the experiment. From our observations at the end of our stay in Mpulungu, it appears that the experimentally added sediment will not wash away at the same rate from each site. At the end of our stay the situation was as follows: on two sites all the added sediment still covered the rocky surface, but in one site the sediment had washed away and about 50% of the rocky surface was exposed as it was prior to the start of the experiment.

Genetic sampling
The genetic sampling of the designated key taxon *Eretmodus cyanostictus*, in the test and control plots prior to and after the experiments and monitoring period finclips was not done because of the problems with the removal of all fishes from the experimental sites. However, I was able to sample some localities in detail for population genetic comparisons with the Congolese populations that we already studied with mtDNA sequences and microsattelites. It is a fine grained programme between Katoto Bay and the mainland at Mbete Island (east of Mpulungu). I was able to collect sufficient specimens to evaluate how genetic distance: Geographic distance is affected by the nature of the coastline (rocky versus sandy) between the sampling points. This information will show us if these rock dwellers actually migrate with the same ease over rocky or sandy streches of shoreline. The amount of genetic variability in populations collected in areas where the impact can be assumed to be more important than in pristine Congolese populations will give us an indication if, and eventually how, the impact of sedimentation affects the genetic variability in natural populations.

Planning
The planning for the field experiment is straightforeward. The success of this experiment depends to a large extent on the results obtained by the BIOSS and SSS team members in our absence. If they produce reliable results during the next six months, it would certainly be worthwile to repeat the experiment later this year to increase the number of replicates in this study, but also to avoid some of the practical problems that we encountered during the first experiment (see above).
If we can repeat the experiment and continue the monitoring of the control sites for another six months I am confident that interesting results may follow. I also think that it may be possible that we may not only detect the direct influence of impact by the artificially added sedimentation. The comparison of the number of species and the number of fishes /surface area with similar observations in other parts of the lake by the Japanese research teams (Uvira, Mahale) may give an indication how this measure of the biodiversity on rocky shores biodiversity in differs in these

parts of the Lake Tanganyika, and eventually, how these differences may be linked to environmental factors such as sedimentation.
Concerning the genetics work in the laboratory of the Royal Belgian Institute of Natural Sciences, I can say that most of the sequencing and microsatelite data should be available in January 2000. The analysis and interpretation of these results are summarized in the manuscript: **'Microsatellite markers reveal high levels of stenotopy and strong evidence of isolation by distance in *Eretmodus cyanostictus*, in a rock-dwelling cichlid from Lake Tanganyika, Africa'.** By Martin TAYLOR and Erik VERHEYEN. The abstract is given hereafter.

Abstract
Microsatellite markers were used to investigate fine scale genetic substructuring in *Eretmodus cyanostictus*, a rock-dwelling cichlid from Lake Tanganyika, Africa. The overall F_{ST} value was high (F_{ST}=0.098, $P < 0.001$). Significant correlations of genetic substructuring and geographic distance were found for both populations separated by barriers and those that were not. Genetic diversity was found to be lower than that found in populations inhabiting more steeply sloping shorelines. In contrast with the rock-dwelling species surveyed from Lake Malawi, *E. cyanostictus* does not appear to require physical barriers between populations to prevent migration.

1.5. Dr K. VAN WAEREBEEK & Dr P.K. OFORI-DANSON (Peruvian Center for Cetacean Research Lima, Peru.-Water Research Institute, Council for Scientific and Industrial Research, Achimota, Ghana)

Exploratory survey of cetaceans and their interactions with fisheries in Ghana and Togo, the Gulf of Guinea, Final Report. March 1999.
1997- 1999

Abstract

Present project revealed the presence of six cetacean species in coastal waters of Ghana: five odontocetes; i.e. clymene dolphin *Stenella clymene*, rough-toothed dolphin, *Steno bredanensis*, bottlenose dolphin *Tursiops truncatus*, dwarf sperm whale *Kogia simus* and the sperm whale *Physeter macrocephalus*, and the humpback whale *Megaptera novaeangliae*. All were first confirmed species records for Ghana. Surprisingly, we found no evidence for the presence of the Atlantic hump-backed dolphin *Sousa teuszii* ; either it has become rare or it does not occur off Ghana. Indeed, unrestrained coastal development may pose a threat to nearshore species. A stranded humpback whale calf raised questions about the breeding stock involved. Regular and year-round by-catches of small cetaceans are documented in artisanal gillnet fisheries operating from Apam, Jamestown (Accra), Kpone and Winneba. At Apam, drift gillnet fishermen intentionally capture dolphins with sharks and tuna. Annual takes at Apam and Jamestown probably count in the low hundreds, higher than at Kpone and Winneba. Bottlenose dolphins are also known to be taken in semi-industrial purse-seines (Jamestown). Carcasses are not filleted, but hacked into small portions including bone, and retailed locally for human consumption. This helps explain why beach-combing around fishing villages did not yield any findings of skeletal parts. There were no signs of a large-scale commerce, however the potential exist that the dolphin exploitation expands. It remained unclear from interviews whether any significant by-catches occurred in Togo waters. Field research and monitoring effort in both countries should be continued and expanded.

Introduction

The exploitation of marine resources in West Africa is irregular but is increasing with the growth of the population and the economic crisis that is enveloping many African countries: as more food is needed, people are looking to the sea to supply their needs (Maigret, 1994). In developing nations around the world, besides fish, crustaceans and molluscs, by-caught dolphins are consumed as a source of mammalian protein (IWC, 1994). Interactions between fisheries and marine mammals off West Africa have hardly been explored, except to some degree in Senegal and The Gambia (Van Waerebeek, 1999). No mortality estimates are available for any country of the region.

Paucity of data on cetaceans and fishery impact from the Gulf of Guinea is extreme (see Mitchell, 1975; Northridge, 1984). A review for Ghana, Togo, Benin, Nigeria, Cameroon, Equatorial Guinea, Sao Tome and Principe, Gabon and Congo-Brazzaville (Maigret, 1994) yielded no details of possible dolphin captures. Off Ivory Coast dolphins of the genera *Tursiops*, *Stenella*, *Delphinus* and *Steno* were reported captured in nets at unknown levels in the 60s and 70s (Cadenat, 1959; R.L. Brownell *in* Mitchell, 1975). According to Maigret (1994) dolphins are caught incidentally in a driftnet fishery for tunas, swordfish and sharks since 1983. However, as catches of marine mammals are prohibited in the Ivory Coast, dolphins are not declared but are consumed by fishermen or buried on the beach. The issue has not been further investigated. The well-documented case of a live-stranded false killer whale *Pseudorca crassidens* in Gabon in July 1992, which eventually was butchered (Van Waerebeek and De Smet, 1996) is the most recent indication that cetaceans continue to be utilized for human food at least in some parts of the region, whenever they become available.

Ofori-Danson and Agbogah (1995) provided some baseline information from Ghanaian waters. This gave rise to a working paper (Ofori-Danson and Odei, 1997) presented to the International Whaling Commission's Scientific Committee meeting in 1997 in Bournemouth. It suggested that dolphins may be taken with some regularity in Ghana, but uncertainty existed about the species involved. KVW proposed to extend the 1997-98 CMS/UNEP initiative for small cetacean research in Senegal, The Gambia and Guinea Bissau (Van Waerebeek, 1999) and organise to provide technical support to biologists in Ghana and Togo as to improve data collection on dolphins and whales. Here we report on the initial results of this collaboration.

Occasionally (1-5 years interval) whales become stranded along the Ghanaian coast (Irvine, 1947; Ofori-Adu, 1987). Normally the stranded whale is left to rot and the bones are later collected and placed under surveillance in shrines. The animal is therefore revered and accordingly treated as a 'god' by some local coastal communities. Therefore, local whaling is therefore not practiced (Irvine, 1947). Since the occurrence is rather infrequent no one cares to take proper records of the stranded animal. Generally a stranded whale is regarded by the local fishermen as an object of veneration or sacredness, so that whenever a whale is washed ashore a religious ceremony is performed and is regarded to be a sign of good omen – like signifying a bumper season for the unsuing fishing season (Ofori-Adu, 1987). Usually donations in cash and in kind are made to the chief priest or the chief fisherman by all the fishermen in that locality. A goat and some drinks (schnapps) are bought and together with other items the chief priest performs some rituals at the site where the carcass lies. After the ceremonies, people are allowed to cut pieces of the dead animal's flesh from which oil is extracted for use in their homes as potent ointment for ailments.

Some of the baleen plates are also removed by the chief priest for use generally as precious ornaments in their homes and shrines (Ofori-Adu, 1987).
Strandings of whales may not be as rare as supposed (e.g. Fig.1); but possibly a good percentage of such strandings may go unreported

Methods

The first author worked in Ghana and Togo in May-June 1998 with time divided between awareness building and field work. Officials in ministries and universities concerned with wildlife and fisheries management (see Appendix 2) were visited and the importance of marine mammal conservation and research was explained.
In Ghana, we surveyed four fishing communities based on former insights as where dolphins were most likely landed: Jamestown (05°33'N, 00°13'W) near Accra, Kpone (05°40'N, 00°05'E), Apam (05°15'N, 00°43'W) and Winneba (05°20'N,00°37'W). After the KVW's departure, the principal investigator in Ghana, Dr. P.K. Ofori-Danson (POD), aided by some assistants, continued periodical monitoring of landing sites.

Dolphins are known locally under various names such as *Atui, Ati, Adii, Adanseke, Fumelokloui,* and *Atakpe*. Unlike large whales, dolphins are more often sighted at sea by local fishermen and are therefore more familiar animals. Interviews were conducted by POD, if possible in a local language as to minimize distrust.
It was attempted to gather a minimum set of data. Of freshly landed dolphins, the standard length (SL) was measured, the weight taken, number of teeth counted and photos were taken. Heads or skulls and skin samples (in 20% DMSO or 70%EtOH) were obtained as voucher data for species identification. More detailed data can not be obtained unless the animals are bought. Specimens are deposited at the Water Research Institute (WRI), Accra.

Fisheries

Fisheries in Ghana
Fishing, perhaps, is the most important economic activity in the coastal zone, in terms of number of people involved directly as well as dependent on it. A survey conducted in 1992 estimated the number of canoes operating in the artisanal sector at 8,688, and the average number of fishermen at 97,500. There are 306 landing sites along the 550km length of the Ghana coastline (Koranteng *et al.*, 1993; Armah *et al.*, 1996).
Currently, there are 156 semi-industrial vessels operating from eight landing sites along the coastline. The estimated number of semi-industrial fishermen is 6,500. The number of industrial trawlers in 1995 was 40 while that of shrimpers 17. The number of industrial fishermen is estimated to be 2,000 (Armah *et al.*, 1996). A total of some 8,840 MT of fish (both frozen and cured) were exported from Ghana in 1994 and the fisheries sub-sector accounts for about 3% of Ghana's GDP. Thus, the socio-economic pressures from the fisheries sector are quite high. The demersal fish stocks certainly are overfished judging from the dwindling size of the species being landed (Armah *et al.*, 1996).

Fisheries in Togo
Little has been published on Togo fisheries, partly because they are not well-developed due to a narrow continental shelf. The artisanal fishery is concentrated around the capital city Lomé. About 80% of fishermen are Ghanaian (Maigret, 1994). The pirogues use two types of net: (1) *awli* nets that resemble a ring-net without rope and are 400-1,000m long by 30-50m deep, with 25mm

mesh; (2) gillnets or *tonga*, made with 2-5 panels of about 3m in length with mesh size varying from 25mm at the top to 100mm at the bottom (Weigel, 1984; not seen, *in* Maigret, 1994).

Monitoring of ports and landing sites

Fish landings are monitored by official fisheries inspectors at a selected number of ports, however cetacean catches are not usually noted. From talks with Mrs. Anang, Director of Research and Utilization Branch at the Fisheries Department (Ministry of Agriculture), Tema, it appeared this could be amended fairly easily. Mr.Ofori-Adu (Fisheries Department, Tema) holds unpublished notes of dolphin catches at Apam (pers.comm. to KVW, 8 June 1998). F.X. Bard (pers.comm. to Maigret, 1994) provided an isolated account of an unidentified dolphin caught in Dixcove, western Ghana, in May 1988. Observations made by the authors during exploratory, shore-based surveys are indicated below. In Lomé, Togo, not enough time was available for port surveying, but talks were had with officials.

Jamestown (Accra)
POD had encountered two landed *Tursiops truncatus* (reported as *Delphinus delphis* in Ofori-Danson and Odei, 1997) on Jamestown beach in February 1994 (Fig. 4). KVW and POD checked the landing site on 30 May 1998 (03 pm) and on 31 May (06:30 am). Rough weather had impeded boats to set out to sea, therefore hardly any boats were landing catches. Wooden pirogues based at Jamestown number in the low hundreds. Most are hand-powered but some, the larger ones, are equipped with (mostly Yamaha) outboard engines. The majority of pirogues deploy purse-seines, others use gillnets and long-lines. Fishing trips are typically limited to the day or night, so that the necessity for ice and the problem of its high cost or unavailability, can be avoided. On tuesdays no fishing activities take place, in compliance with animist beliefs.

One fisherman interviewed claimed dolphins are by-caught and landed regularly; he cited '4-10 dolphins a week'. Dolphins are said to measure up to 3m, which would agree with many delphinids including *Tursiops truncatus*. Some live animals are landed, often very battered and are slaughtered on the beach. The fish market of Jamestown was checked for cetacean meat, and while some market people suggested it to be available daily, we did not encounter it then. The presence of a white person (KVW) may have instigated some reticence in showing dolphin meat.

The Ga fishermen's community of Jamestown are locally infamous for rowdiness. The place is overcrowded, fights are commonplace and outsiders are (un)welcomed with probing questions about intentions. Despite the company of a hired Ga guide, the taking of an overview photograph of the landing site was considered provocative and payment was demanded aggressively; an atmosphere starkly contrasting with the friendliness of other fisher's communities in Ghana. We rate Jamestown low as sampling site for its lack of working space and relative insecurity as major inconveniences.
During subsequent checks of Jamestown (12 August, 5 September 1998), no cetaceans were encountered. In the last quarter of 1998, drift gillnet fishermen had migrated westwards. POD did not witness any dolphins brought ashore.

Kpone
Kpone is a small-scale fisheries village situated 7km east of Tema which is Ghana's largest industrial port and home to the nation's foremost commercial tuna fleet. We first surveyed this small fishing community on 1 June 98. Kpone fishermen utilize man-powered canoes. The bigger canoes carry outboard motors, even these steam to the fishing grounds where they switch to paddles to limit fuel consumption. All fishing trips last less than 24hours since no ice is taken

along. Nets seen include purse-seines and multifilament drift gillnets, the latter with one-side mesh size smaller than 10cm. Fishers told us that the day before (31 May) two small dolphins had been landed. One of us (POD) had received notice that a week earlier (~ 24 May), two larger dolphins had been taken.

Further interviews revealed that dolphins are accidental net entanglement victims and that Kpone fishermen do not deliberately target marine mammals. One estimate is that at least 10 dolphins a month are landed here. The situation is thought to be similar in four or five other coastal sites in Ghana. No harpooning has been reported; moreover no indications of a dolphin hunting tradition were encountered. Dolphins are landed entire; most are dead, others moribund. Once sold to women fishmongers, meat is not filleted from the bony carcass as is customary elsewhere (e.g. Peru), but the whole animal including bones is chopped into small pieces, and sold as such. This explains why we could not find any bony remains on the beach. Kitchen middens may contain such material.
No dolphins were landed on three survey days (09/08/98, 25/08/98 and 04/09/98), but fishers gave positive reports of recent instances of catches. Kpone gillnetters in the third and fourth quarter of 1998 had moved to the central region (e.g. Apam), where better catches were had.

Winneba
Artisanal fishers of Winneba (05°20'N, 00°37W), a fishing community west of Accra, employ mostly small dug-out canoes and set small-meshed gillnets mainly nearshore. On 3 June 1998, most fishers were involved in hauling huge beach-seines, manually. Locals denied takes of dolphins and beach-combing did not yield any cetacean bones. Some fishers, significantly, referred us to Apam if we wished to encounter dolphins. However, a clymene dolphin *Stenella clymene* was landed here in September 1998.

Apam
Apam (05°15'N, 00°13'W) is a sizable artisanal fishing town, bustling with activity, some 70km east of Accra. Many tens of dug-out canoes are hauled on the beach at any one time. Without exception, people questioned confirmed regular catches of dolphins, with landings of between 0-10 animals/day. One older fisherman suggested that catches of dolphins are particularly high in September-October, related to the peak presence of sardines (*Sardinella* spp.). Both accidental and directed catches seem to occur. Dolphins are cut in pieces, smoked and consumed locally. A few people eat the meat fresh.

Artisanal purse-seiners mostly fish for sardine (*Sardinella aurita* and *S. maderensis*) and anchovy, embark a numerous crew (to haul nets) and fish close to shore; they rarely capture dolphins. In contrast, drift gillnets are deployed from smaller, lighter and faster boats which set farther to sea with a reduced crew and target shark (e.g. *Sphyraena* spp.), tuna and, since recently, dolphins.
Typically, shark gillnet fishermen set out in the morning, drive offshore during daylight hours to arrive on the fishing grounds in the evening. Nets are soaked all night and recovered in the early morning; boats return to port the next day at 2-5PM. The shark fishery first developed around 1974. Maximum takes of shark occur from 15 July till September, related to major upwelling (Ofori-Adu and Koranteng, 1993).

On 3 June (at 17:00hrs), three gillnet boats landed only skipjack tuna *Katsuwonus pelamis*. On 23 August 1998, POD documented the landing of five small cetaceans, one of which a *Kogia* sp. of 120cm. Heads were purchased, skin samples and teeth collected.

Mr. Botwe Samuel from the Department of Fisheries reported on a 121cm female dolphin landed on 2 July which had 64 and 62 teeth, respectively in upper and lower jaw. Agricultural Officer Mr. Quartey, was given some funds (to buy dolphin heads) and a compact camera as to optimize data collection and allow identification. Apam seems a promising site for biological data collection. Local fishermen of the Akan tribe are far more cooperative than their counterparts in Jamestown.

Dolphin exploitation

Utilization of cetaceans

As recently as 1987, Ofori-Adu stated 'apparently one species [of dolphin] is abundant in Ghanaian coastal waters, but unfortunately its flesh is not acceptable for eating by a large section of the general public'. Ofori-Danson and Agbogah (1995) indicated that dolphin meat is disliked as food by most Ghanaians. Apparently a taste for a new food item can be rapidly acquired and integrated within the acceptable food pattern of a population, especially if it responds to a dietary need. Indications are that this may be the case with dolphin meat in Ghana.

From interviews with fishermen of Apam, Kpone and Jamestown, we know that all parts of the dolphin are utilized. The carcass is hacked into small, individual portions, with bone attached. This explains why we found no skeletal or other remains in the vicinity of the landing sites. All internal organs are eaten, including intestines may be used. For instance, the meat of a bottlenose dolphin bought for research by the Water Research Institute on 5 Feb 1994 was taken home (for consumption) by personnel that assisted the dissection.

In order to sample specimens, whole carcassess will have to be purchased. Middle-sized dolphins are sold for the cedi equivalent of about USD 100. Generally, fish prices were considerably higher than e.g. in Senegal. In June-August, period of highest fish takes in the Gulf of Guinea prices go down.

Monitoring of dolphin takes

Fish landings are monitored by fisheries inspectors at a selected number of ports, however no data on cetacean catches have so far been noted. From talks with Mrs. Anang, Director of Research and Utilization Branch at the Fisheries Department (Ministry of Agriculture), Tema, this could be amended fairly easily. The need for better general information and/or training on cetacean biology was expressed. KVW and Ofori-Danson would help to provide such technical support in the future.

Mr.Ofori-Adu (Fisheries and Utilization Branch, Fisheries Department, Tema) holds unpublished notes of dolphin catches at Apam (pers.comm. to KVW, 8 June 1998). Attempts by POD to convince Ofori-Adu to publish his results have not been effective to date.

Industrial fisheries

No verifiable information is published on dolphin by-catches in the commercial tuna fishery. Tuna cans produced by the Ghana Agro-Food Company Ltd., sold on the domestic market (Sankofa tuna chunks in brine), claims that their product is 'dolphin friendly'.

Ofori-Adu (1987) stated that 'a few porpoises are occasionally landed by purse-seiners which happen to catch the species by chance during the *Sardinella* seasons'. Ofori-Danson and Agbogah (1995) added that 'one major threat may emanate from increases in their entanglement [of dolphins] particularly in purse-seine nets'. Initial attempts by Ofori-Danson and Agbogah (1995) to evaluate the magnitude of dolphin mortality from large-scale fishing operations proved futile because the fishermen failed to report by-catches.

Legal protection status of cetaceans

Depending on the interpretation of 'wildlife', whether it includes cetaceans, they are -or not- protected in Ghana by domestic legislation. The management of wildlife falls under the Ghana National Wildlife Conservation Policy of 1971 (Ofori-Danson and Odei, 1997) and is the responsibility of the Ghana Wildlife Department, part of the Forestry Commission within the Ministry of Lands and Forestry. If dolphins and whales are rather considered aquatic resources, and thus the domain of the Ministry of Fisheries, no specific management and conservation measures are in place. However, Ghana has recently become party to the Bonn Convention on the Conservation of Migratory Species of Wild Animals (CMS/UNEP), which addresses conservation of cetaceans at a regional level. Nonetheless, frequent by-catches, and the development of a directed dolphin fishery at Apam, calls for dedicated management measures.

Cetacean records from Ghana

The distribution of cetaceans in the Gulf of Guinea is poorly understood. In anticipation of a general review, we here discuss the six species which currently are confirmed from Ghana's coastal waters. Accounts will be upgraded as available samples are being processed in the months ahead. Also, whale shrines along the coast have to be perused in the future, for skeletal material may yield valuable information.

Bottlenose dolphin (*Tursiops truncatus)*

To date we can confirm four records (five specimens captured) of *T. truncatus* for Ghana.

POD encountered two bottlenosed dolphins landed together by a purse-seiner at the Jamestown beach on 5 February 1994 (Fig. 4). One, a 300cm physically adult male of 265kg was bought for necropsy at the Water Research Institute. Material kept: skull, scapulae, atlas/axis, two other vertebrae, hyale, sternum (partial), 1 rib, 1 humerus/ulna, several teeth. The female measured 295cm and weighed 280kg. The animals were previously reported as Delphinus delphis *(Ofori-Danson and Odei, 1997). Specimen and photos deposited at Water Research Institute (WRI), C.S.I.R., Achimota. Tissue collected in DMSO. A male of 255cm and another of 315cm were disembarked at Senya Beraku and Tema respectively (Ofori-Danson and Odei, 1997).*

A calvaria kindly showed to us by Mr. Ofori-Adu was identified as a bottlenosed dolphin. The specimen was dredged by a fishing boat in shelf waters off Ghana; exact locality and date unknown, and is deposited at the Research and Utilization Branch, Fisheries Department, Ministry of Agriculture, Tema.

Clymene dolphin (*Stenella clymene)*

Dr. Chris Gordon directed our attention to a complete mounted dolphin skeleton kept in the collections of the Zoology Department, University of Ghana, Accra. KVW identified it as a physically mature clymene dolphin. The animal had stranded near Keta (05'55'N,00°59'E), a fishing town, in May 1956; it had possibly been by-caught. Teeth: upper left 41, lower left 42. This is the second record, and the first specimen record of *Stenella clymene* for the Gulf of Guinea. A group was photographed at 02°10'N, 02°30'W (in Leatherwood *et al.*, 1976) and erroneously identified as *S. longirostris* (Perrin *et al.*, 1981).

A 216cm female clymene dolphin was captured off Winneba on 23 September 1998 (Fig.2). The number of visible, sharply-pointed, teeth in the fresh head was 38-39 (UL/LL). Two photographs show the tripartite body colouration, including the white belly. The black eye-patch, grey eye-to-flipper stripe, the characteristic dark stripe on the central part of the upper beak ending in a black rostrum tip and fine blackish lip patches are clearly visible (see e.g. Perrin *et al.*, 1981).

Rough-toothed dolphin (*Steno bredanensis)*
Two rough-toothed dolphins were landed at Apam (Fig.3), captured in nets, probably gillnets. Date uncertain, either on 29 August or 24 September 1998. Photograph available showing characteristic conical, tapering shape of the head and large flippers. Two sightings of *S. bredanensis* in 1972 have been reported from Ghana by C.W. Oliver (pers.comm. *in* Jefferson *et al.*, 1997) but were not authenticated.

Dwarf sperm whale (*Kogia simus)*
A 120cm *Kogia* sp. was landed at Apam on 23 August 1998, as evidenced by a photograph of the head in the flesh (Fig.3). POD counted nine pairs of teeth in the lower jaw and five pairs of teeth in the upper jaw, which identifies it as a *Kogia simus.* Only this *Kogia* species is known to bear teeth in the upper jaw (see Caldwell and Caldwell, 1989); *K. breviceps* moreover has more (10-16) pairs of teeth in the lower jaw. The skull is deposited at the Water Research Institute.

Sperm whale (*Physeter macrocephalus)*
A sperm whale of undetermined sex and of an estimated 8-9m length (estimated from photos) stranded at Osu beach, Accra, in July 1994. No specimens were collected. Two photographs of the animal are deposited at the Water Research Institute.

Humpback whale (*Megaptera novaeangliae)*
Two photographs provided by an officer from the Ghana Wildlife Department stationed at Ada (05°48'S, 00°38'E), near the Volta river estuary, show the complete fresh carcass of a calf humpback whale on a beach. It is unknown whether it was stranded or captured. Further information is being sought, especially also with reference to the date.

Unidentified or unsupported cetacean records
1) Ofori-Adu (1987) recalls seeing a stranded whale at Sekondi beach - Akuburam, near the lighthouse by the Sekondi-Takoradi beach road on 19 November 1975. A large crowd impeded to take any records of the stranded whale whose total length was estimated to be over 15m.

2) Ofori-Adu (1987) sighted a whale (at ~10:00hrs) during a trawling survey cruise (R/V Kakadiamaa) for demersal fishes off the Saltpond oil rig in March 1985. The whale kept on surfacing and re-surfacing for about 45min all along swimming towards the research vessel until it finally left.

3) F.X. Bard (pers.comm. to Maigret, 1994) saw one dolphin caught in Dixcove, western Ghana, in May 1988.

4) The pantropical spotted dolphin, *Stenella attenuata,* and killer whale *Orcinus orca* have been reported from Ghana by C.W. Oliver (pers.comm. *in* Jefferson *et al.*, 1997) but none were authenticated.

Conclusion

To date six cetacean species, all first records, are confirmed to occur in Ghana's coastal waters: five odontocetes *Tursiops truncatus*, *Stenella clymene*, *Steno bredanensis*, *Kogia simus*, *Physeter macrocephalus*, and the humpback whale *Megaptera novaeangliae*. Other warm-water species are expected to be added in the near future with advancing field work.

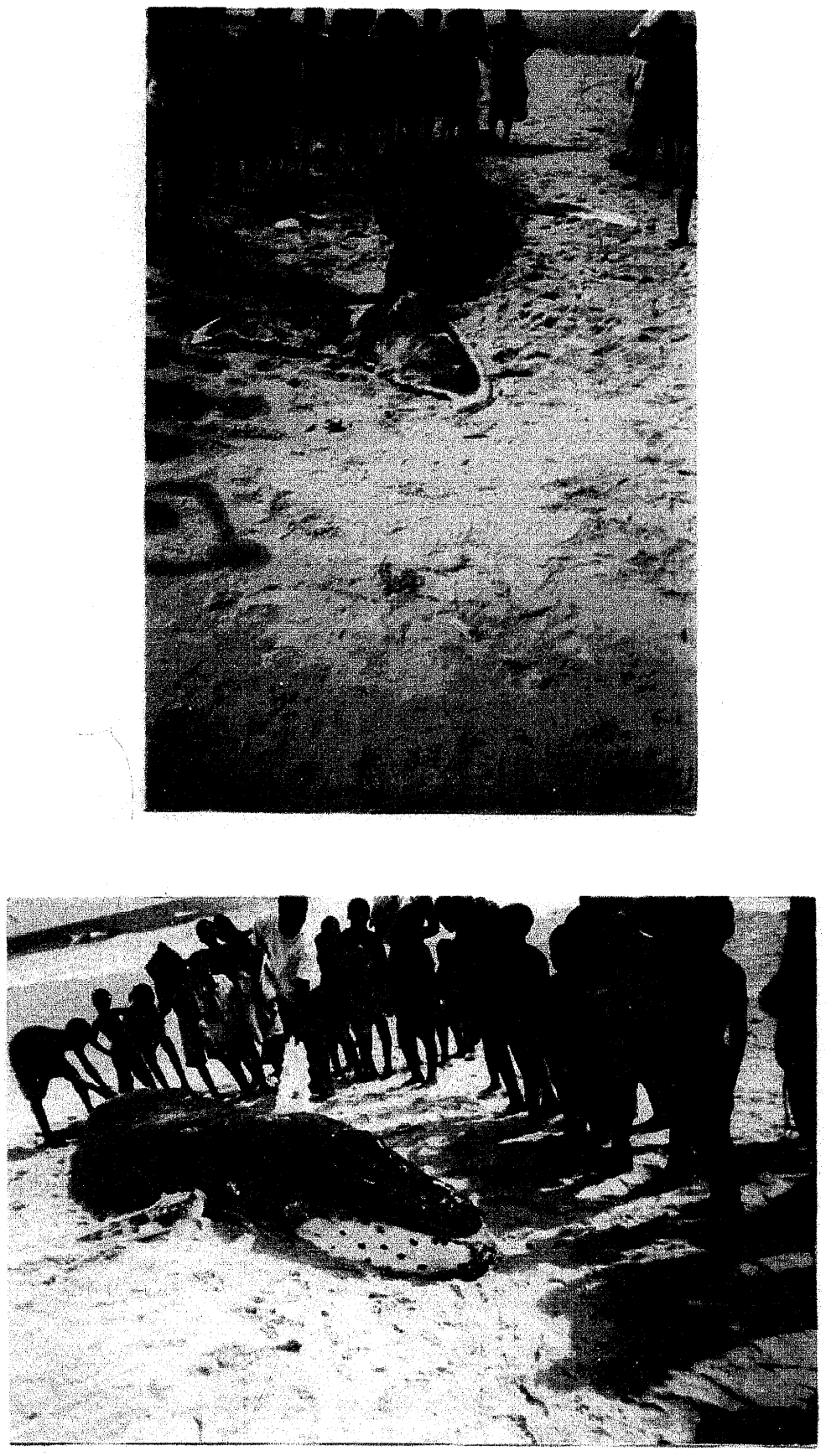


FIGURE 1. A calf humpback whale stranded on a beach of Ada, near the Volta river estuary. It is unclear whether the calf had been by-caught or not. The event raises questions about a possible nursery area off the Ghana coast.

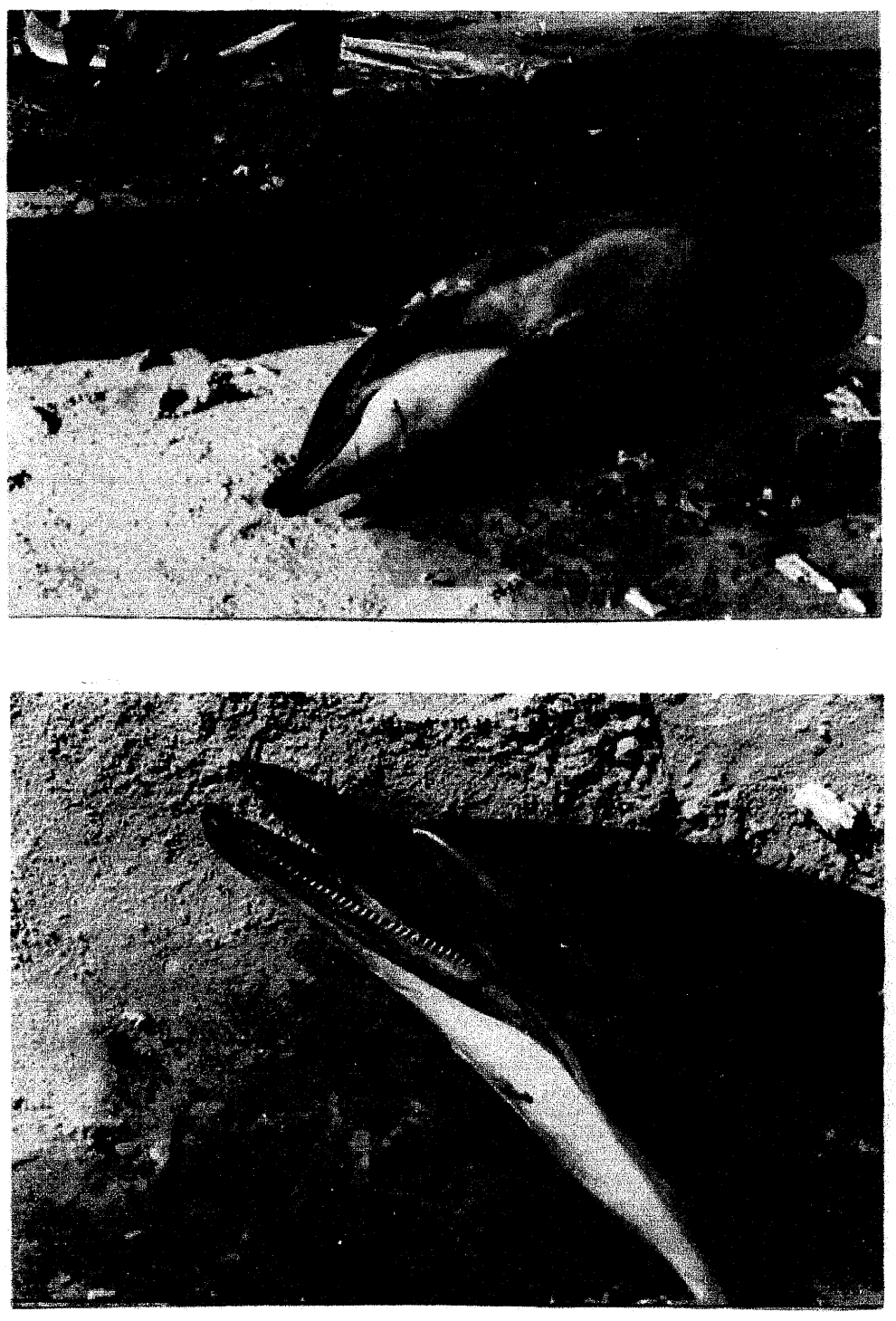


FIGURE 2. Clymene dolphin, *Stenella clymene*, landed at Winneba in September 1998. First record of this species for Ghana, and second case for the Gulf of Guinea.

FIGURE 3. Two rough-toothed dolphins *Steno bredanensis* caught in drift gillnets and landed at Apam in September 1998 (TOP). Head of dwarf sperm whale *Kogia simus* netted at Apam in August 1998 (BOTTOM). Both species are first records for Ghana.

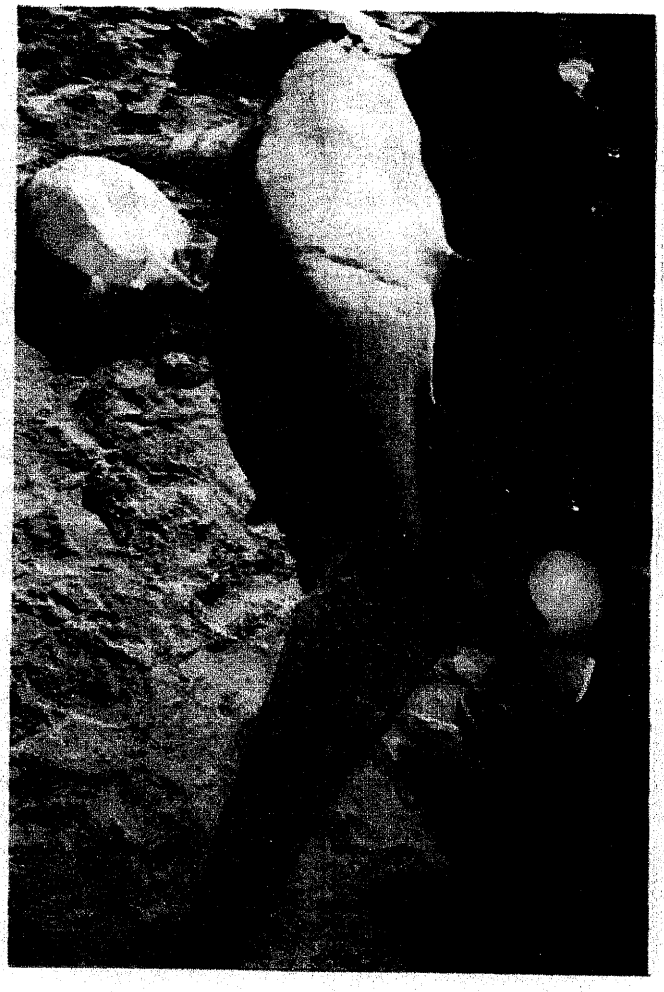


FIGURE 4. Two adult bottlenose dolphins *Tursiops truncatus* captured in semi-industrial purse-seine nets off Jamestown, in 1994 (TOP). Thresher shark and unidentified sea turtle taken in drift gillnets off Apam, the same nets that target dolphins (BOTTOM).

The findings of two clymene dolphin specimens in Ghana (this paper) and a recent record of the species for The Gambia (Van Waerebeek, 1999) supports the argument of Robineau *et al.* (1994) that apparent unequal distribution in the western and eastern parts of the tropical north Atlantic may be an artifact of poor sampling in African waters. Although Ghana, through geographical extrapolation, can be expected to be part of the range of the Atlantic hump-backed dolphin *Sousa teuszii* (see Maigret, 1980; Jefferson *et al.*, 1997), we did not encounter the species. Search effort, admittedly, was insufficient for a definitive answer. It is conceivable also that a local *S. teuszii* population may have been drastically reduced before field research started.

The stranding of a calf humpback whale (Figure 1) invites speculation about a potential nursery area in Ghana coastal waters. The specimen's affinity with the historically exploited stock of humpback whales off Gabon (Budker, 1953) opens interesting research perspectives.

Back in the 1960s and 70s, off Ivory Coast, dolphins of the genera *Tursiops*, *Stenella*, *Delphinus* and *Steno* were reported captured in nets at unknown levels (Cadenat, 1959; R.L. Brownell *in* Mitchell, 1975). Dolphins were caught incidentally in a driftnet fishery for tunas, swordfish and sharks since 1983 (Maigret, 1994). With marine mammal takes prohibited in Ivory Coast, animals were not declared but promptly eaten by fishermen; offal and other remains were routinely buried on the beach (Maigret, 1994). Consumption of cetacean meat is well-documented in Senegal (reviewed in Van Waerebeek, 1999). Farther south, in Gabon, a live-stranded false killer whale *Pseudorca crassidens* was killed and eaten in 1992 (Van Waerebeek and De Smet, 1996). Along with information presented here, the combined body of evidence suggests that the utilization of stranded and captured cetaceans as food is the norm in West Africa.

Annual takes at Apam and Jamestown probably count, at each port, in the low hundreds, higher than at Kpone and Winneba. Possibly then the main threat to small cetacean populations of Ghana consists of unknown total levels of incidental captures in a variety of fisheries and the potential for an expansion of a so far localized (Apam, Jamestown) but unregulated directed dolphin fishery. The latter may be stimulated by the decline of local commercial fish stocks. Although many coastal communities of the Gulf of Guinea traditionally worship marine mammals (Maigret, 1994), pressure from rapid population growth creates immediate food needs. Indications from this survey suggest that such pressure is indeed overriding any religious-inspired reluctance to consume cetacean meat. A similar effect was noticed in Senegal and The Gambia (Van Waerebeek, 1999). Unfortunately, we lack even basic information on the species' natural history, including rough distribution patterns, species/stock composition, movements, ecology, and recruitment rates, let alone abundance estimates. There is a great need for continued field research, monitoring, professional training and awareness building.

Unrestrained coastal 'development' may pose an additional threat for nearshore species. Countries like The Gambia, Senegal, Ivory Coast and Cameroon already derive substantial income from the coastal tourism industry (Folorunsho and Awosika, 1996), and this is only the beginning. In Ghana the coastal zone is the fastest growing area in terms of urbanisation and industrialisation (Armah *et al.*, 1996). Although pollution was not thought to be a problem in the region until recently (Maigret, 1994), large ports (e.g. Tema, Accra, Abidjan, Lagos) and associated heavy industries are mushrooming and generate substantial environmental disturbance. Pollution monitoring, moreover, is non-existent.

It is hoped that the initial effort in Ghana, as described above, will have a long-lasting effect; that it may lead to an improved legislation for the management of cetaceans in that country, and

ensure the further preparation of a Ghanaian aquatic mammal specialist (Ofori-Danson). The professional contacts are and will be maintained and new information is continuously adding to the small but growing database on Ghana's cetaceans. Valuable contacts have also been established in Togo; during a subsequent stage dedicated field work time should be programmed for.

It is too early to formulate any specific recommendations concerning cetacean management and conservation in the study countries, except that the overall database on captures and biological parameters should urgently be broadened and improved. Some form of continuation of research will be highly desirable.

Acknowledgements

We are greatly indebted to the many professionals who contributed with valuable information and offered their insight. In specific thanks are indebted to: Mr. N.K. Ankudey, Dr. Chris Gordon, Mr. Koffi Kotahe Batawila, Ing. Sedzro Kossi Maxoe, Prof. Yaa Ntiamoah, Dr. M.A. Odei, Mr. Ofori-Adu, and Mr. G.A. Punguse. We gratefully acknowledge Drs. George Rabb, R.R. Reeves and J. Van Goethem for personal support and for their patience. We thank the Chicago Zoological Society and the "Leopold III-Fonds voor Natuuronderzoek en Natuurbehoud" for sponsoring this survey and its follow-up.

2. Divers - Varia

2.1. Lac Roi Léopold III – Koning Leopold III-meer.

Le Baron André de VIRON, Ambassadeur de Belgique à Caracas, a communiqué qu'il existe au Venezuela un lac dédié au Roi Léopold III. Le lac se trouve dans la partie méridionale du Venezuela (Territorio Federal Amazonas), à l'est du fleuve Orinoque, 90 km au sud-est de Puerto Ayacucho (voir carte en annexe).

Il s'agit d'un petit lac paraissant à celui d'un cratère d'un volcan mais dans une zone qui n'est pas volcanique. Il n'y a pas de rivière qui débouche dans ce lac dont la profondeur change sans qu'il soit jamais à sec et donc l'alimentation doit probablement provenir du sous-sol.

2.2. Conférence - Voordracht

Institut royal des Sciences naturelles de Belgique – Koninklijk Belgisch Instituut voor Natuurwetenschappen : 06.05.1999

- Voordracht *« Het bonobo in-situ project: onderzoek en behoud van de laatst ontdekte mensaap in het Congobekken »* door Dr L. VAN ELSACKER, Société royale de Zoologie d'Anvers, en Dhr. J. DUPAIN, Universitaire Instelling Antwerpen.
- Conférence *« Le projet bonobo in-situ: recherche et conservation de la dernière découverte de singes anthropoïdes dans le bassin du Congo »* par le Dr L. VAN ELSACKER, Société royale de Zoologie d'Anvers, et M. J. DUPAIN, Universitaire Instelling Antwerpen.

2.3. Expositions - Tentoonstellingen

Het Leopold III-Fonds voor Natuuronderzoek en Natuurbehoud verleende zijn medewerking aan het 'Orinoco' Festival van Wetenschappen en Kunsten 1997-1998, dat plaats had in het 'Museo de

Ciencias' Caracas, Venezuela, van oktober 1997 tot midden 1998.

In de tweede helft van 1998 en in 1999, is deze tentoonstelling opgesteld in diverse Europese steden w.o. Parijs, Rome en Frankfurt a.M.

Het Leopold III-Fonds verleende eveneens zijn medewerking aan de tentoonstelling 'Het Ongerepte Woud – La Forêt Vierge' ten huize 'Clairmarais', Oude Dijk 11, 2300 TURNHOUT (november 1999 – januari 2000).

2.4. Livres et documentation reçus - Ontvangen boeken en documentatie

De nombreux livres et tirés-à-part ont été reçus en 1999, notamment du Musée royal de l'Afrique centrale.

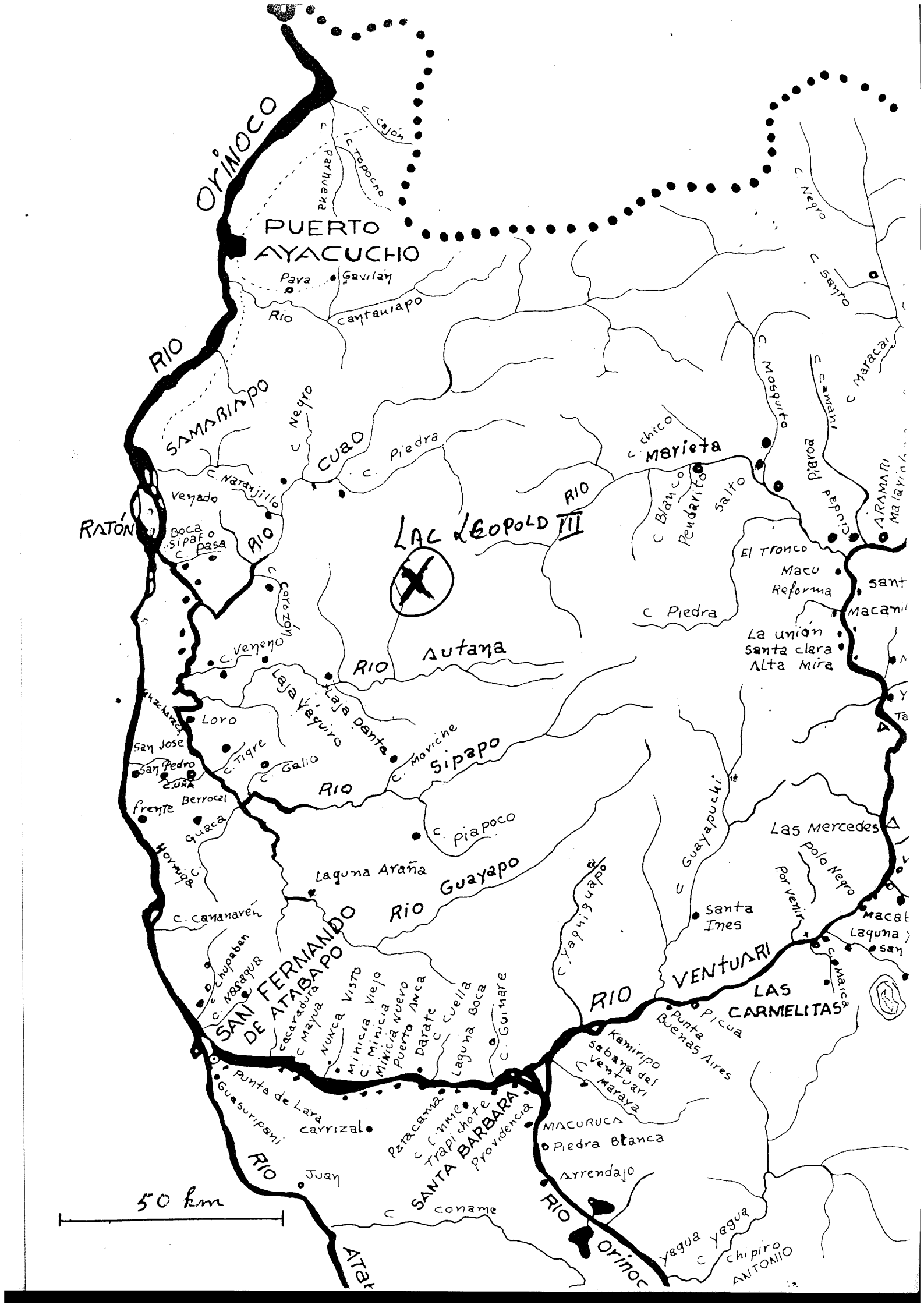
Het Fonds heeft talrijke boeken en overdrukken ontvangen in 1999, vooral van het Koninklijk Museum voor Midden-Afrika.

2.5. Publications scientifiques réalisées avec l'appui du Fonds
Wetenschappelijke publicaties verwezenlijkt met de steun van het Fonds

- COCQUYT, C., PLISNIER, P.-D., SERNEELS, S. & LAMBIN, E.F., 1999. Could possible ENSO signature be detected in Lake Tanganyika ? *Symposium for European Freshwater Sciences: University of Antwerp (RUCA), Belgium.* Abstract book 1 p.
- DARLINGTON, J.P.E.C., LEPONCE, M. & OGUTU W.O., 1997. Termites (Isoptera) in Kibale Forest National Park, Western Uganda. *Journal of East African Natural History, 86: 51-59.*
- DEHEYN, D., MALLEFET, J. & JANGOUX, M., 1999. Variation in bioluminescence with ambient illumination and diel cycle in a cosmopolitan ophiuroid (Echinodermata). *Cahiers de Biologie Marine, 40: 57-63.*
- MASSIN, C., 1999. Reef-dwelling Holothuroidea (Echinodermata) of the Spermonde Archipelago (South-West Sulawesi, Indonesia). *Zoologische Verhandelingen, 329: 144pp.*
- VAN BRESSEM, M.-F., VAN WAEREBEEK, K. & RAGA, J.A., 1999. A review of virus infections of cetaceans and the potential impact of morbilliviruses, proxviruses and papillomaviruses on host population dynamics. *Diseases of Aquatic Organisms, 38: 53-65.*
- VAN WAEREBEEK, K., ANDRE, M., SEQUEIRA, M., MARTIN, V., ROBINEAU, D., COLLET, A., PAPASTAVROU, V. & NDIAYE, E., 1999. Spatial and temporal distribution of the minke whale, *Balaenoptera acutorostrata* (Lacépède, 1804), in the southern northeast Atlantic Ocean and the Mediterranean Sea, with reference to stock identity. *J. Cetacean Res. Manage, 1(3): 223-237.*
- VERSCHUREN, J., 1999. Science et conservation de la nature. Aventures vécues. *Sciences: 18-20.*

Bruxelles-Brussel, 25.04.2000.

J.L. VAN GOETHEM,
Administrateur-Secrétaire,
Beheerder-Secretaris.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C. Santo
C. Mosquito
C. Camani
C. Maracal
RIO
SAMARIAPO
C. Negro
CUAO
C. Piedra
C. Naranjillo
Venado
RATÓN
Boca Sipapo
C. Pasa
RIO
C. Corazón
C. chico
Marieta
C. Blanco
Pendarito
Salto
Ciudad Piaroa
ARAMANI
Malaya
LAC LEOPOLD III
El Tronco
Macu
Reforma
C. Piedra
La unión
santa clara
Alta Mira
C. Veneno
RIO
Autana
Laja Vaquero
Laja Danta
Shazuma
Loro
San Jose
San Pedro
C. Tigre
C. Gallo
C. Moriche
SIPAPO
RIO
Frente
Berrocal
Guaca
C. Piapoco
Las Mercedes
Polo Negro
Por venir
C. Guayapuchi
Hormiga C.
Laguna Araña
Guayapo
RIO
C. Yaquiguapo
C. Camanaven
santa Ines
Macaé
Laguna
C. Chupaban
C. Negagua
SAN FERNANDO DE ATABAPO
Cacaradura
C. Mayua
Nunca Visto
C. Minicia Viejo
C. Minicia Nuevo
Puerto Anca
Darate
C. Cuella
Laguna Boca
C. Guinare
RIO
VENTUARI
LAS CARMELITAS
C. Maica
Punta Picua
Buenas Aires
Kamiripo
Sabana del Ventuari
Maraya
Punta de Lara
Guasuripani
carrizal
Paracana
C. Inmc
Trapichote
Providencia
SANTA BARBARA
MACURUCA
Piedra Blanca
Arrendajo
RIO
Juan
C. Coname
50 km
Yagua
C. Yagua
Chiripo
ANTONIO
Orinoc
Atab