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INVESTIGATION OF CRUSTACEANS FROM SHELF AREAS IN THE GULF OF GUINEA, WITH SPECIAL EMPHASIS ON BRACHYURA

BY

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1. ABSTRACT

Crustacean abundance on continental shelves off Nigeria, Cameroon and Gabon in the Gulf of Guinea was investigated in this study. Quantitative data was sampled with a 0.1 m^2 Van Veen grab during a survey with RV Dr. Fridtjof Nansen in 2005. The Brachyuran fauna was identified based on the grab samples from 2005 as well as from demersal trawl samples collected in the Gulf of Guinea during 2005, 2006 and 2007. The findings of the current investigation were compared with results of previous studies in West Africa. Hydrographical data of depth, temperature, oxygen and salinity were obtained and their effect on species distribution and abundance was tested using ordination analysis. Molecular sequencing of the cytochrome c oxidase subunit 1 (COI) gene was attempted for ten brachyuran species. The most common crustacean order encountered in the sediment samples off Nigeria, Cameroon and Gabon was Amphipoda. Gabon had the highest abundance of crustaceans, whereas the benthic fauna in Cameroon was composed of the highest percentage of brachyurans (7.99%). A total of 291 brachyuran specimens were collected at the investigated trawl and grab stations. It was possible to identify 45 species, of which three (*Ebalia cranchii*, *Ilia nucleus* and *Herbstia condyliata*) were recorded in the southern part of the Gulf of Guinea for the first time. Including brachyurans recorded in previous investigations, a total of 86 species of Brachyura have been recorded from Nigeria, Cameroon and Gabon. New distribution ranges were identified for several brachyuran species. Temperature emerged as a significant ($P<0.05$) parameter in affecting distribution ranges of the brachyuran grab fauna, which seemed to prefer habitats of medium depths and relatively high salinity levels. No clear distribution pattern in relation to environmental variables was detected for the brachyuran trawl fauna. A COI sequence was obtained for three of the ten species subjected to molecular sequencing. The results of this study can be used for environmental monitoring and resource management.

2. INTRODUCTION

Crustacea is one of the most diverse taxa on Earth, both morphologically and in number of species (Martin and Davis, 2001). The 68,000 species described so far may represent only half of the actual, extant crustacean fauna (Martin and Davis, 2006). An example of their spectacular morphological diversity can be found within the infraorder Brachyura, true crabs, where the size of an adult crab ranges from a leg span of approximately 4 m in the giant Japanese spider crab (*Macrocheira kaempferdi*) to a minute carapace width of 1.5 mm in the small pinnotherid crab *Nannotheres moorei* (Martin and Davis, 2001). Enormous amounts of research have been focused on this taxon, especially on members of the order Decapoda, the most species-rich group of Crustacea (Porter et al., 2005). The interest is partially due to their great evolutionary success and morphological diversity, but also because of the economic importance of this order (Martin and Davis, 2001), being some of the worlds most important fisheries species; shrimps, crabs, crayfish and lobsters (FAO, 2005b).

Infraorder Brachyura is the largest clade of the decapod crustaceans, with more than 6,500 species (Ahyong et al., 2007) divided into 93 families (Ng et al., 2008). It is regarded as the most diverse taxa within the Crustacea, and its members are able to colonise almost every marine, limnic and terrestrial habitat on Earth. Brachyurans have been found at abyssal ocean depths down to 6,000 m as well as on mountain slopes 2,000 m above sea level (Ng et al., 2008). Brachyura is currently divided in to two clades; Podotremata (primitive) and Eubrachyura (advanced) (Ng et al., 2008). The brachyuaran fauna is considered well known, but as Manning and Holthuis (1981) experienced when they initiated their work on West African Brachyura there are still many unresolved questions regarding biogeography, nomenclature and species identity. Also, the structure of the decapod crustacean communities in West Africa are more or less unknown (Macpherson, 1991). Furthermore, brachyuran species new to science are discovered at a quick and constant rate (Martin and Davis, 2006). Winston (1999) emphasised the importance of describing species and referred to the vast number of undescribed species

as a “biodiversity crisis”. The marine environment in particular, due to man’s difficulty of observing it, possesses many undiscovered mysteries.

In this study the biodiversity of crustaceans was investigated on soft-bottom habitats off the coast of Nigeria, Cameroon and Gabon in the Gulf of Guinea, West Africa. In addition, a few brachyuran specimens sampled off the offshore islands of São Tomé and Principe was included in the study. The benthic fauna in this region is largely unknown (Isebor, 2004) and there is a need for a regional identification manual for benthic organisms (IGCC, 2005). The main focus of the current study was the biogeography of the brachyuran fauna. Biogeography can be defined as the distribution of plants and animals, their pattern of biodiversity and the ecological and historical reasons for these patterns (Winston, 1999).

Biodiversity is a huge field within marine, limnic and terrestrial biological research, often concerned with taxonomy of species (Martin and Davis, 2006). Loss of biodiversity in the terrestrial environment, e.g. deforestation of the rainforest, has received much attention globally. Although marine ecosystems are at least as diverse as terrestrial ones, loss of marine biodiversity has been given a lot less publicity (Martens, 1992). The coastal zone is the most vulnerable and the most abused marine zone. Nearly all major cities are located along the coast. Airports, harbours, agricultural plantations and other industries are placed in close proximity to these cities. Work, as well as educational and financial opportunities, attracts people to the cities at an escalating rate. Great pressure is then exerted on coastal ecosystems in the form of habitat alteration and loss, pollution, over-exploitation, introduction of alien species and climate change; issues that affect coastal zones worldwide (Ukwe et al., 2006).

The Gulf of Guinea is classified as a large marine ecosystem (LME). To achieve such a classification, certain criteria must be met: it must be a relatively large ocean region (200,000 km² or greater), characterized by distinct bathymetry, hydrography, productivity and trophically dependent populations. There are 64 currently defined LME’s in the

world, which together produce 95% of the world's annual marine fishery biomass yields (EDC, 2003). It is also in these ecosystems that most of the global ocean pollution, coastal habitat alteration and overexploitation occur. To ensure a sustainable future for these regions, a five-module strategy was introduced, focusing on: LME productivity, fish and fisheries, pollution and health, socioeconomics and governance has been developed (EDC, 2003). The Gulf of Guinea LME is one of the 33 LME's currently using this approach (Ukwe et al., 2003).

An important factor to consider when resource management is discussed is the need for baseline studies of seafloor communities and habitats. Knowledge of the structure of seafloor communities is crucial to be able to identify and monitor reserve areas and for development of fishing strategies (Hewitt et al., 2004). Such studies should include both physical features (acoustic data and CTD) and ecology (sediment and animals) of the sea floor (Hewitt et al., 2004). In addition, the management of fisheries species requires knowledge of the aggregation of species in the ecosystem (Koranteng, 2001).

Marine soft-sediments is the most common habitat on Earth (Wilson, 1991). Its inhabitants play a fundamental role in remineralization of organic carbon and nutrients and as food producers for larger macrofauna and fish (Olsgard et al., 2008). Marine sediments are derived primarily from either wind driven sediments which are transported to the ocean by rivers, erosion or glacial processes, or from biogenic material from tests of sedimenting plankton (Gray, 2002). The sediments are dominated by fine-grained deposits of silt or clay-sized particles. The concentration of organic detritus in the sediment varies as a consequence of the productivity of the overlying water (Rhoads, 1974). Soft bottom habitats are unusual in the quick rate at which the physical environment can change (Wilson, 1991). In addition, intricate systems of animal-animal and animal-sediment relationships exist. An understanding of these relationships as well as the parameters which determine the physical environment is crucial to be able to comprehend the population ecology on the muddy sea floor (Rhoads, 1974). Competition, predation and burrowing behaviour of infauna are biological parameters that can alter

soft-sediment habitats (Wilson, 1991). Bottom-feeding fish and crabs are important predatory species. They are regulators of species abundance both when they are present (prey-species abundance low) and when they are absent (increase in prey-species abundance) (Ambrose, 1984). Temperature, oxygen, salinity, depth and type of sediment particles are examples of physical determinants of species assemblages (Bianchi, 1992). Most sediment-dwelling organisms are restricted to areas of sediment of specific characteristics. The determining characteristics may be different from larva to adult, and hence the two stages may occupy different habitats (Gray, 1974). The most abundant macrofaunal (>0.5 mm invertebrates) group in soft-sediment habitats is polychaete worms. Other dominant taxa are Crustacea, Echinodermata and Mollusca. Crustacea are mainly represented by ostracodes, isopods, amphipods, tanaids and decapods (Lenihan and Micheli, 2001).

As mentioned above, the concentration of organic matter in the sediment is determined by the productivity of the water column. The residues of primary production, dead animals and organic detritus which are not utilised accumulates on the sea floor (Alongi and Christoffersen, 1992). Matter which cannot be used by any organism however, also ends up on the bottom. The sediments of the world's oceans are subject to oil spills, dumping of hazardous wastes and discharge of effluents from industry. Plastic debris and heavy metals are often encountered in sediment samples. Pollution of coastal zones and oceans have in some cases lead to eutrophication, oxygen depletion, decrease in fish populations and outbreaks of waterborne diseases (Scheren et al., 2002). These problems have increased in the Gulf of Guinea over the last 30 years as a result of large growth of both population and industry in coastal areas (Scheren et al., 2002). Pollutants which have accumulated in marine sediments, such as heavy metals, are often found concentrated in the tissues of animals living in that environment. As a result, bottom-living organisms can be used as indicator species of pollution (Marcovecchio, 1994).

The convenient size of most brachyurans make them easy targets for biochemical and molecular research (Martin and Davis, 2001). Biological barcoding has emerged as an

efficient identification tool. Barcoding implies that part of a species genome is used as a marker, an identification tag, for the organism (Schander and Willassen, 2005). The ability for a ~ 658 base pair (bp) section of the mitochondrial cytochrome c oxidase I (COI) gene to become such a marker, has been demonstrated for many animal lineages, including Crustacea (Costa et al., 2007). Hebert et al. (2003a) suggest that DNA barcoding, when organised into an identification system, could provide a reliable, cost-effective and accessible alternative to traditional morphological based species identification. In this study an attempt was made to apply the DNA barcode method using the COI gene on brachyurans.

This thesis was written as part of an ongoing project in the Gulf of Guinea involving the Food and Agriculture Organisation of the United Nations (FAO), the Norwegian Agency for Development Cooperation (Norad) and the Norwegian Institute of Marine Research (IMR). The project is based on an agreement between the Guinea Current Large Marine Ecosystem (GCLME) project, FAO and IMR and aims to contribute to sustainable management of the marine environment in the costal area and continental shelf of the Gulf of Guinea. As a result, annual ecosystem surveys, largely financed by Norad, have been conducted within the region since 1985 (Norad, 2008). Through cooperation with IMR and GCLME, the University of Bergen (UoB) has been given responsibility to promote scientific training and to analyse some of the material from these surveys.

2.1. OBJECTIVES

- Quantitative study of the crustacean shelf fauna off Nigeria, Cameroon and Gabon
- Identify the subtidal, soft-bottom brachyuran fauna off Nigeria, Cameroon and Gabon.
- Compare the brachyuran distribution in 2005, 2006 and 2007 with results from previous investigations in the area.
- Link the faunistic results to environmental data.
- Test the value of molecular bar-coding as a tool for assessing brachyuran species diversity.

3. MATERIALS AND METHODS

3.1. STUDY AREA

The Gulf of Guinea is located off West Africa, in a narrow protrusion of eastern Equatorial Atlantic between latitudes 5˚S and 5˚S and longitudes 8˚W to 12˚E. It has a coastline of approximately 240 km (Ukwe et al., 2003). The Gulf of Guinea has a tropical climate which can be attributed to the Guinea Current. There are two primary source waters for the Guinea Current (GC); the Canary Current and the North Equatorial Counter Current (NECC) (Gyory et al., 2005). These two currents vary temporally, which leads to seasonal fluctuations of the GC. There is generally a weakening of the current during winter (November through February) and an intensification during summer (May through September). The summer intensification of the GC is related to coastal upwelling (Gyory et al., 2005). In addition to the GC, the Benguela Current (BC) and South Equatorial Counter Current (SECC) are important systems affecting the hydrography of the GoG (Schneider, 1990).

The Gulf of Guinea current systems are driven by a combination of factors (Hardman-Mountford and McGlade, 2003). An intensification of trade winds over the Western Atlantic leads to strengthening of the NECC, SECC and the Equatorial Undercurrent (EUC) which again promotes a shallow thermocline (Binet et al., 2001). The shallow thermocline is a characteristic of the Eastern Atlantic water; warm, low saline surface water overlies a cold water mass of south Atlantic central water, transported to the Gulf of Guinea by the EUC (Schneider, 1990). It is under such conditions, when the thermocline is shallow and the current systems strengthened, that upwelling occurs (Philander, 1979). The thermocline however, as well as the current systems are subject to seasonal variations (Schneider, 1990). A relaxation of trade winds over the Western Atlantic leads to a generation of internal Kelvin waves which propagate along the equator and deepen the thermocline (Binet et al., 2001). Under these circumstances the warm

surface layer penetrates too deep for local winds to induce upwelling (Philander, 1979). An illustration of the major current systems in the GoG is presented in Figure 1.

The Inter-Tropical Convergence Zone (ITCZ) is a zone of wind cells located close to the equator. The wind cells have origins in both the southern and northern hemispheres (Taupin et al., 2000). ITCZ migrates latitudinally over the Gulf of Guinea (Hardman-Mountford and McGlade, 2003) and its presence is usually connected with heavy rainfall (Binet et al., 2001). Two main pools of low salinity waters in the Gulf of Guinea are the Bay of Biafra and the Congo River plume (Figure 1). Periods of heavy rainfall lead to increased discharge from the Congo River to the Congo River Plume and from the Cross and Niger Rivers into the Bay of Biafra, respectively (Binet et al., 2001). As well as affecting salinity, discharge from river systems contribute more than 92 million tonnes of sediment per year into the Gulf of Guinea (Ukwe et al., 2006).

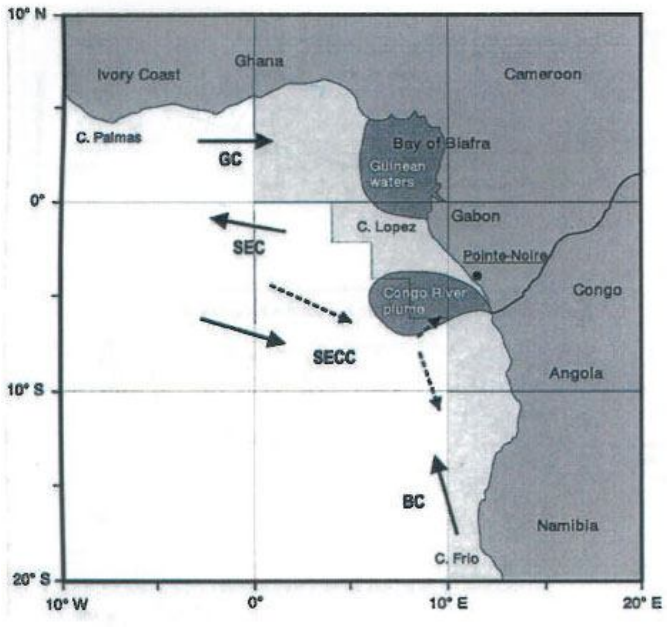


Figure 1 Map of the Gulf of Guinea and Southeast Atlantic Ocean illustrating the main currents and river discharges of the system. GC: Guinea current, SEC: south equatorial current, SECC: south equatorial counter current in periods of upwelling (full line) and during warm events (broken line), BC: Benguela current. The dark shadowed areas indicate fresh water pools of Bay of Biafra and the Congo River plume (Binet et al., 2001).

The Gulf of Guinea can be divided into three types of hydroclimatic regions; two typical tropical regions, one atypical tropical region and two alternance regions (Le Læuff and von Cosel, 1998). Cameroon and Nigeria are located in the eastern typical tropical region which is characterized by waters with little seasonal temperature variation but with important salinity fluctuations near the coast. The area is subject to the largest precipitation of the West African Coast (Le Læuff and von Cosel, 1998). Hence, discharge from Cross and Niger Rivers are substantial and have great influence on the system (Krakstad et al., 2006b). Gabon, on the other hand, is situated in the southern alternance region. The alternance regions represent the northern and southern limits of the extensions of the warm water layer (Schneider, 1990). As a consequence, these regions experience strong seasonal contrasts due to the shift in position of oceanic fronts leading to upwelling/non-upwelling periods (Le Læuff and von Cosel, 1998). In Gabon, the dynamic front is located just north of Port Gentil, at Cape Lopez. The front fluctuates seasonally and annually from the area around Port Gentil and southwards to Angola. The ecosystem north and south of Cape Lopez differs, and there is an observable change in distribution of species and species assemblages between the two (Schneider, 1990).

The Nigerian coastline is about 853 km long and has four distinct geomorphical zones; the barrier island outside Lagos, the mud coast, the delta area and the strand coast (Nwilo and Badejo, 2006). The bottom biotypes alter between soft, sandy and muddy sediments, and mixed to hard bottom types (Koranteng, 2001). The continental shelf becomes progressively wider from west to east and gradually muddier in deeper areas, due to alluvial input and decomposition from the Niger River. It is the third largest mangrove area in the world (Nwilo and Badejo, 2006).

Cameroon has a coastline of approximately 420 km. Like Nigeria, the bottom biotypes of Cameroon vary between soft, sandy sediments and mixed to hard substrates with patches of coral areas in the south (Koranteng, 2001). The part of the continental shelf bordering to Nigeria is characterized by shallow water. The shelf break is steep and irregular. The

patches of coral and hard bottom substrates, make it impossible to trawl the shelf in some areas (Krakstad et al., 2006a).

The coastline of Gabon is approximately 885 km (CIA, 2008). The shelf is relatively wide, with a steep shelf break between 100 and 200 m depth. The bottom is mostly dominated by sand, sand-shell and gravel, but hard rocky patches emerge from time to time between the soft substrate (Bianchi, 1992). Compared to Nigeria and Cameroon, the shelf is quite abundant with life, for instance; daily sightings of whales and dolphin (Krakstad et al., 2006a).

The Island Republics of São Tomé and Principe are volcanic islands, and their bottom substrate is therefore a mix between younger volcanic rocks intermixed with softer sediments (Meyers et al., 1998). Due to the hard bottom biotype it is not possible to use grab to investigate the benthic fauna, instead sledges and bottom trawl are used (pers. comm. Krakstad 2009). The marine fauna of these islands is one of the least described in the world, and they are considered marine biodiversity hotspots due to the high level of endemism (Floeter et al., 2007).

The Gulf of Guinea has a relatively productive coastal and offshore waters with rich fishery resources (Ukwe et al., 2006). Naturally, the fishing industry is a significant contributor to the economies of Gulf of Guinea countries (Ukwe et al., 2003). The dominant fish resources in Nigeria, Cameroon and Gabon are the clupeids: *Sardinella aurita*, *Sardinella maderensis* and and the carangid *Trachurus trecae* (Binet et al., 2001). Nigeria traditionally has a total marine catch twice that of Cameroon and three times that of Gabon (FAO, 2005a). Nigeria and Cameroon have overexploited their fishery resources while Gabon is in the unique position of having an underexploited fishery resource (pers. comm. Krakstad 2009).

Most countries in the Gulf of Guinea, including Nigeria, Cameroon and Gabon, have significant oil and gas resources. Production is heavily concentrated in offshore and

shoreline installations (Ukwe et al., 2003). The offshore security zones around oil installations restricted sampling in some areas (Krakstad et al., 2006b).

3.2. SAMPLING

Field work was conducted onboard R/V Dr. Fridtjof Nansen during May 2008. Due to time constraints, grab samples collected between 3rd of June to 15th of July 2005 and trawl samples collected in the region during 2005, 2006 and 2007 (Krakstad et al., 2006a, Krakstad et al., 2006b, Krakstad et al., 2008) were used in this study. Material collected on these three surveys is henceforth referred to as the "Nansen samples".

3.2.1. GRAB SAMPLES

Benthic samples were collected quantitatively using a Van Veen grab with a surface area of 0.1 m². The Van Veen grab was deployed from a winch onto the seafloor. A total of 65 grab stations were sampled in Nigeria, Cameroon and Gabon during 2005 (Figure 2). Four replicate samples were taken at each station. The grab samples were taken randomly, and covered areas of the shelf between 20 and 100 m depth. Two sediment replicates each were screened through sieves with mesh sizes 0.5 mm and 1.0 mm, respectively. Two of the samples were preserved in 90% ethanol, while the other two were fixed in 10% borax pre-buffered formaldehyde. One replicate sample from each of the stations was sent to the University of Ghana, Legon, Ghana, while the other three were sent to the Museum of Natural History in Bergen, Norway. Samples sieved with mesh size 0.5 mm were examined in this study. Some of the 65 grab stations had not been processed or did not contain crustaceans. For this reason, I sorted 42 out of 65 grab stations (see Table 1 in the result section). Two replicate sediment samples were sorted for some of the stations (N2, N9, N12, N15, C1, G9, G11 and G16). For the other stations one replicate sample was sorted from each.

A sediment sample was collected from the top layer of the first replicate at each sampling station. These samples were analysed at the Nigerian Institute for Oceanography and Marine Research in Nigeria. Analysis of grain size, texture and total organic matter were conducted by Mr Akanbi Bambikole Williams, Principal Research Officer of the Marine

Biology Section. Analyses were only performed on sediment samples from Nigeria and Cameroon (Appendix I).

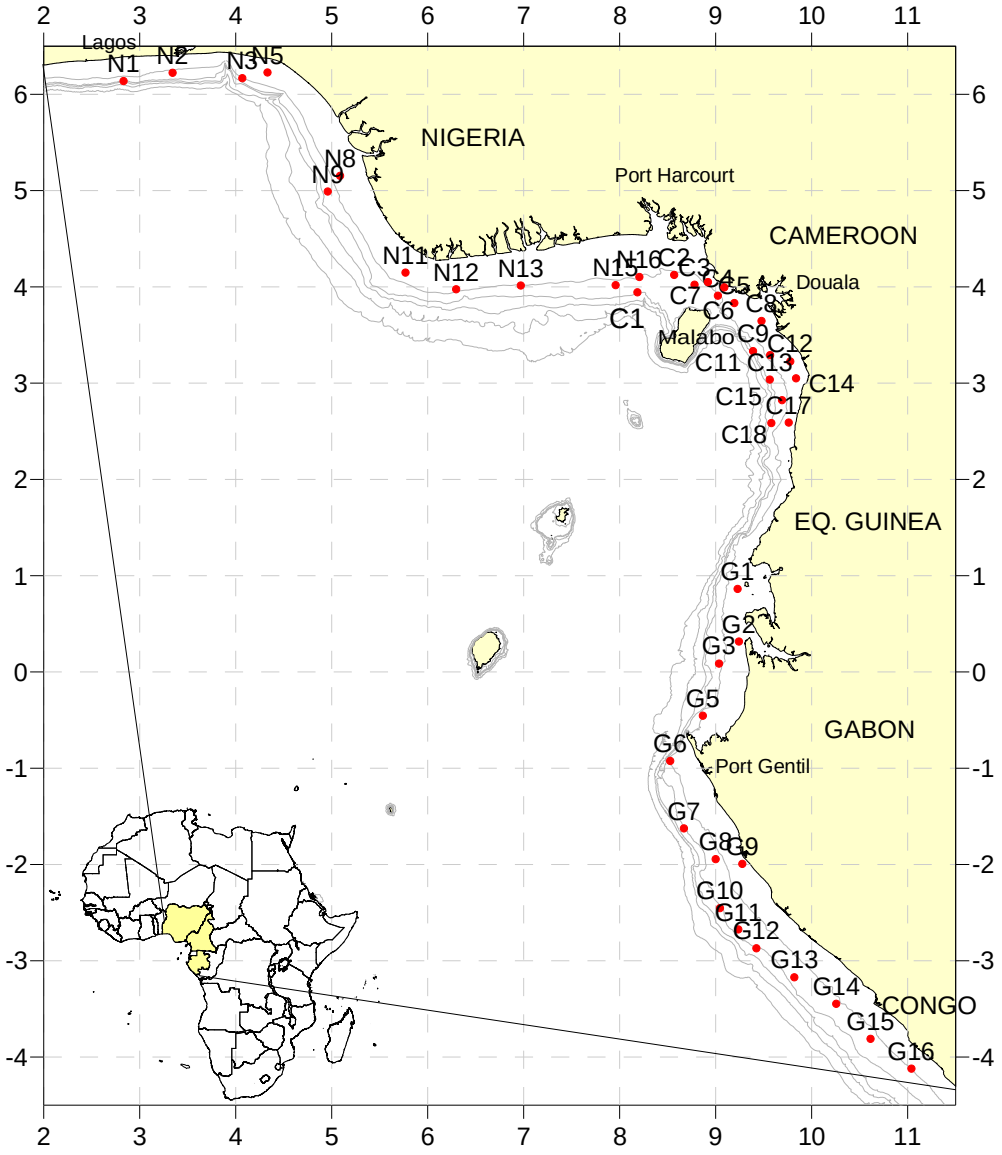


Figure 2 Map of the investigated grab stations off the coast of Nigeria, Cameroon and Gabon.

3.2.2. TRAWL SAMPLES

Epifauna was collected in demersal trawls. Some of these samples were preserved in 90% ethanol and others were fixed in 10% borax pre-buffered formaldehyde. They were sent to both the University of Ghana and Museum of Natural History in Bergen (Krakstad et al., 2006a). Brachyurans found in demersal trawls from research cruises conducted in

2005, 2006 and 2007, have been investigated in this study. All trawl stations containing brachyurans were investigated for the 2005 research cruise (25 samples). Due to time constraints only random samples were investigated for the 2006 and 2007 cruise (8 and 4 samples respectively) (Figure 3) (see also Table 2 in the result section). In 2005 and 2006 sampling was also conducted off the coast of São Tomé and Principe. Some of these samples, along with two trawl samples collected off the coast of Congo in 2007, have been included in this study.

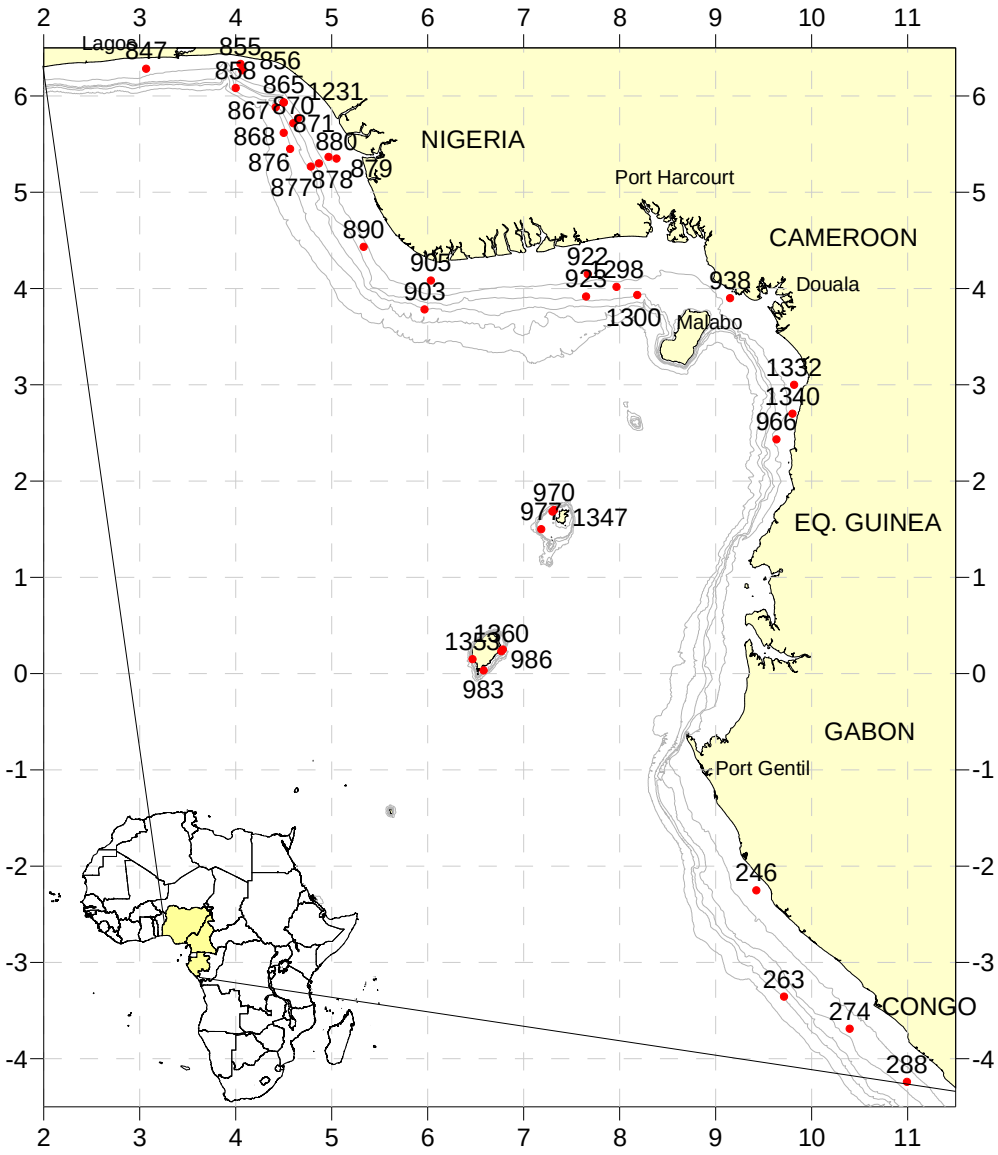


Figure 3 Map of the investigated trawl stations off the coast of Nigeria, Cameroon and Gabon.

3.3. HYDROGRAPHICAL DATA

Conductivity, temperature and depth (CTD) measurements were taken in connection with most bottom trawls and at hydrographical transects which was conducted with regular intervals throughout the study area. The CTD measurements were recorded down to a few metres above the sea floor, or to a maximum depth of 500 m. Vertical profiles of temperature, salinity and oxygen were obtained using a Seabird 911 CTD plus. Real time plotting and logging was done using Seabird Seasave software. Sea surface salinity and relative temperature (5 m depth) were obtained with a SBE 21 Seacat thermosalinograph (Krakstad et al., 2006a). CTD station data were carefully selected for each grab and trawl station investigated in this study according to time and position of sampling.

3.4. SORTING AND IDENTIFICATION OF CRUSTACEA AND BRACHYURA

Sorting of the crustacean fauna from grab samples and identification of Brachyura species from grab and trawl samples was carried out at the Museum of Natural History in Bergen from January 2008 through September 2008 using a Wild Heerbrugg M3B stereo microscope.

The grab samples had been pre-sorted to phylum and subphylum. For this study samples containing subphylum Crustacea were further sorted to order and counted. The order Decapoda was sorted into major groups. A field guide for crustaceans (Enckell, 1980) was an important tool in this work. The animals were put in glass jars labelled with station, date, mesh size, fixation type and animal group, and stored. The jars containing decapod crustaceans of the infraorder Brachyura were retained for further identification. The Brachyura collected from the grab and trawl samples were identified to species level. Identification was mainly based on the literature of Monod (1956) and Manning and Holthuis (1981). Some of the damaged specimens and juveniles were difficult to identify to species level.

Carapace is the portion of the hard exoskeleton that covers the head and thorax in brachyurans. The length and width of the carapace was measured for each specimen. Carapace length was measured from the intestinal to the frontal region of the carapace, and carapace width was measured across the broadest point of the carapace. Spine(s) were not included in either of these measurements.

All recorded taxa were photographed using a Canon 20D camera, with MP-E 65 mm and EF 100 mm macro lenses. The pictures were edited in Adobe Photoshop CS3 Extended, Version 10.0. (Adobe, 2007). Station maps as well as distribution maps of the most common species (encountered at 5 or more stations) were constructed with GoldenSoftware Surfer version 8.0. (GoldenSoftware, 2002).

3.5. COMPARISON WITH EARLIER WORK ON WEST AFRICAN BRACHYURA

Faunistic work on the material from the Danish “Atlantide” expedition (1945-1946) was undertaken at the Zoological Museum in Copenhagen, during a two-week period in April 2008. The Atlantide expedition collected a variety of brachyuran species, but the results have not yet been published (Appendix IV). In addition to the brachyuran specimens found in the Atlantide expedition, reports of the brachyuran findings in other expeditions, respectively the “American Museum Congo expedition (1909-1915)” (Rathbun, 1921), the “Expédition océanographique Belge dans les Eaux Côtières Africaines de l'Antique Sud (1948-1949)” (Capart, 1951) and the “Campagne de la "Calypso" dans le Golfe de Guinée et aux îles Principe, São Tomé et Annabon (1956)” (Forest and Guinot, 1966) were studied to map the occurrences and composition of species in the particular regions. Furthermore, any potential changes in distribution compared to species identified in the current study were examined. Studies of valuable and unique literature were also conducted at the Zoological Museum in Copenhagen.

3.6. MOLECULAR BAR-CODING

Molecular sequencing of the cytochrome oxidase 1 (CO1) gene was conducted to test its applicability as a tool for species level identification of Brachyura. Ten specimens;

Calappa pelii, *Homola barbata*, *Pseudomyra mbizi*, *Pachygrapsus grasilis*, *Pilumnus perrieri*, *Menippe nodifrons*, *Inachus angolensis*, *Goneoplax barnardi*, *Macropodia gilsoni* and *Acanthocarpus brevispinus* were chosen based on fixation (96% ethanol) and their reoccurrence in the Nansen samples. There were no sequences of West-African brachyuran available in the Barcode of Life Data Systems (BOLD), but for most specimens a sequence from a close relative was available. A leg was removed from each crab and placed in 96% ethanol. Total genomic DNA was extracted using Qiagen DNeasy tissue kit for animal tissue, using the Tissue Protocol as recommended by the manufacturer (Qiagen, 2003). The CO1 gene was amplified by the polymerase chain reaction (PCR) in 25 µl volumes in a Peltier DNA Engine DYAD™ Thermal Cycler (Bio-Rad, California, United States). The primer pair LCO1490 (5'-TAA ACT TCA GGG TGA CCA AAA AAT CA-3') and HCO2198 (5'-GGT CAA ATC ATA AAG ATA TTG G-3'), which have been proven to consistently amplify a 650-710-bp fragment of CO1 across a broad array of invertebrates (Folmer et al., 1994), was used for all specimens. The enzyme used was AmpliTaq. Amplification was performed using a PCR-programme with the following thermal regime: an initial step of 94˚C for 1 min followed by six cycles of 94˚C for 1 min, 45˚C for 1 min and 72˚C for 1 min, followed in turn by a second set of 35 cycles of 94˚C for 1 min, 50˚C for 1 min and 72˚C for 1 min, followed by a final cycle of 72˚C for 7 min, and held at 4˚C.

The amplified products were separated on a 1% Agarose gel in TBE buffer, stained with ethidium bromide, and viewed under ultraviolet (UV) light in a Syngene UV-cabinet. The samples were then purified using the hydrolytic enzymes Exonuclease I (EXO) and Shrimp Alkaline Phosphatase (SAP), and run on the EXOSAP-programme in an Eppendorf Mastercycler ep gradient S (Eppendorf, New York, United States) on the following cycle: an initial step of 37˚C for 30 min, followed by 85˚C for 15 min and then held at 4˚C.

Sequences were produced using BigDye® Terminator v3.1 Cycle Sequencing Kit (Applied Biosystems, California, United States) in an Eppendorf Mastercycler ep

gradient S under the following thermal conditions: 96˚C for 120 min, then a set of 30 cycles of 96˚C for 15 s, 50˚C for 15 s and 60˚C for 4 min. Finally the samples were held at 4˚C.

The sequences were edited in eBioX version 1.5.1 and consensus sequences were made in BioEdit version7.0.9 (Hall, 1999). Searches with nucleotide blast were made in BOLD (Ratnasingham and Hebert, 2007) and Basic Local Alignment Search Tool (BLAST) (Altschul et al., 1990).

3.7. STATISTICAL ANALYSES

All statistical analyses were performed on station level. Data tables and figures were created in Excel, Microsoft Office Professional Edition 2003 (Microsoft, 2003). Ordinations and correlations for species and environmental variables were calculated with Canoco 4.5 for Windows statistical software (ter Braak and Smilauer, 2002). Stations without brachyurans were excluded from the analysis. Hydrographical data obtained for bottom conditions at each station were used for environmental analyses. For analysis of demersal trawl data, data collected at the start position of each station were used and the variable “gear depth” was used as a proxy for bottom depth. “CTD depth”, “CTD station” and “date” were excluded from the analysis. Unimodal canonical correspondence analyses (CCA) were applied. The number of specimens per station was low, and therefore there was no need to transform the data. Ordinations on grab data were quantitative, while ordinations on demersal trawl data were based on presence-absence. Sediment analysis was only conducted for Nigeria and Cameroon, hence no statistical analyses were performed on these results.

4. RESULTS

4.1. HYDROGRAPHICAL DATA

4.1.1. SURFACE CONDITIONS

Sea surface temperatures and salinities in the survey area in 2005 were used to illustrate characteristics within the Gulf of Guinea. The region off Nigeria was dominated of warm water masses, >28˚C. Cooler water masses were encountered further east in a gradual manner, but the surface temperature generally never dropped below 27˚C (Figure 4a). Water masses off Cameroon had a surface temperature which fluctuated between 26.8˚C and 27.6˚C. Both temperature extremes were reached in the shallow area outside Douala (Figure 4b). An oceanic front was present off Port Gentil in Gabon. In the water masses north of Port Gentil temperature ranged from 22.0˚C to 25.0˚C. Surface waters south of Port Gentil on the other hand, did not have temperatures above 21.0˚C (Figure 4c).

Surface salinity was generally more stable in Nigeria compared to Cameroon. Off Nigeria salinity values measured between 32‰ to 34‰, whereas a drastic decrease in salinity occurred towards Cameroon, where salinity ranged from 19‰ to 32‰ (Figure 5a). The surface water salinity was generally lower north than south of Port Gentil in Gabon (Figure 5b). North of Port Gentil salinity ranged from 34.5‰ (offshore) to 35.0‰ (inshore). Salinity south of Port Gentil measured between 35.0‰ to 35.5‰. There was a slight decrease in salinity towards Congo.

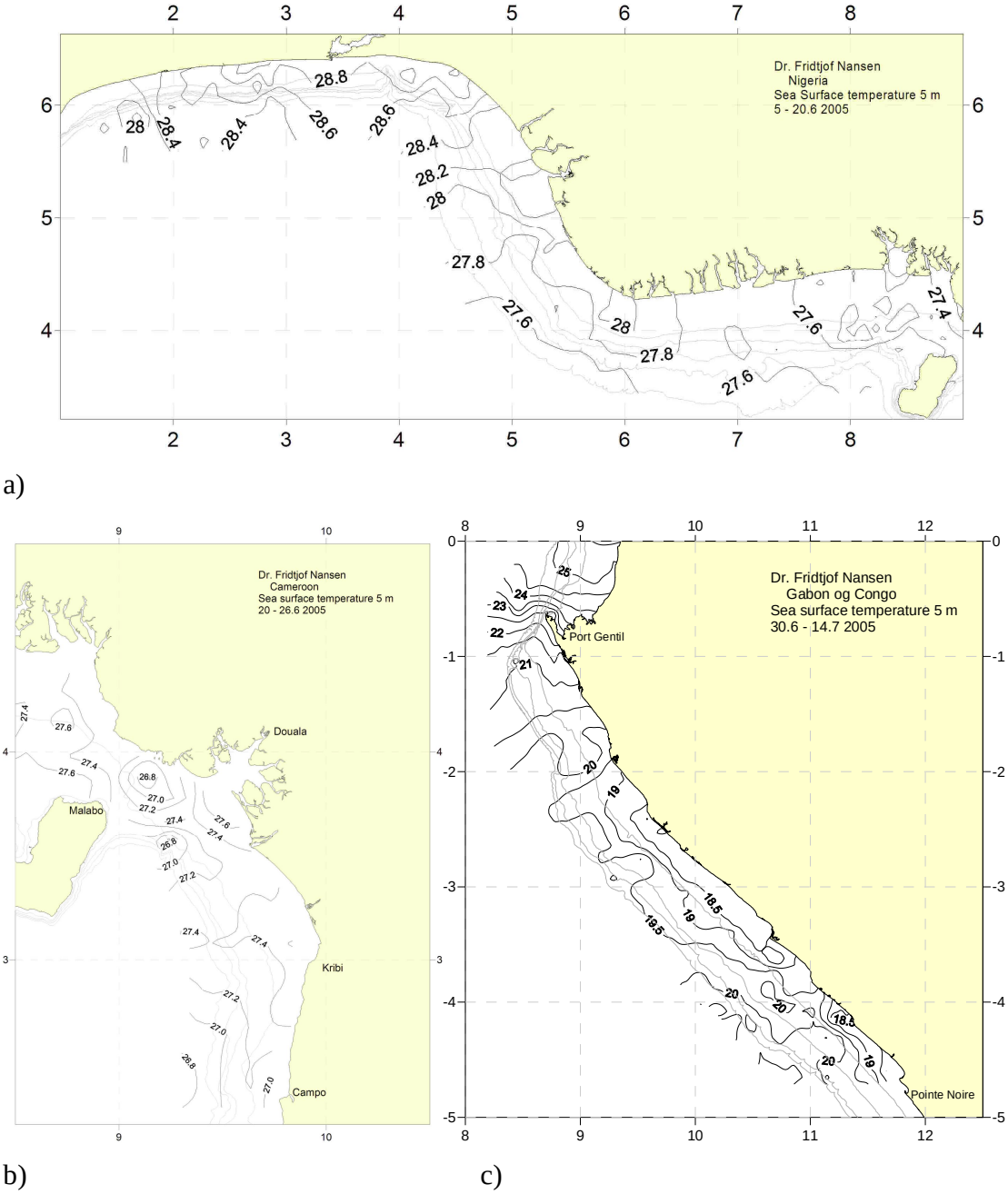
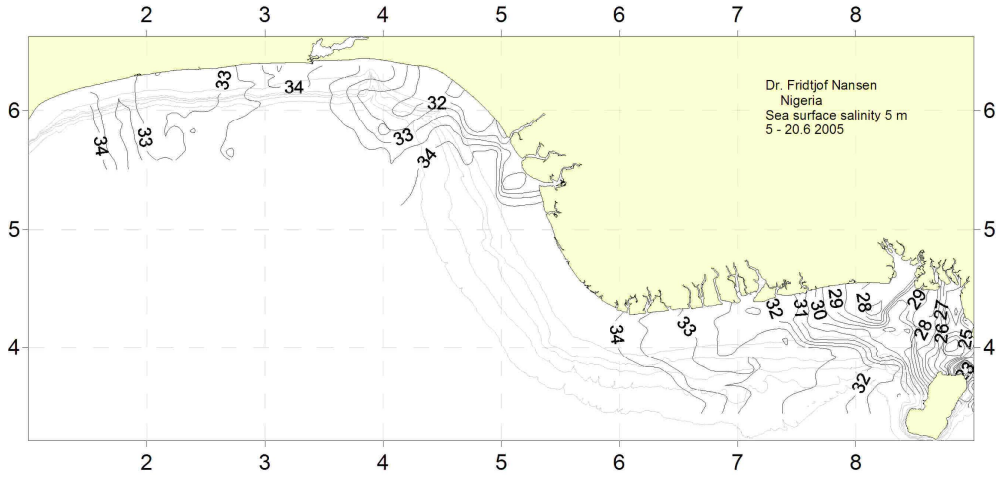
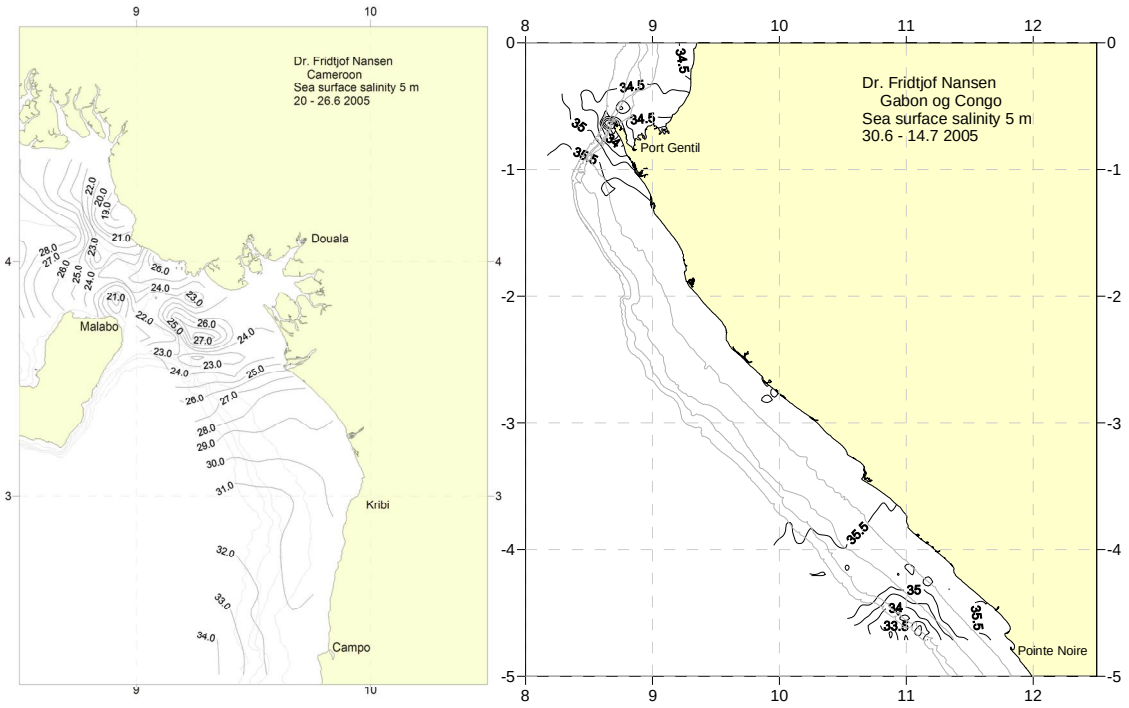


Figure 4 Horizontal distribution of surface temperature (5 m depth) off a) Nigeria – Cameroon b) Cameroon and c) Gabon – Congo measured during a survey in 2005 (Krakstad et al., 2006a). The x and y axes indicate latitude and longitude.



a)



b) c)

Figure 5 Horizontal distribution of surface salinity (5 m depth) off a) Nigeria – Cameroon, b) Cameroon and c) Gabon – Congo measured during a survey in 2005 (Krakstad et al., 2006a). The x and y axes indicate latitude and longitude.

4.1.2.BOTTOM CONDITIONS

Bottom temperature, salinity and oxygen content showed a great variation between grab stations (Table 1). The temperature ranged between 15.8˚C and 29˚C, whereas salinity levels varied from 29.6‰ to 35.9‰. The oxygen content measured varied from 1.5 ml/l to 4.4 ml/l.

Table 1 Date, longitude and latitude in decimal degrees , echo depth, CTD depth, the selected CTD station and bottom temperature, salinity and oxygen for the investigated grab stations in Nigeria, Cameroon and Gabon.

Grab station	Date	Long.	Lat.	Echo depth	CTD depth	CTD station	Temp. °C	Salinity ‰	Oxygen ml/l
N1	05.06.2005	2,832	6,138	98	96	828	16,9	35,7	2,3
N2	06.06.2005	3,343	6,224	70	62	837	19,0	35,9	2,6
N3	07.06.2005	4,069	6,168	60	60	847	18,9	35,9	2,5
N5*	08.06.2005	4,331	6,227	25	23	856	29,0	34,4	3,9
N8*	10.06.2005	5,087	5,154	39	32	879	27,4	34,7	4,3
N9	10.06.2005	4,959	4,991	83	72	881	18,1	35,9	2,7
N11	12.06.2005	5,769	4,148	25	23	900	27,8	34,7	4,3
N12	13.06.2005	6,297	3,975	45	33	912	28,2	34,5	4,4
N13	14.06.2005	6,970	4,014	66	58	921	18,8	35,9	2,4
N15	20.06.2005	7,958	4,018	63	61	941	17,4	35,8	2,4
N16	20.06.2005	8,205	4,103	44	43	944	21,5	35,2	2,6
C1	20.06.2005	8,185	3,944	78	76	945	16,3	35,7	2,5
C2	20.06.2005	8,568	4,124	60	50	946	18,7	35,9	2,4
C3*	20.06.2005	8,780	4,022	65	61	950	17,6	35,8	2,4
C4	21.06.2005	9,023	3,909	56	60	951	18,0	34,0	2,6
C5*	21.06.2005	9,195	3,832	22	17	954	27,8	31,4	4,2
C6	21.06.2005	9,090	3,995	28	25	953	27,3	33,2	3,7
C7	22.06.2005	8,920	4,050	50	42	949	26,3	34,3	3,8
C8	22.06.2005	9,478	3,646	20	16	956	27,8	29,6	4,3
C9	22.06.2005	9,389	3,333	105	94	957	15,9	35,7	2,7
C11	23.06.2005	9,568	3,291	37	38	964	19,9	35,4	3,4
C12*	23.06.2005	9,777	3,225	23	19	967	27,6	31,8	4,2
C13	24.06.2005	9,564	3,037	101	115	970	15,9	35,7	2,8
C14	24.06.2005	9,837	3,050	20	12	968	27,5	29,8	4,4
C15	24.06.2005	9,691	2,823	82	83	973	16,2	35,7	2,9
C17*	24.06.2005	9,761	2,591	23	16	975	27,4	31,3	4,4
C18	24.06.2005	9,580	2,585	92	88	978	16,2	35,7	2,7
G1	30.06.2005	9,229	0,863	19	16	1047	25,6	34,2	4,4

G2	01.07.2005	9,242	0,316	25	16	1055	25,6	34,6	4,4
G3	01.07.2005	9,035	0,087	60	54	1058	16,6	35,8	3,0
G5	02.07.2005	8,866	-0,455	43	41	1070	18,2	35,7	3,1
G6*	05.07.2005	8,527	-0,925	47	43	1080	17,8	35,8	3,2
G7*	06.07.2005	8,669	-1,625	95	92	1082	15,8	35,7	2,7
G8	06.07.2005	9,000	-1,944	63	47	1088	16,4	35,7	2,3
G9	07.07.2005	9,278	-1,994	19	17	1098	17,9	35,9	2,1
G10*	07.07.2005	9,045	-2,453	109	105	1101	15,8	35,7	2,4
G11	08.07.2005	9,236	-2,674	90	82	1103	16,1	35,7	2,4
G12	08.07.2005	9,424	-2,870	105	96	1109	16,0	35,7	2,2
G13	09.07.2005	9,819	-3,172	92	84	1119	16,2	35,7	1,5
G14	10.07.2005	10,256	-3,447	64	60	1128	16,4	35,7	2,1
G15	11.07.2005	10,613	-3,811	69	61	1137	16,2	35,7	2,4
G16	12.07.2005	11,039	-4,121	49	39	1143	16,5	35,7	1,7

* These stations did not contain Brachyura.

The environmental variables measured for the trawl stations, also showed great variability (Table 2). Temperature ranged from a low 8.6˚C to a high 29˚C. The salinity varied from 30.5‰ to 36.3‰. The oxygen content ranged from 1.3 ml/l to 4.7 ml/l.

Table 2 Date, longitude and latitude in decimal degrees, depth, CTD depth, the corresponding CTD station and bottom temperature, salinity and oxygen for the investigated trawl stations off Nigeria, Cameroon and Gabon (including some stations of São Tomé and Principe, and Congo).

Trawl station	Date	Long.	Lat.	Depth	CTD depth	CTD station	Temp. °C	Salinity ‰	Oxygen ml/l
847	06.06.2005	3,067	6,283	37	33	833	22,5	35,8	3,9
855	07.06.2005	4,050	6,333	18	18	845	29,0	34,3	4,0
856	07.06.2005	4,067	6,267	36	32	846	29,0	34,8	4,2
858	07.06.2005	4,000	6,083	281	254	848	11,7	35,2	1,3
865	08.06.2005	4,500	5,933	72	74	859	17,2	35,8	2,3
867	08.06.2005	4,417	5,883	264	285	860	10,6	35,0	1,3
868	09.06.2005	4,500	5,617	413	380	861	9,2	34,9	1,4
870	09.06.2005	4,600	5,717	116	105	863	15,9	35,7	2,1
871	09.06.2005	4,650	5,767	64	58	864	18,3	35,8	2,5
876	09.06.2005	4,567	5,450	481	463	869	8,6	34,8	1,5
877	10.06.2005	4,783	5,267	147	132	875	14,8	35,5	1,8
878	10.06.2005	4,867	5,300	81	72	876	17,4	35,8	2,8
879	10.06.2005	4,967	5,367	40	41	877	20,6	35,7	3,0
880	10.06.2005	5,050	5,350	26	25	878	28,0	34,6	4,2
890	11.06.2005	5,333	4,433	63	57	889	21,1	35,7	3,3
903	13.06.2005	5,967	3,783	152	140	909	15,5	35,6	2,1
905	13.06.2005	6,033	4,083	24	19	911	27,9	34,0	4,4
922	15.06.2005	7,667	4,150	40	35	932	27,9	33,0	4,3
923	15.06.2005	7,650	3,917	101	91	933	16,4	35,7	2,5
938	21.06.2005	9,150	3,900	0	25	953	27,4	33,2	3,7
966	25.06.2005	9,633	2,433	47	42	985	26,8	34,4	4,2
970	26.06.2005	7,317	1,700	58	46	992	20,5	35,9	3,8
977	27.06.2005	7,183	1,500	81	77	1004	16,6	35,8	3,1
983	29.06.2005	6,583	0,033	66	75	1036	16,5	35,8	3,2
986	29.06.2005	6,783	0,250	73	88	1039	15,7	35,7	3,1
1231	13.06.2006	4,500	5,933	72	63	723	19,0	35,9	2,8
1298	22.06.2006	7,967	4,017	64	57	810	19,0	35,9	2,4
1300	22.06.2006	8,183	3,933	82	76	812	17,5	35,8	2,8
1332	29.06.2006	9,817	3,000	24	20	848	28,5	30,5	4,6
1340	30.06.2006	9,800	2,700	27	22	856	28,3	32,2	4,6
1347	02.07.2006	7,300	1,683	60	53	876	26,7	34,7	4,7
1353	03.07.2006	6,467	0,150	73	78	893	18,1	36,0	3,9
1360	04.07.2006	6,767	0,233	54	49	911	19,1	36,1	4,0
246	30.06.2007	9,424	-2,251	18	14	871	20,7	36,3	3,8
263	02.07.2007	9,712	-3,355	329	334	890	9,5	34,9	1,5
274	04.07.2007	10,396	-3,689	84	76	903	16,3	35,7	2,7
288	05.07.2007	10,993	-4,241	88	75	918	16,6	35,7	2,4

Correlations between the different environmental variables from each grab station are presented in Table 3. Depth showed a strong negative correlation with temperature and oxygen. Temperature revealed a strong negative correlation with salinity, and a strong positive correlation with oxygen. There was also a strong negative correlation between salinity and oxygen.

Table 3 Correlation matrix of the environmental variables at the grab stations, calculated in CANOCO. Significant correlation values > 0.6/-0.6 are shown in bold.

Environmental variables	Longitude	Latitude	Depth	Temperature	Salinity	Oxygen
Longitude	1.00					
Latitude	-0.69	1.00				
Depth	-0.26	-0.03	1.00			
Temperature	-0.10	0.41	**-0.72**	1.00		
Salinity	-0.20	-0.27	0.57	**-0.70**	1.00	
Oxygen	-0.12	0.44	**-0.64**	**0.92**	**-0.65**	1.00

In Table 4 the correlations between the different environmental variables measured at each trawl station are given. Temperature showed a strong positive correlation with temperature and a strong negative correlation with depth. Oxygen revealed a strong negative correlation with salinity. There was not a strong correlation between temperature and salinity.

Table 4 Correlation matrix of the environmental variables at the trawl stations, calculated in CANOCO. Significant correlation values >0.6/-0.6 are shown in bold.

Environmental variables	Temperature	Salinity	Oxygen	Longitude	Latitude	Depth
Temperature	1.00					
Salinity	-0.59	1.00				
Oxygen	**0.90**	-0.44	1.00			
Longitude	0.15	-0.33	0.19	1.00		
Latitude	0.20	-0.15	-0.02	**-0.80**	1.00	
Depth	**-0.77**	0.16	**-0.78**	-0.20	0.04	1.00

4.2. SEDIMENT ANALYSIS

Sediment grain size analyses for grab stations in Nigeria and Cameroon are presented in figure 6. There are four categories; silt/clay (<63 µm), fine sand (63-250 µm), medium sand (250-500 µm) and course sand (>500 µm). Percentage grain size recorded for each category ranged from 5.3-34.9 for silt/clay, 25.5-73.2 for fine sand, 12.6-31.5 for medium sand, and 4.1-27.3 for course sand. In other words, silt/clay had the highest level of variation, while medium and course sand fluctuated less. Fine sand had the highest and course sand the lowest sediment composition in total.

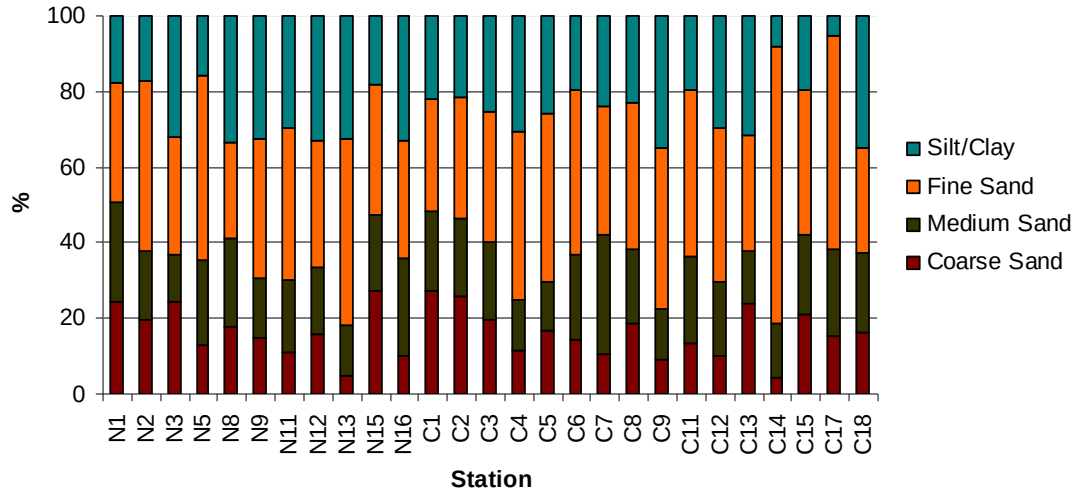


Figure 6 Sediment grain size for the investigated grab stations in Nigeria and Cameroon.

The lowest level of total organic matter, 2.4%, was measured at station C4. 16.1% was the the highest level of total organic matter measured, and this was encountered at station C12 (Figure 7). The average level of total organic matter was 8.4%.

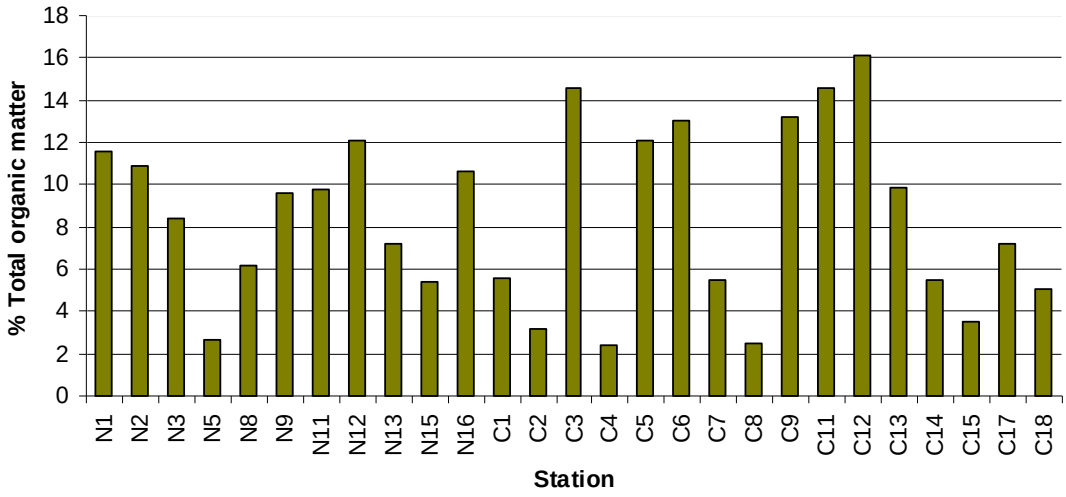


Figure 7 Total organic matter (TOM) for the investigated grab stations in Nigeria and Cameroon.

4.3. ABUNDANS OF MAIN TAXA OF CRUSTACEA

The most common crustacean group found in the grab samples was Amphipoda (Table 5). In number of speciemens, this order accounted for more than 50% of the crustacean fauna. Tanaidacea was another group commonly encountered, especially in Cameroon. Nigeria and Cameroon had a similar number of specimens on their sediment, and the various animal groups occurred in more or less the same number in both countries. Gabon on the other hand, had a much higher number of specimens compared to Nigeria and Cameroon. In addition to amphipods and tanaidaceans, relatively high numbers of cumaceans, isopods and ostracods were found in the samples for Gabon. A complete list of the grab stations, with number of specimens recorded for different taxa of Crustacea, is given in Appendix II.

Table 5 An overview of the main Crustacean groups, with number of specimens, encountered in the grab samples from Nigeria, Cameroon and Gabon.

Group	Nigeria	Cameroon	Gabon	Sum
Crustacea (fragments)	101	32	116	249
Ostracoda	18	15	161	194
Lepostraca	0	0	2	2
Mysidacea	1	2	8	11
Amphipoda	155	176	1594	1925
Isopoda	11	21	161	193
Tanaidacea	24	231	288	543
Cumacea	46	13	170	229
Euphausiacea	0	0	2	2
Decapoda	0	0	8	8
Natantia	53	18	82	153
Callianassidae	14	0	0	14
Reptantia	9	0	0	9
Anomura	8	4	10	22
Brachyura	37	43	56	136
Sum	477	555	2658	**3690**

The highest percentage of brachyurans was found in Cameroon (7.99%), while Gabon had the lowest percentage of brachyurans (2.11%) (Table 6).

Table 6 The percentage of brachyurans in the Crustacean fauna of Nigeria, Cameroon and Gabon.

Country	Total number of specimens	Number of brachyuran specimens	% Brachyura
Nigeria	477	37	7,76
Cameroon	538	43	7,99
Gabon	2659	56	2,11

4.4. THE BRACHYURAN FAUNA

Class Brachyura Latreille, 1802

For all taxa identified in this study, the following information, if obtainable, is given: type locality, examined material with station code and number of specimens, relevant synonyms used on registered observations in West Africa, previous reported distribution, Nansen sample distribution, habitat, measurements of carapace width and length, and characteristics. Remarks are given when relevant. Nomenclature for higher taxa follows Ng et al. (2008) and Manning and Holthuis (1981). Where discrepancies between the two occurred, Ng et al. were preferred. Type localities were difficult to find for all investigated species, and the information provided is found in Rathbun (1921), Capart (1951), Monod (1956), Forest and Guinot (1966), Manning and Holthuis (1981) and Chavan et al. (1998). Taxa characteristics and habitat description were based on Monod (1956), Manning and Holthuis (1981) and observations from the present study. In addition, Guinot and Richer de Forges (1995), Hendrix and Cervantes (2003), Pallaoro and Dulčić (2004) and Artüz (2007) were used for some characteristics. Complete descriptions of the species can be found in Capart (1951), Monod (1956) and Manning and Holthuis (1981). Layout of synonym lists follow that of Manning and Holthuis (1981).

The main characters of Brachyura are illustrated in Figure 8. Two photographs were taken for each species (Figure 9-54). Both photos were habitus pictures; one of the dorsal side and one of the ventral side of the specimen. In the case of *Macropodia gilsoni* an addditonal photo of the length of the pereipods was taken. For *Menippe nodifrons*, it was also necessary to visualise the juvenile form which is clearly distinct from the adult form.

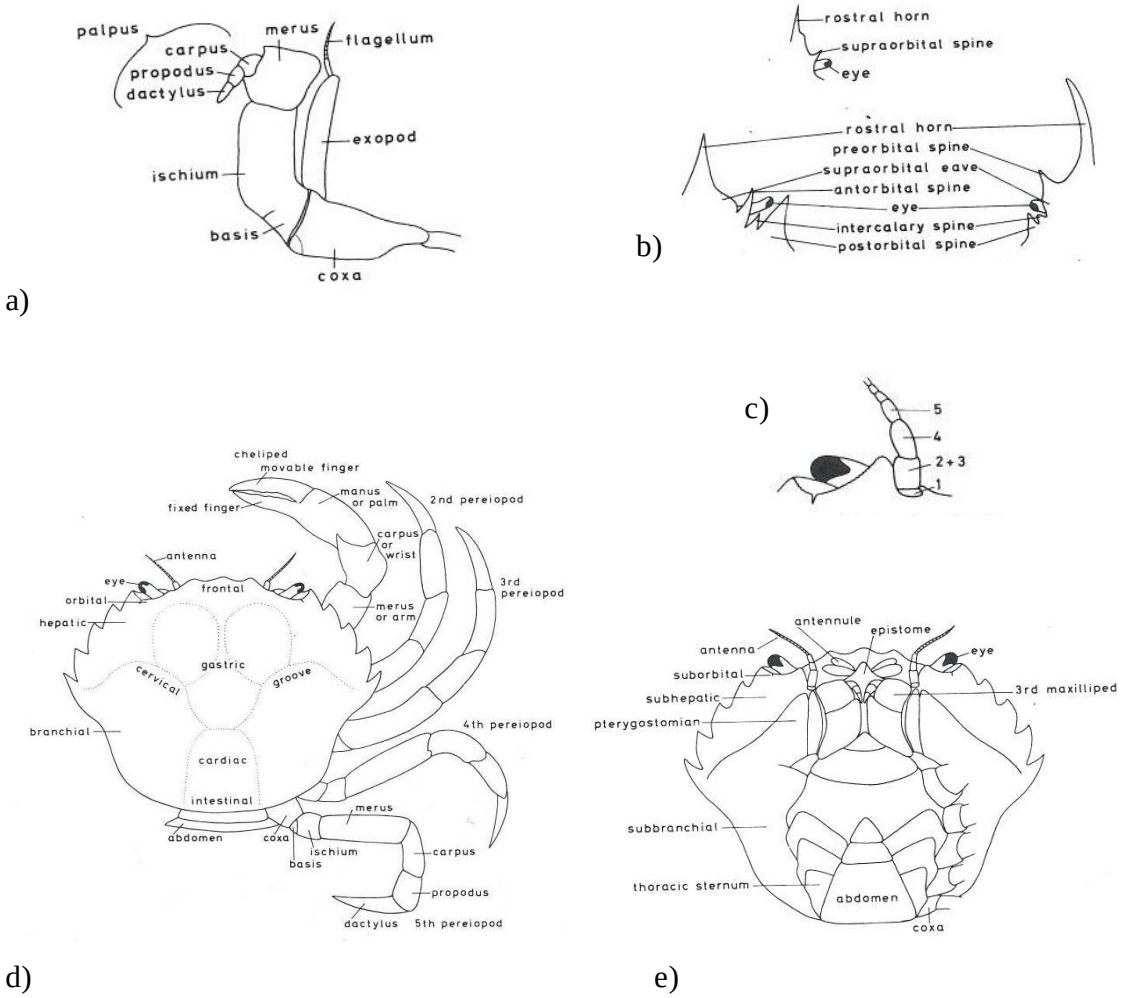


Figure 8 Schematic drawing of a crab copied from Christiansen (1969). a) left third maxilliped (mouthpart), b) orbital region, c) antennae; numbers 1-5 indicate the antennal pduncle, 2+3 the basal antennal article, d) dorsal view of a crab showing only the pereiopods and cheliped on the right side, e) ventral view of crab with coax and articulation of basis indicated on the left side.

Family CALAPPIDAE de Haan, 1883

Characteristics: The carapace of the species in this family is globular, spherical or hemispherical. The antennae are small and there are inhalant branchial openings in front of the basal segment of the chelipeds.

Genus *Acanthocarpus* Stimpson, 1871

Characteristics: This genus is easily recognized by the large antero-lateral spine on the carapace, and the large spine on the merus of the first pereiopod.

Acanthocarpus brevispinis Monod, 1946

Figure 9.

Acanthocarpus africanus Capart, 1951:35. – Rossignol, 1957:127.

Acanthocarpus brevispinis Monod, 1956:109. - Guinot-Dumortier and Dumortier, 1960:129. - Guinot and Ribeiro, 1962:27.- Forest, 1963:628. – Maurin, 1968b:484. - Le Loeuff and Intès, 1969:66.

Acanthocarpus bispinosus. – Longhurst, 1958:87

Acanthocarpus brevispinnis [sic.]. – Maurin, 1968b:489.

Type locality: Cap Juby, Spanish Sahara

Material examined: Trawl station 858 (15 specimens), 867 (2), 870 (1), 876 (1), 263(1).

Previous reported distribution: Cap Juby to Angola, 100-500m.

Nansen samples distribution: Off Nigeria and Gabon, 116-481 m.

Habitat: Epifaunal, soft sediments**.**

Measurements: Carapace length: 12-56 mm. Carapace width: 10-56 mm.

Characteristics: The width of the terminal segment of the male abdomen is much greater than the length. The walking legs are slender and on the fifth leg the carpus is more than three time as long as its greatest width. There are about 40 striae on the stridulating ridge on the claw.

Figure 9 *Acanthocarpus brevispinis*. Habitus: left: dorsal view; right: ventral view. The speciemen has a carapace width of 22 mm and a carapace length of 25 mm.

Genus *Calappa* Weber, 1795

Characteristics: Carapace has a distinct, box-formed shape. The chelipeds are large and folds around the posterolateral border. The four remaining pereiopods are bent and are nearly hidden by the chelipeds.

Calappa pelii Herklots, 1851

Figure 10.

Calappa piscatorum Calman, 1914.

Calappa peli. – Capart, 1951:39. – Monod, 1956:102. – Rossignol, 1957:75. – Longhurst, 1958:87. – Gauld, 1960:69. - Guinot and Ribeiro, 1962:26. – Rossignol, 1962:114. – Crosnier, 1964:34. - Forest and Guinot, 1966:52. – Monod, 1967:178. – Maurin, 1968a:48; 1968b:484. - Le Loeuff and Intès, 1968:40; 1969:63. – Crosnier, 1970:1215.

Calappa. – Voss, 1966:19. – Maurin, 1968b.

Calappa pelii. – Holthuis, 1968:29.

Type locality: Ghana, Gold Coast.

Material examined: Trawl station 977 (1 specimen), 1298 (1), 274 (4).

Previous reported distribution: Spanish Sahara to Angola, 20-400 m.

Nansen samples distribution: Off Nigeria, Principe and Congo, 64-84 m.

Habitat: Epifaunal, soft sediments.

Measurements: Carapace length: 15-40 mm. Carapace width: 16-46 mm.

Characteristics: Carapace with a uniform slightly purple colour. The posterior margin of the carapace has many short, pointy spines. Both chelipeds and carapace are granulated.

Figure 10 *Calappa pelii*. Habitus: left: dorsal view; right: ventral view. The specimen has a carapace width of 21 mm and a carapace length of 20 mm.

Family DORIPPIDAE MacLeay, 1838

Characteristics: Carapace short and squarish, abdomen not fully hidden beneath carapace, last two pairs of legs reduced and subdorsal. The male outlet for genital products (gonophores) shows a series of transformations from coxal to coxosternal condition.

Genus *Medorippe* Manning and Holthuis, 1981

Characteristics: The carapace is broader than long, with a distinct epibranchial spine (located in the anterior part of the branchial region) on either side. *Medorippe* can be distinguished from the genera *Dorippe* and *Phyllodorippe* by the short, straight gonopod without distal appendages. Further more, the presence of spines on the dorsal margin of the merus of pereiopods 2 and 3 is a characteristic that distinguish *Medorippe* from the others.

***Medorippe lanata* (Linnaeus, 1767)**

Figure 11.

Dorippe affinis Desmarest, 1823.

Dorippe lanata. – Capart, 1951:30. - Monod, 1956:90. – Rossignol, 1957:350. – Gauld, 1960:350. - Guinot and Ribeiro, 1962:25. – Rossignol, 1962:114. – Crosnier, 1964:34. - Forest and Guinot, 1966:50. – Guinot, 1967a:244. – Maurin, 1968a:30; 1968b:480. - Le Loeuff and Intès, 1968:38; 1969:63. - Serène and Romimohtarto, 1969:6. - Bas, Arias and Guerra, 1976. - Türkay 1976a:25.

Dorippe armata. – Monod, 1956. – Crosnier, 1964. – Maurin, 1968b.

Dorripe lanata [sic.]. – Rossignol, 1957:126. – Crosnier, 1970:1215.

Type locality: The Mediterranean Sea.

Material examined: Trawl station 856 (4 specimens), 879 (1), 880 (9), 922 (1), 938 (2), 288 (1).

Previous reported distribution: Eastern Atlantic, from the Mediterranea Sea and Portugal to South Africa and Mozambique, 15-100 m.

Nansen samples distribution: Off Nigeria, Cameroon and Congo, 0-88 m**.**

Habitat: Epifaunal, soft sediment with hard particles imbedded in it.

Measurements: Carapace length: 11-29 mm. Carapace width: 12-28 mm.

Characteristics: There is a V-shaped ridge present on the cardiac region of the carapace, and the lateral margin of the carapace is granulated. The chelipeds are even in females and juveniles, but unequal in adult males. The 2nd and 3rd pereiopods are long (3rd pair longest), while the 4th and 5th pereiopods are short and slender, and with dactyls ending in a hook-like form.

Figure 11 *Medorippe lanata*. Habitus: left: dorsal view; right: ventral view. The specimen has a carapace width of 23 mm and a carapace length of 24 mm.

Genus *Phyllodorippe* Manning and Holthuis, 1981

Characteristics: The carapace is broader than long, with a distinct epibranchial spine on either side. Dorsal margins of pereiopds 2 and 3 without spines on dorsal margin of merus. The male gonopod ends in a narrow acute point and carries two lobiform appendages.

***Phyllodorippe armata* (Miers, 1881)**

Figure 12.

Dorippe armata Miers, 1881.

Dorippe senegalensis Monod, 1933b:548.

Dorippe armato [sic.]. – Monod, 1933b:548.

Dorippe armata. – Capart, 1951:33. – Monod, 1956:92. – Rossignol, 1957:75. – Longhurst, 1958:87. – Lebour, 1959:131. – Gauld, 1960:68. – Rossignol, 1962:114. - Guinot and Ribeiro, 1962:24. – Crosnier, 1964:32. - Forest and Guinot, 1966:50. - Le Loeuff and Intès, 1968:38; 1969:63-65. – Maurin, 1968a:48. – Monod, 1970:66.

Dorrippe armata [sic.]. – Rossignol, 1957:126.

Dorippe armate [sic.], Lebour, 1959:136.

Dorippe. – Voss, 1966:19. – Maurin, 1968b.

Type locality: Gorée, Senegal.

Material examined: Grab station G9 (2 specimens), G13 (1). Trawl station 880 (1 specimen), 905 (1).

Previous reported distribution: Cabo Corbeiro and Spanish Sahara to Angola, 7-60 m.

Nansen samples distribution: Off Nigeria and Gabon, 19-92 m.

Habitat: Epifaunal, soft sediment with hard particles imbedded in it.

Measurements: Carapace length: 12-19 mm. Carapace width: 10-20 mm.

Characteristics: The chelipeds are of unequal size (the right is larger than the left). There is no V-shaped ridge on the cardiac region of the carapace.

Figure 12 *Phyllodorippe armata*. Habitus: left: dorsal view; right: ventral view. The specimen has a carapace width of 19 mm and a carapace length of 18 mm.

Family EPIALTIDAE MacLeay, 1838

Characteristics: The basal segment of the antenna is trapezoidal, with the distal margin being narrower than the proximal.

Genus *Herbstia* H. Milne Edwards, 1834

Characteristics: Do not have an intercalary spine, but a large intercalary lobe. This lobe is only slightly prominent and more or less embedded in the supraorbital eve, merely limited by 2 poorly marked fissures.

Herbstia condyliata (?) (Fabricius, 1787)

Figure 13.

Mithrax herbsti Risso, 1827.

Mithrax scaber Costa, 1840.

Cancer condyliatus Fabricius, 1787:324.

Herbstia condyliata. – Monod, 1933a:212. - Forest and Gantès, 1960:356.

Herbstia rubra. – Sourie, 1954a:113; 1954b:147. - Chapman and Santler, 1955:375. – Monod, 1956:482.

Type locality: The Aegean Sea.

Material examined: Grab station N9 (1 specimen), N13 (2), N15 (1), G3 (1), G5 (1).

Previous reported distribution: The Mediterranean Sea and adjacent Atlantic south to Ghana, 2-51 m.

Nansen samples distribution: Off Nigeria and Gabon, 43-83 m.

Habitat: Epifaunal, soft sediments with shelly debris.

Measurements: Carapace length: 4-5mm. Carapace width: 3 mm.

Characteristics: Carapace with many spines and covered with a thin coat of dark setae. It is pyriform, but irregular dorsally. The posterior median margin of the carapace has a

trilobed projection. Dactyli of walking legs with fixed triangular teeth on the opposable margins.

Remarks: Only juvenile specimens were found of this species. Juveniles can easily be confused with juveniles of *Herbstia nitida* or *Herbstia rubra*. However, *H. nitida* is only found on the offshore islands of the Gulf of Guinea while *H. rubra* is restricted to the Cape Verde Islands. *H. condyliata* is the only species occuring on the continental shelf. The distribution of these species in addition to the much more spinulose carapace of *H. condyliata* compared to *H. nitida* and *H. rubra*, were determining factors in the identification of this specimen to *H. condyliata*.

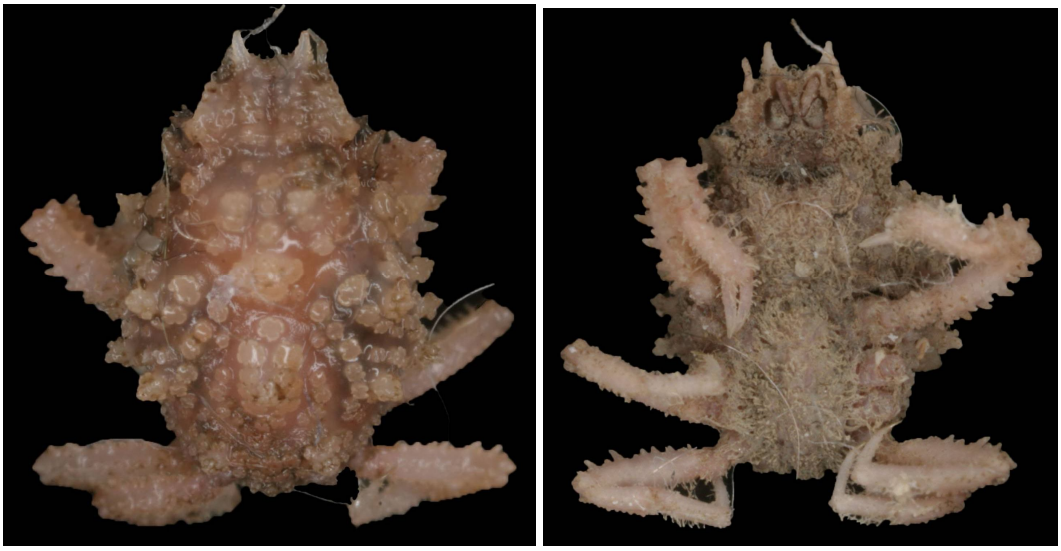


Figure 13 *Herbstia condyliata*. Habitus: left: dorsal view; right: ventral view. The specimen had a carapace width of 3 mm and a carapace length of 4 mm.

Genus *Pisa* Leach, 1814

Characteristics: The rostrum (anteromedial projection of frontal margin of head) spines are short and non divergent at the base.

***Pisa carinimana* Miers, 1879**

Figure 14.

Pisa carinimana. – Capart, 1951:87. – Sourie, 1954b:147. – Monod, 1956:488. – Rossignol, 1957:116. – Longhurst, 1958:89. – Forest, 1959:19. – Gauld, 1960:72. – Rossignol, 1962:122. - Guinot and Ribeiro, 1962:74. - Forest and Guinot, 1966:99. – Uschakov, 1970:439. – Türkay, 1957a:71.

Type locality: The Canary Islands.

Material examined: Trawl station 986 (1 specimen).

Previous reported distribution: The Canary Islands and Spanish Sahara, to Angola, 14-100 m.

Nansen samples distribution: Off São Tomé, 73 m.

Habitat: Epifaunal, soft sediments.

Measurements: Carapace length: 5 mm. Carapace width: 5 mm.

Characteristics: Elevation of the carapace not prominent. There is a lamellar expansion in the post orbitaire region. The rostrum is cut out widely with divergent peaks.

Figure 14 *Pisa carinimana*. Habitus: left: dorsal view; left: ventral view. The specimen has a carapace width of 5 mm and a carapace length of 5 mm.

Family ETHUSIDAE Guinot, 1977

Characteristics: Carapace slightly rounded in the posterior end and with 4 spines/lobes in the frontal region. The male gonopores only show a coxosternal condition.

Genus *Ethusa* Roux, 1830

Characteristics: Eyes movable. Basal segment of antennules normal (not large and swollen).

Ethusa rosacea A. Milne Edwards and Bouvier, 1897

Figure 15.

Ethusa rosacea. – Capart, 1951:28. – Monod, 1956:88. – Rossignol, 1957:126. – Crosnier, 1967:323; 1969:530.

Type locality: South of the Canary Islands and North Banc d'Arguin, Mauritania.
Material examined: Trawl station 274 (1 specimen).
Previous reported distribution: The Canary Islands to Luanda, Angola, 100-1113 m.
Nansen samples distribution: Off Congo, 84 m.
Habitat: Epifaunal, soft sediments.
Measurements: Carapace length: 16 mm. Carapace width: 14 mm.
Characteristics: The 2nd and 3rd pereiopod are stout and very long with some hair in the crevices. The dactyls are long and scythe-shaped. The 4th and 5th pereiopods are quite small. The 4th pereiopod rests on the abdomen.

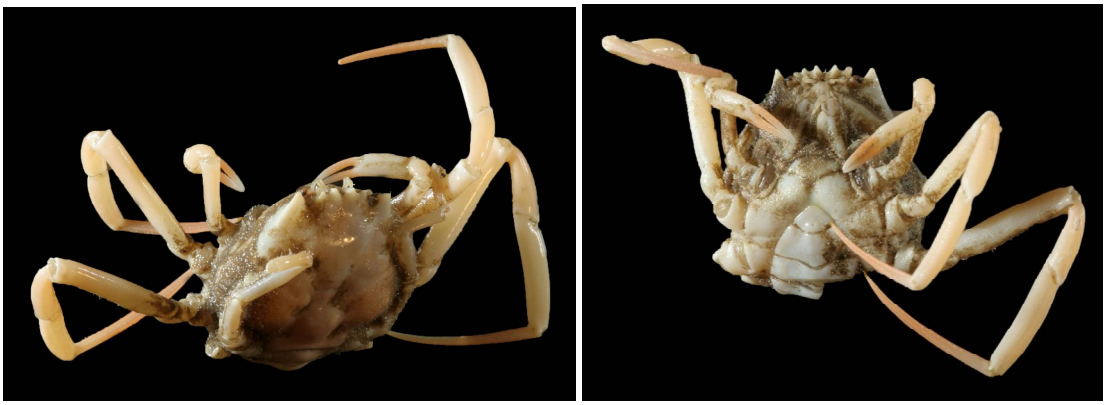


Figure 15 *Ethusa rosacea*. Habitus: left: dorsal view; left: ventral view. The speciemen has a carapace width of 14 mm and a carapace length of 16 mm.

Family EURYPLACIDAE Stimpson, 1871

Characteristics: Carapace has a "xanthoide" form; the widest part of the carapace is just behind the orbital groove. The orbital grooves do not occupy the entire frontal region, but have a normal size and shape.

Genus *Machaerus* Leach, 1818

Characteristics: The carapace is smooth, broader than long, and has a convex shape anterolaterally. There are 3 or 4 anterolateral teeth; the outer orbital tooth is distinct from the first anterolateral tooth (it is strongly spiniforme). There are 2 closed incisions in the supraorbital margin (above the orbit). The chelipeds are stout and slightly unequal; the remaining 4 pereiopods are slender.

***Machaerus oxyacantha* (Monod, 1956)**

Figure 16.

Pilumnoplax atlantica Capart, 1951:166.

Pilumnoplax oxyacantha Monod, 1956:346. - Gauld 1960:70. - Rossignol 1962:118. - Guinot and Ribeiro 1962:63. - Crosnier 1064:38. - Forest and Guinot 1966:85. - Le Loeuff and Intès 1968:31. - Guinot 1969b:517. - 1969c:688.

"*Pilumnoplax*" *oxyacantha*. – Guinot, 1969b:507.

[*Pilumnoplax*] *oxyacantha*. – Guinot, 1971:1081.

Type locality: The Gulf of Guinea.

Material examined: Grab Station N3 (1 juvenile specimen). Trawl station 847 (1 specimen).

Previous reported distribution: Mauritania to Angola, 7-73 m.

Nansen samples distribution: Off Nigeria, 37-60 m.

Habitat: Epifauna, soft sediments with Foraminifera or shells.

Measurements: Carapace length: 2-10 mm. Carapace width: 3-13 mm.

Characteristics: Carapace curved from front to back, with a few very small tubercles in the branchial region and an arc in the hepatic region. The superior orbital margin is granular, and the 2 fissures are barely visible. The external orbital tooth is rather blunt. The anterior lateral border is cut into 3 teeth, where the second is the largest. The posterior lateral border is also granular.

Figure 16 *Machaerus oxyacantha*. Habitus: left: dorsal view; right: ventral view. The specimen has a carapace width of 13 mm and a carapace length of 10 mm.

Family GONEPLACIDAE MacLeay, 1838

Characteristics: Palp of the 3rd maxilliped is inserted on the distal angle of the internal merus. The male genital opening is located on the sternum (or at least a penis is present on between the 4th and 5th sternite). Carapace is squarish and the branchial region is not swollen.

Genus *Goneplax* Leach, 1814

Characteristics: Carapace more or less quadrilateral, the anterior border is completely occupied by the elongated orbital grove and the frontal area of carapace. The chelipeds are very elongated.

***Goneplax barnardi* (Capart, 1951)**

Figure 17.

Carcinoplax barnardi Capart, 1951:170. – Monod, 1956:351. – Forest, 1963:627. – Maurin, 1968b:484. – Guinot, 1969b:526.

Type locality: Angola and Guinea-Bissau.

Material examined: Trawl station 858 (2 specimens), 867 (1), 868 (2).

Previous reported distribution: Spanish Sahara to Angola, 200-586 m.

Nansen samples distribution: Off Nigeria, 264-413 m.

Habitat: Epifaunal, soft sediments.

Measurements: Carapace length: 12-20 mm. Carapace width: 16-25 mm.

Characteristics: Can be distinguished from *Goneplax rhomboides* by the longer spine on the carapace and the shorter eye stalks. Have a distinct, but faint squarish pattern in the gastric region of carapace.

Figure 17 *Goneplax barnardi.* Habitus: left: dorsal view; right: ventral view. The specimen has a carapace width of 25 mm and a carapace length of 20 mm.

***Goneplax rhomboides* (Linnaeus, 1758)**

Figure 18.

Cancer angulatus Pennant, 1777.

Ocypode bispinosa Lamarck, 1801.

Ocypode longimana Latreille, 1803.

Cancer rhomboides Linnaeus, 1758:626.

Goneplax angulata. – Capart, 1951:168. – Barnard, 1954:126. – Monod, 1956:354. – Pérès, 1964:27. – Maurin, 1968a:19; 1968b:482.

Goneplax rhomboides. – Capart, 1951. - Forest and Gantès, 1960:353. - Guinot and Ribeiro, 1962:63. - Forest and Guinot, 1966:86. - Crosnier, 1970:1215. - Türkay 1976a:25; 1976b:61.

Goneplax. - Maurin, 1968a:14.

Goneplax rhomboïdes. - Le Loeff and Intès, 1968.

Type locality: Weymouth, England.

Material examined: Grab station N12 (1 specimen), N13 (2), N15 (2), N16 (1), C4 (7), C6 (1), C7 (6), C8 (1), C14 (1), G1 (6), G16 (4).

Previous reported distribution: The English Channel to South Africa, including the Mediterranean, 30-700 m.

Nansen samples distribution: Off Nigeria, Cameroon and Gabon, 19-66 m.

Habitat: Epifaunal, soft sediments.

Measurements: Carapace length: 1-15 mm. Carapace width: 1-11 mm.

Characteristics: The carapace is almost rectangular, with a smooth surface. There are faint granulated lines, especially on the border of carapace. In the middle of the carapace there is a transverse grove. The orbital grove is curved and sharp, the lateral edge is convex with a pointy spike which are directed foreward. The chelipeds are uneven, the right claw is especially stout.

Remarks: Only juvenile specimens were found of this species**.**

Figure 18 *Goneplax rhomboides*. Habitus: left: dorsal view; right: ventral view. The specimen has a carapace width of 5 mm and a carapace length of 4 mm.

Family GRAPSIDAE MacLeay, 1838

Characteristics: The 5th pereiopods are not dorsally placed. The sides of the carapace is strongly arched, the front broad.

Genus *Pachygrapsus* Randall, 1839

Characteristics: The antenna enter the orbital groove.

***Pachygrapsus gracilis* (De Saussure, 1858)**

Figure 19.

Metopograpsus gracilis De Saussure, 1858.

Grapsus guadulpensis Desbonne, in Desbonne and Schramm, 1867.

Pachygrapsus gracilis. – Frade, 1950:11. – Capart, 1951:187. - Monod 1956:419. – Rossignol, 1957:89. - Guinot and Ribeiro, 1962:71. – Rossignol, 1962:120. - Forest and Guinot, 1966:92. – Uschakov, 1970:443. – Powell, 1979:127.

Pachygrapsus "africanus". – sensu Hartmann-Schröder and Hartmann, 1974:19.

Type locality: St. Thomas, the Antilles

Material examined: Trawl station 1300 (1 specimen), 1332 (1 (juvenile)), 1353 (1).

Previous reported distribution: Senegal to Angola, the littoral zone.

Nansen samples distribution: Off Nigeria, Cameroon and São Tomé, 24-82 m.

Habitat: Epifaunal, among/under stones on soft sediments.

Measurements: Carapace length: 2-8 mm. Carapace width: 2-8 mm.

Characteristics: The frontal area of carapace is not particulary curved, but very smooth and it is decorated with many dots that create a distinct, wavy/linear pattern. The male pleopod is short, stout and ends in a set of stiff bristles.

Figure 19 *Pachygrapsus gracilis.* Habitus: left: dorsal view; right: ventral view. The specimen has a carapace width of 8 mm and a carapace length of 6 mm.

Family HEXAPODIDAE Miers, 1886

Characteristics: In this family the last pair of pereiopods is completely suppressed. The carapace has a rounded, oval shape.

Genus *Lamdophallus* Alcock, 1900

Characteristics: The eyes are fixed. The pereiopods (except chelae) are long and slender. The merus of the longest pair is longer than carapace. Males have long, narrow transverse grooves in the sternum which extend laterally from the abdominal fossa.

Lamdophallus sexpes Alcock, 1900

Figure 20.

Lambdophallus, Alcock, 1900:329.

Type locality: India.

Material examined: Grab station N11 (5 specimens), C8 (6).

Previous reported distribution: The West Coast of Africa; Ghana and Benin, sublittoral.

Nansen samples distribution: Off Nigeria and Cameroon, 20-25 m.

Habitat: Epifaunal, soft sediments.

Measurements: Carapace length: 1-2 mm. Carapace width: 1-3 mm.

Characteristics: The 3rd and 4th pereiopods are almost equal in length. The width of the carapace is approximately 1.6 times the length.

Figure 20 *Lambdophallus sexpes.* Habitus: left: dorsal view; right: ventral view. The specimen has a carapace width of 2 mm and a carapace length of 1 mm.

Family HOMOLIDAE de Haan, 1839

Characteristics: This family can be distinguished by the presence of a longitudinal groove on the carapace, called a homolienne line. Pereiopod 5 is generally much reduced and dactylus have a cheliform or cheliform-like arrangement.

Genus *Homola* Leach, 1815

Characteristics: The merus of the fith pereiopod is rather short, and do not reach the level of the progastric spines of the carapace. The eyes have a swollen appearance.

***Homola barbata* (Fabricius, 1793)**

Figure 21.

Cancer cubicus Forskål, 1775.

Cancer novemdecos Sulzer, 1776.

Cancer barbata Fabricius, 1793

Thelxiope palpigera Rafinesque, 1814.

Homola spinifrons Leach, 1815.

Dorippe spinosus Risso, 1816.

Thelxiope barbata. – Gordon, 1950:221. – Monod, 1956:79. – Maurin, 1968b:486. - Le Loeff and Intés, 1968:31.

Homola barbata. – Figueira, 1960:7. – Guinot and Ribeiro, 1962:23. – Pérès, 1964:20. - Forest and Guinot, 1966:48. – Crosnier, 1967:322. – Maurin, 1968a:19; 1968b:480. - Rice and Provenzano, 1970:446. - Türkay 1976a:25; 1976b:61.

Type locality: Bay of Naples.

Material examined: Trawl station 983 (1 specimen), 1347 (1), 1360 (1).

Previous reported distribution: Mediterranean, eastern and southern Atlantic, and off South Africa, 10-679 m.

Nansen samples distribution: Off São Tomé and Principe, 54-66 m.

Habitat: Epifaunal, soft sediments with shell debris.

Measurements: Carapace length: 11-16 mm. Carapace width: 8-11 mm.

Characteristics: The pattern of spines on the rostrum is a great characteristic of this species. The gastric region has 9 large spines; 4 forming a square on the midline, 1 are located posteriorly to the midline, and two pairs of spines are arranged in an oblique line latereally of the midline. The frontorbital border of the carapace has two pairs of spines in a transverse row. The anterolateral area of the carapace has 2 large spines and the lateral margin of the carapace have a line of spinules wich decrease in size posteriorly. It has a distinct homolienne line. At the front, under the orbit, 3 spines are forming a triangle. The eyes are elongated. The chela are slender and equal, the walking legs are compressed, thin and elongate.

Figure 21 *Homola barbata*. Habitus: left: dorsal view; right: ventral view. The specimen has a carapace width of 11 mm and a carapace length of 18 mm.

Family INACHIDAE MacLeay, 1838

Characteristics: Distinct supraorbital and postorbital spine(s). May or may not have retractible eyes.

Genus *Achaeus* Leach, 1817

Characteristics: The plate which separates the two antennular cavities from each other, the interantennular septum, is distinct but only slightly visible in ventral view. The rostrum is bilobed and the male chelipeds are inflated. The dactyli of 2 or 3 of the posterior pereiopods are sickle-shaped (falciform).

***Achaeus monodi* (Capart, 1951)**

Figure 22.

Podochela monodi Capart, 1951:95.

Achaeus monody. – Monod, 1956:548. – Longhurst, 1958:89. – Rossignol, 1962:122. - Forest and Guinot, 1966:109. - Le Loeuff and Intès, 1968.

Type locality: Cabinda, Angola (9˚20'S).

Material examined: Trawl station 1360 (2 specimens). Grab station N2 (1 specimen).

Previous reported distribution: Senegal to Angola, sublittoral, 0-100 m.

Nansen samples distribution: Off Nigeria and São Tomé, 54-70 m.

Habitat: Epifaunal, on a variety of bottom types.

Measurements: Carapace length: 6 mm. Carapace width: 3.5 - 4.5 mm.

Characteristics: Erect spines are present on both cardiac and gastric regions of the carapace. The width of the carapace is greater than 0.8 times the length. Only one of the pereiopods has a falciform dactylus.

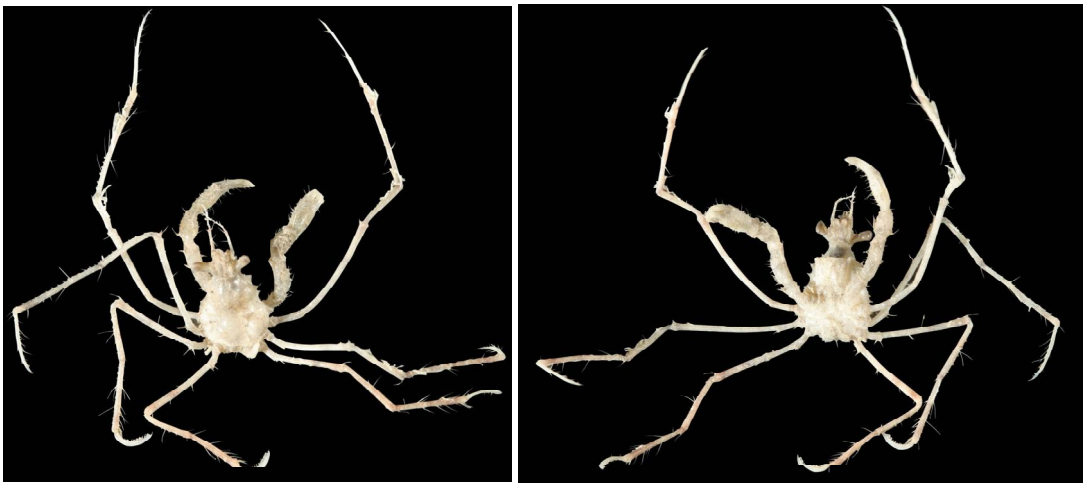


Figure 22 *Achaeus monodi*. Habitus: left: dorsal view; right: ventral view. The specimen has a carapace width of 3.5 mm and a carapace length of 6 mm.

Genus *Capartiella* Manning and Holthuis, 1981

Characteristics: The front of carapace is truncate and rather obscurely bilobed. The carapace lack spines dorsally. None of the dactyli are falciform.

Capartiella longipes (Capart, 1951)

Figure 23.

Achaeus ? *longipes* Capart, 1951:62.

Physachaeus (?) *longipes*. - Monod, 1956:537. – Forest, 1959:15. – Rossignol, 1962:122. - Forest and Guinot, 1966:108. - Crosnier 1967:340.

Type locality: Off Luanda, Angola.

Material examined: Trawl station 867 (1 specimen).

Previous reported distribution: Senegal to Angola, 33-82 m.

Nansen samples distribution: Off Nigeria, 264 m.

Habitat: Epifaunal, soft sediments.

Measurements: Carapace length: 12 mm. Carapace width: 9 mm.

Characteristics: The walking legs exceedes the chela in length. The five pairs of pereiopods are all covered in fine hair; on the propodi and dactyli the hair takes a fan-shaped form. The carapace has a slightly rounded form.

Figure 23 *Capartiella longipes.* Habitus: left: dorsal view; right: ventral view. The specimen has a carapace width of 9 mm and a carapace length of 12 mm.

Genus *Inachus* Weber, 1795

Characteristics: The postorbital spine has been reduced into a broad, cupped process. The rostrum is short; consisting of 2 blunt lobes or broad, triangular spines. The 2nd pereiopod is much longer than the 3rd, and noticeably enlarged. The abdomen has six somites in both sexes.

Inachus angolensis Capart, 1951

Figure 24.

Inachus angolensis Capart, 1951:72. – Monod, 1956:524. – Rossignol, 1957:77. – Gauld, 1960:72. – Rossignol, 1962:122. – Crosnier, 1964:34. – Forest, 1965b:394. - Forest and Guinot, 1966:106. - Le Loeuff and Intès, 1968:31. – Maurin, 1969:66. – Crosnier, 1970:1215.

Inachus. - Maurin 1968b.

?Inachus mauritanicus. - Maurin 1968b:484.

Type locality: Elephant Bay, Angola, 13˚05’S, 12˚46’E.

Material examined: Trawl station 878 (2 specimens), 938 (1), 1231 (1).

Previous reported distribution: Spanish Sahara to southern Angola, 46-350 m.

Nansen samples distribution: Off Nigeria and Cameroon, 0-81 m.

Measurements: Carapace length: 8-20 mm. Carapace width: 4-19 mm.

Habitat: Epifaunal, soft sediments.

Characteristics: The cardiac and branchial regions of carapace lack erect spines.

Figure 22 *Inachus angolensis*. Habitus: left: dorsal view; right: ventral view. The specimen has a carapace width of 13 mm and a carapace length of 15 mm.

Genus *Macropodia* Leach, 1814

Characteristics: Rostrum is produced into smooth, unarmed spines, which are contiguous throughout their length. The chelae are inflated, especially in adult males. The orbital margins either without spines or with 1 or 2 dorsal spines.

Macropodia gilsoni (Capart, 1951)

Figure 25.

Achaeopsis gilsoni Capart, 1951:65. - Rossignol 1957:115.

Macropodia gilsoni. – Monod, 1956:555. – Longhurst, 1958:89. – Rossignol, 1962:123. – Crosnier, 1964:34.

Macropodia intermedia. - Guinot and Ribeiro, 1962:78. - Forest and Guinot, 1966:115. - Crosnier, 1970:1215.

Macropodia. – Voss, 1966:22.

Type locality: Cap Lopez, Gabon.

Material examined: Trawl station 867 (1 specimen), 938 (4), 288 (1).

Previous reported distribution: Senegal to Angola, 37-200 m.

Nansen samples distribution: Off Nigeria, Cameroon and Congo, 0-264 m.

Habitat: Epifaunal, soft sediments.

Measurements: Carapace length: 12-17 mm. Carapace width: 8-10 mm.

Characteristics: Rostrum extends beyond midlength of the distal article of the antennal peduncle. A neck (nuchal) spine is present. The orbital margin has dorsal spines or tubercles. The basal article of antenna has strong spines ventrally.

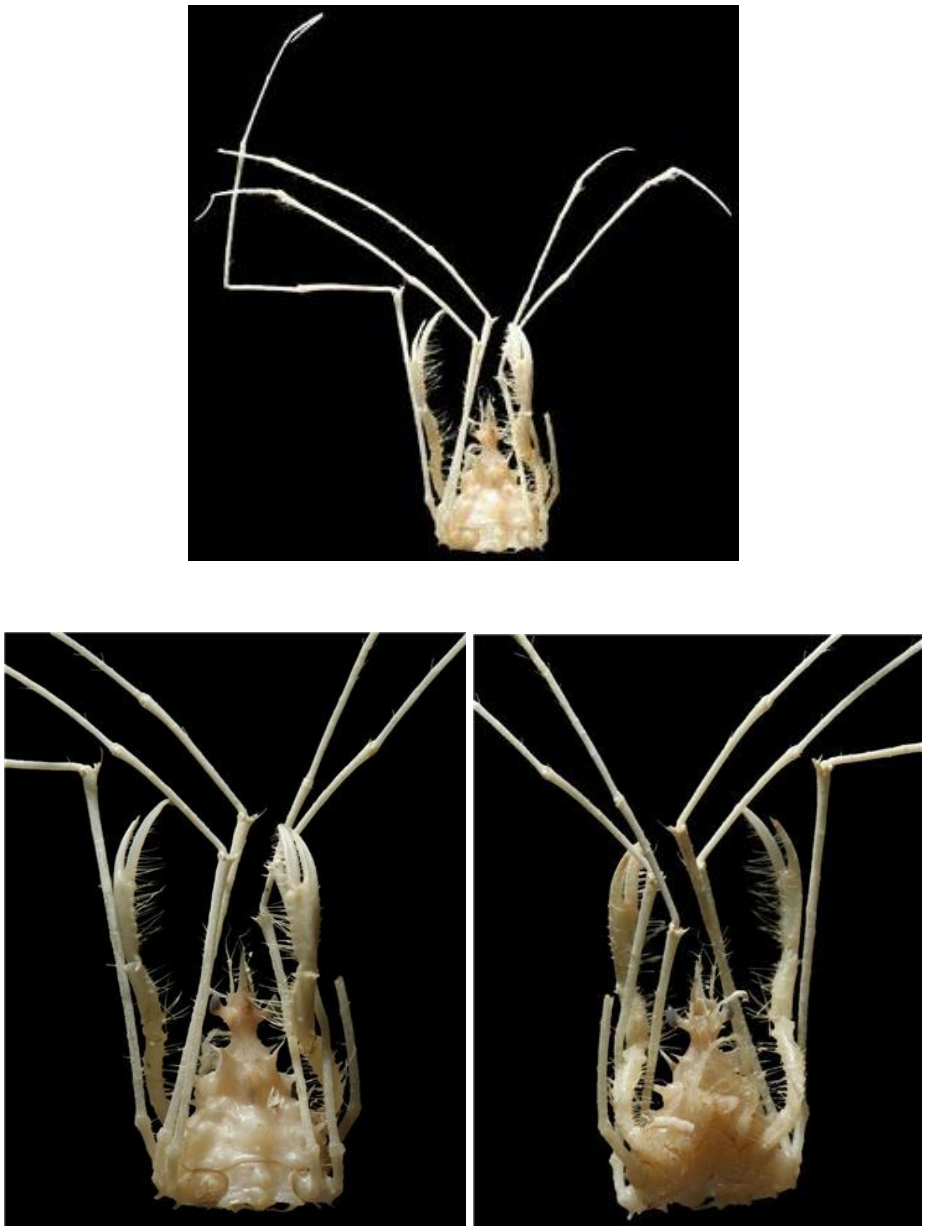


Figure 25 *Macropodia gilsoni*. Top middle: habitus picture, dorsal view; bottom left: carapace dorsal view; bottom right: carapace ventral view. The specimen has a carapace width of 10 mm and a carapace length of 15 mm.

Genus *Stenorhynchus* Lamarck, 1801

Characteristics: Rostrum undivided, elongate (as long as or longer than postrostral carapace), and with spinules laterally. The abdomen consists of 6 somites in males, 5 in females.

***Stenorhynchus lanceolatus* (Brullé, 1837)**

Figure 26.

Cancer seticornis Herbst, 1788.

Leptopodia lanceolata Brullé, 1837.

Leptopodia canariensis Brullé, 1839:15.

Leptopodia sagittaria. – Brullé, 1839:15. – White, 1847a:1. – Stimpson, 1858d:219. – Kingsley, 1880b:383. – Miers, 1886:3. – Osorio, 1887:221; 1888:187. – Koelbel, 1892:114. – Osorio, 1898:187. - A. Milne Edwards and Bouvier, 1900:153. – Stimpson, 1907:23. – Balss, 1922:72. - Guérin-Méneville, 1844:10.

Leptopodia sagittarius. – Herklots, 1861:136.

Leptopodia vittata. – Kingsley, 1880b:384.

Leptopodia sagittarius. – Rathbun, 1900a:293. – Stimpson, 1907:23.

Stenorynchus sagittarius. – Rathbun, 1900a:293. – Stimpson, 1907:23.

Stenorhynchus sagittarius. – Odhner, 1923:19.

Stenorynchus seticornis. – Rathbun, 1925:13.

Stenorhynchus seticornis. – Monod, 1933b:503. – Capart, 1951:81. – Sourie, 1954b:147. – Monod, 1956:567. – Rossignol, 1957:78. – Longhurst, 1958:89. – Gauld, 1960:72. - Guinot and Ribeiro, 1962:79. – Rossignol, 1962:123. – Ribeiro, 1964:21. – Crosnier, 1964:38. - Forest and Guinot, 1966:117. – Maurin, 1968b:484. - Le Loeuff and Intès, 1968; 1969:65. – Uschakov, 1970:455.

Stenorhynchus. – Voss, 1966:17.

Stenorhynchus lanceolatus. – Yang, 1967:220. – Barr, 1975:47.

Type locality: Guadeloupe, Antilles.

Material examined: Trawl station 847 (2 specimens), 890 (1), 922 (3), 923 (1), 1340 (1).
Previous reported distribution: Eastern Atlantic: Madeira, the Canary Island, the Cape Verde Islands and from Spanish Sahara to Angola, 6-96 m.
Nansen samples distribution: Off Nigeria and Cameroon, 37-101 m.
Habitat: Epifaunal, soft sediments with hard substances (rock/shell) embedded in it.
Measurements: Carapace length: 13-25 mm. Carapace width: 10-18 mm.
Characteristics: *S. lanceolatus* have two spines at the distal margin of the 4th segment of the thoracic appendage, the meropodite. The carapace is decorated with purple, triangular shaped lines, which point towards the rostrum.

Figure 26 *Stenorhynchus lanceolatus*. Habitus: left: dorsal view; right: ventral view. The specimen has a carapace width of 12 mm and a carapace length of 16 mm.

Family LEUCOSIIDAE Samouelle, 1819

Characteristics: The carapace is circular, spherical or hemispherical. The antennae are small, and inhalant branchial openings are present at the base of the external maxillipeds.

Genus *Ebalia* Leach, 1817

Characteristics: The carapace has a polygonal form and its lateral sides are more or less streamlined. The carapace is smooth, without prominent tubercles, but may have wart-like proturberances.

Ebalia affinis Miers, 1881

Figure 27.

Ebalia atlantica A. Milne Edwards and Bouvier, 1898. – Capart, 1951:54.

Ebalia affinis. – Monod, 1956:117. – Longhurst, 1958:87, - Gauld, 1960:69. - Forest and Guinot, 1966:53.

Type locality: Gorée, Senegal.

Material examined: Grab station N15 (1 specimen), G3 (1), G14 (1).

Previous reported distribution: Senagal to Angola, also reported from the Seine Seamouth north of Madeira, 4-140 m.

Nansen samples distribution: Off Nigeria and Gabon, 60-64 m.

Habitat: Epifaunal, soft sediment mixed with shells or other hard substances.

Measurements: Carapace length: 2-4 mm. Carapace width: 2-4 mm.

Characteristics: Granulation of carapace is quite subtle and shallow. This species has a medium size.

Figure 27 *Ebalia affinis.* Habitus: left: dorsal view; right: ventral view. The specimen has a carapace width of 4 mm and a carapace length of 4 mm.

***Ebalia cranchii* Leach, 1817**

Figure 28.

Ebalia cranchi. – Monod, 1956:122. – Türkay, 1976a:25.

Ebalia cranchii. – Christiansen, 1969:31.

Type locality: Plymouth, England.

Material examined: Grab station N2 (1 specimen), N9 (1), N15 (1), G3 (2), G8 (1), G11 (1), G14 (2), G15 (2), G16 (1).

Previous reported distribution: Norway to Senegal, 20-550 m.

Nansen samples distribution: Off Nigeria and Gabon, 49-90 m.

Habitat: Epifaunal, soft sediments.

Measurements: Carapace length: 2-4 mm. Carapace width: 2-4 mm.

Characteristics: Manus is more or less compressed and has a streamlined appearance. Fingers are barely shorter than manus.

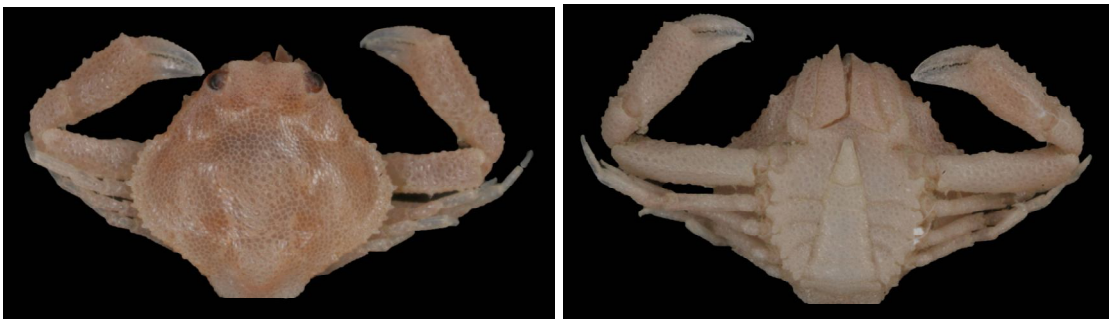


Figure 28 *Ebalia cranchii.* Habitus: left: dorsal view; right: ventral view. The specimen has a carapace width of 3 mm and a carapace length of 3 mm.

***Ebalia tuberculata* Miers, 1881**

Figure 29.

Lithadia barnardi Stebbing, 1920.

Ebalia tuberculata. – Capart, 1951:56. – Monod, 1956:127. – Gauld, 1960:69. - Forest and Guinot, 1966:54.

Type locality: Gorée, Senegal.

Material examined: Grab station N15 (1 specimen). Trawl station 1231 (1 specimen).

Previous reported distribution: Morocco to Angola (and possibly South Africa), 10-250 m.

Nansen samples distribution: Off Nigeria, 63-72 m.

Habitat: Epifauna, soft sediments.

Measurements: Carapace length: 4-4 mm. Carapace width: 4-5 mm.

Characteristics: The contour of the branchial region has prominent proturbances. The surface of carapace is completely granulated. In some places the outgrowths group together and produce distinct bumps.

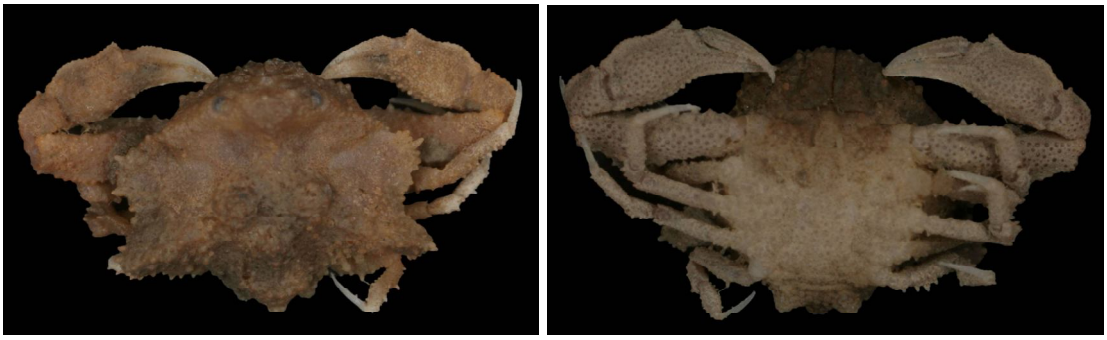


Figure 29 *Ebalia tuberculata*. Habitus: left: dorsal view; right: ventral view. The specimen has a carapace width of 5 mm and a carapace length of 4 mm.

Genus *Ilia* Leach, 1817

Characteristics: This genus has 4 spines at the lateral end of carapace; 2 postero-lateral of the branchial region, and 2 posterior of the midline.

***Ilia nucleus* (Linnaeus, 1758)**

Figure 30.

Cancer nucleus Linnaeus, 1758.

Cancer orbicularis Olivi, 1792.

Leucosia leachii Risso, 1822.

Ilia laevigata Risso, 1827.

Ilia rugulosa Risso, 1827.

Ilia parvicauda Costa, 1853.

Ilia nucleus. – Monod, 1956:139. - Guinot and Ribeiro, 1962:30.

?*Ilia nucleus spinosa*. – Türkay, 1975a:71.

Type locality: The Mediterranean Sea.

Material examined: Grab station G1 (1 specimen).

Previous reported distribution: Eastern Atlantic, from the Cape Verde Islands, Spanish Sahara and the Mediterranean Sea, 4-162 m.

Nansen samples distribution: Off Gabon, 19 m.

Habitat: Epifaunal, soft sediments.

Measurements: Carapace length: 5 mm. Carapace width: 6 mm.

Characteristics: The posterolateral spines are more or less triangular shaped. The granulation of carapace is very subtle.

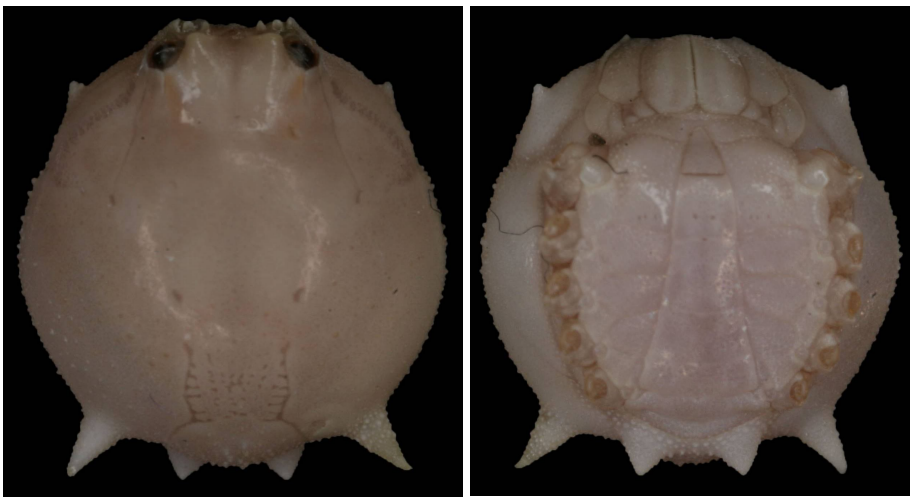


Figure 30 *Ilia nucleus*. Habitus: left: dorsal view; right: ventral view. The specimen has a carapace width of 6 mm and a carapace length of 5 mm.

***Ilia spinosa* Miers, 1881**

Figure 31

?Ilia nucleus. - Bouvier 1911:226.

Leucosia spinosa. – Capart, 1951:52.

Ilia spinosa. – Monod, 1956:136. – Buchanan, 1958:28. – Longhurst, 1958:87. – Lebour, 1959:133. – Gauld, 1960:69. – Rossignol, 1962:114. - Guinot and Ribeiro, 1962:30. – Crosnier, 1964:38. – Ribeiro, 1964:4. - Forest and Guinot, 1966:55. – Crosnier, 1967:323. - Le Loeuff and Intès, 1968:31.

Type locality: Gorée, Senegal and the Canary Islands.

Material examined: Grab station G5 (1 specimen). Trawl station 847 (2 specimens), 880 (3).

Previous reported distribution: From the Canary Islands, the Cape Verde Islands and Mauritania, to Angola, 4-132 m.

Nansen samples distribution: Off Nigeria and Gabon, 26-43 m.

Habitat: Epifaunal, soft sediments with harder (larger?) substances imbedded in it.

Measurements: Carapace length: 6-13 mm. Carapace width: 6-13 mm.

Characteristics: The 4 posterolateral spines are slightly bent upwards. Granulation of carapace is prominent.

Figure 31 *Ilia spinosa*. Habitus: left: dorsal view; left: ventral view. The specimen has a carapace width of 13 mm and a carapace length of 12 mm.

Genus *Philyra* Leach, 1817

Characteristics: Carapace has a convex or subglobular form, with a distinctly truncated frontal area. There are no posterolateral spines. The chelae are massive.

Philyra cristata Miers, 1881

Figure 32.

Philyra cristata. – Monod, 1956:144. – Longhurst, 1958:87. – Rossignol, 1962:115. - Forest and Guinot, 1966:56.

Type locality: Gorée, Senegal.

Material examined: Grab station G11 (1 specimen).

Previous reported distribution: Senegal to Congo, 4-25 m.

Nansen samples distribution: Off Gabon, 90 m.

Habitat: Epifaunal, soft sediments.

Measurements: Carapace length: 4 mm. Carapace width: 4 mm.

Characteristics: Carapace depressed behind the orbital regions. An evident crest surrounds the depression.

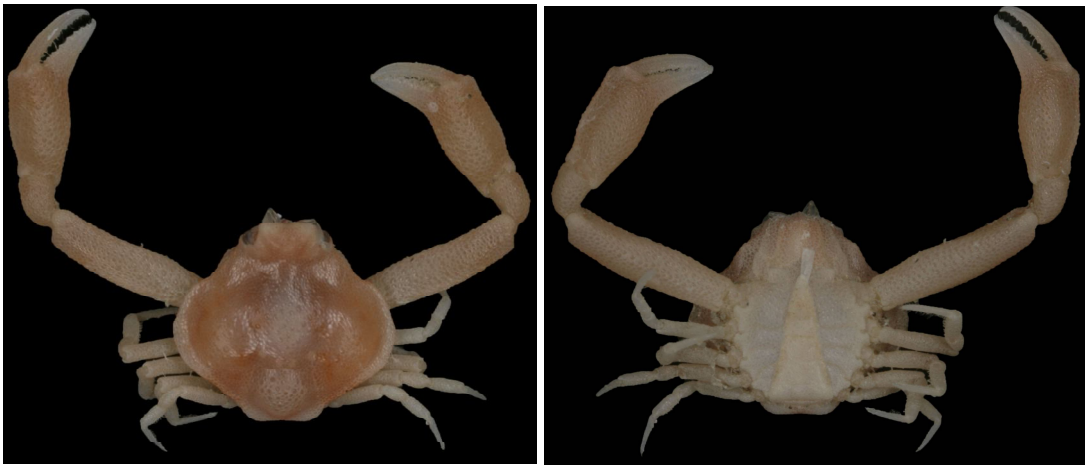


Figure 33 *Philyra cristata*. Habitus: left: dorsal view; right: ventral view. The specimen has a carapace width of 4 mm and a carapace length of 4 mm.

***Philyra laevidorsalis* Miers, 1881**

Figure 31.

Philyra laevidorsalis. – Capart, 1951:47. – Monod, 1956:141. – Rossignol, 1957:77. - Longhurst 1958:87. - Buchanan 1958:20. - Gauld 1960:69. – Rossignol, 1962:115. - Forest and Guinot, 1966:56.

Type locality: Gorée, Senegal.

Material examined: Grab station N11 (1 specimen).

Previous reported distribution: From Cap Blanc, Mauritania, to Angola, 4-30 m.

Nansen samples distribution: Off Nigeria, 25 m.

Measurements: Carapace length: 4 mm. Carapace width: 3.5 mm.

Habitat: Epifaunal, soft sediments with shell debris.

Characteristics: Carapace is distinctly curved, crest lacking. The contour of carapace is granulated.

Figure 33 *Philyra laevidorsalis.* Habitus: left: dorsal view; right: ventral view. The specimen has a carapace width of 3.5 mm and a carapace length of 4 mm.

Genus *Pseudomyra* Capart, 1951

Characteristics: The carapace has a hemispherical shape, smooth surface, and more or less circular outline. The regions of the carapace are not distinct. The chelipeds are very elongated; the walking legs long and slender. Abdominal segments 3 to 6 are welded in both sexes.

Pseudomyra mbizi (Capart, 1951)

Figure 34.

Pseudomyra mbizi Capart, 1951:49. – Monod, 1956:140. – Rossignol, 1962:115. - Guinot andRibeiro, 1962:30. – Crosnier, 1964:35. - Forest and Guinot, 1966:56. – Voss, 1966:35. - Le Loeuff and Intès, 1968:40. – Maurin, 1968b:491. - Crosnier 1970:1215.

Type locality: West coast of Africa, between 4˚ and 13˚ latitude South.

Material examined: Grab station N9 (1 specimen), C2 (1). Trawl station 865 (1 specimen), 871 (2), 877 (1), 878 (1), 938 (1), 1231 (1), 288 (9).

Previous reported distribution: Senegal to Angola, 12-300 m.

Nansen samples distribution: Off Nigeria, Cameroon and Congo, 0-147 m.

Habitat: Epifaunal, on a variety of bottom types.

Measurements: Carapace length: 3-22 mm. Carapace width: 3-19 mm.

Characteristics: 2 spines are present on the posterior edge of carapace.

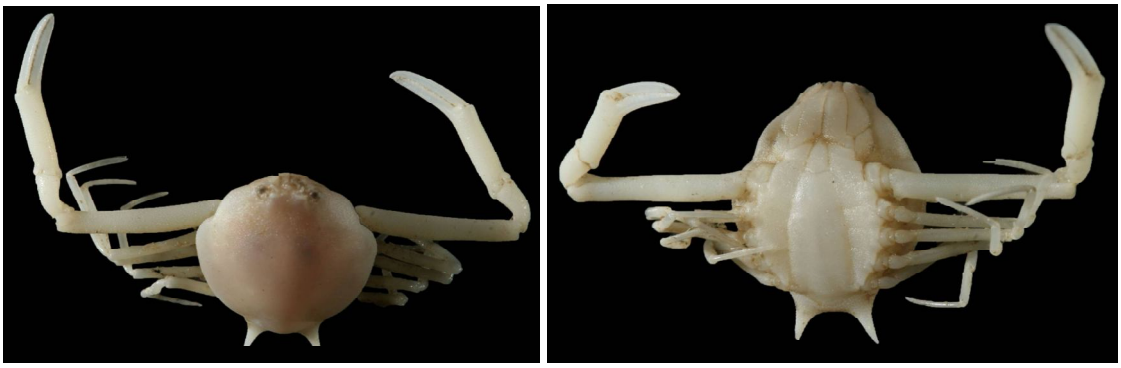


Figure 34 *Pseudomyra mbizi.* Habitus: left: dorsal view; right: ventral view. The specimen has a carapace width of 9 mm and a carapace length of 9 mm.

Family MAJIDAE Samouelle, 1819

Characteristics: Carapace usually pyriform or conical shaped. The basal segment of antenna is fused with the epistome and with the front. Chelipeds are shorter than walking legs.

Genus *Maja* Lamarck, 1801

Characteristics: Carapace has a triangular shape. The rostral spines are quite prominent, spaced wide apart and bent outward at the tip.

Maja goltziana d'Oliveira, 1888

Figure 35.

Maja goltziana. – Capart, 1951:100. – Monod, 1956:478. – Rossignol, 1957:116. – Crosnier, 1967:339. – Longhurst, 1958:88.

Maïa goltziana. - Le Loeuff and Intès, 1968.

Maia goltziana. – Maurin, 1968a:30; 1968b:484.

Type locality: Buarcos, Portugal.

Material examined: Trawl station 1340 (1 specimen).

Previous reported distribution: From the Mediterranean and Portugal S to Congo, 15-200 m.

Nansen samples distribution: Off Cameroon, 27 m.

Habitat: Epifaunal, soft sediments.

Measurements: Carapace length: 72 mm. Carapace width: 63 mm.

Characteristics: A median series of 5 strong dorsal spines are present on the carapace; 3 in the gastric region, 1 anterior and 1 posterior to the cardiac region. A sharp spine separates the cardiac and brancial regions at each side of the carapace. The lateral sides of the carapace are bent upwards dorsally.

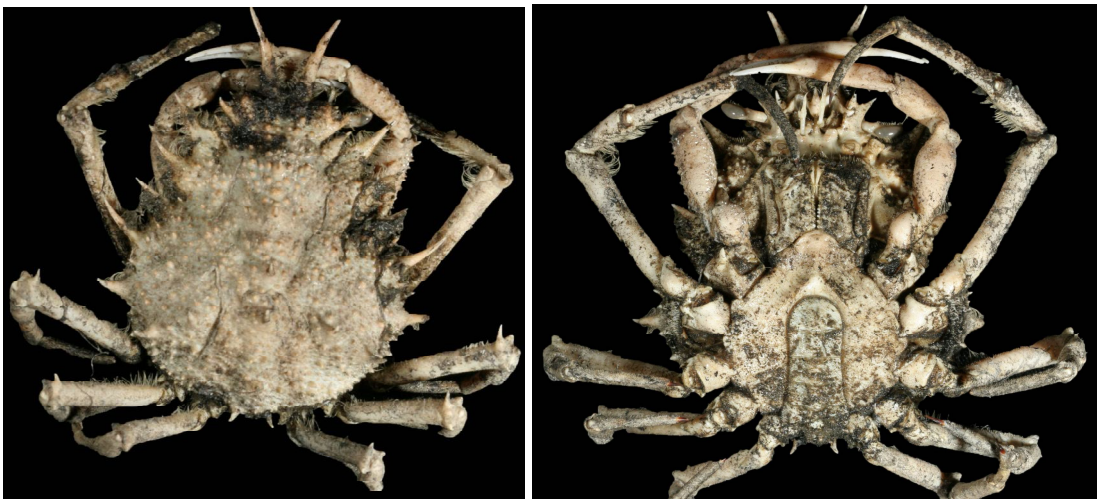


Figure 35 *Maja goltziana*. Habitus: left: dorsal view; right: ventral view. The specimen has a carapace width of 63 mm and a carapace length of 72 mm.

Family MATUTIDAE de Haan, 1841

Characteristics: The carapace is circular and the chelipeds fit against the body to form a box-like shape. The walking legs are modified.

Genus *Mebeli* Weber, 1795

Characteristics: Legs adapted for digging, carapace with a strong spine at the junction of the anterolateral and posterolateral border. The mouth is compeletely covered by the 3rd maxilliped and the palp is hidden beneath the merus.

***Mebeli michaelseni* (Balss, 1921)**

Figure 36.

Matuta michaelseni Balss, 1921. – Capart, 1951:45. – Monod, 1956:98. – Rossignol, 1957:77. – Buchanan, 1958:20. – Longhurst, 1958:87. – Gauld, 1960:68. - Guinot and Ribeiro, 1962:25. – Rossignol, 1962:114. - Forest and Guinot, 1966:51. - Le Loeuff and Intès, 1968.

Type locality: The East-Atlantic Ocean, West-Africa (numerous localities).
Material examined: Trawl station 855 (1 specimen).
Previous reported distribution: Senegal to Angola, littoral zone to 30 m.
Nansen samples distribution: Off Nigeria, 18 m.
Habitat: Epifanual, soft sediments.
Measurements: Carapace length: 11 mm. Carapace width: 13 mm.
Characteristics: The carapace is slightly broader than long, and somewhat curved and smooth. The antero-lateral margin of the carapace have five spines, the fifth is longer and pointier than the rest.

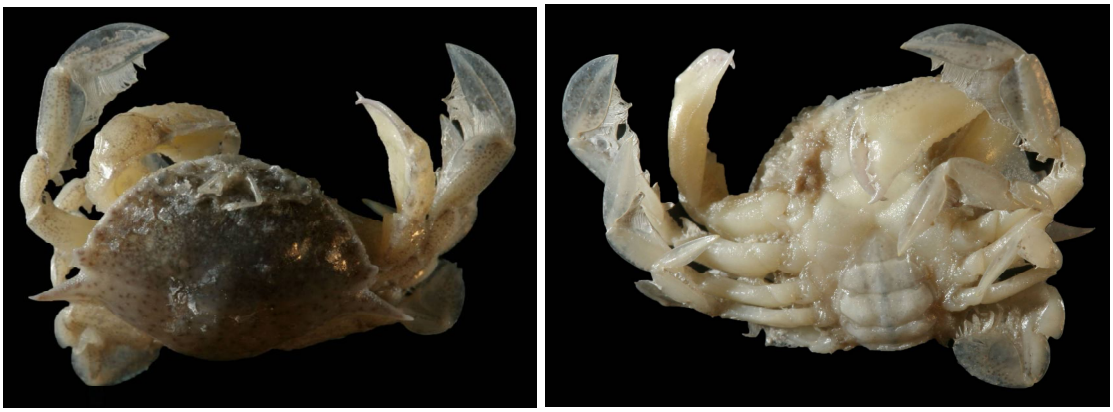


Figure 36 *Mebeli michaelseni*. Habitus: left: dorsal view, right: ventral view. The speciemen has a carapace width of 13 mm and a carapace length of 11 mm.

Family MENIPPIDAE Ortmann, 1893

Characteristics: Carapace smooth and bare, with small depressions, especially on the anterior half. The chelipeds are slightly uneven, very robust and have a smooth surface. Merus is short. Carpus is smooth with a large tubercle on the lateral margin.

Genus *Menippe* de Haan, 1833

Characteristics: The gastric region is distinct by having 2 deep furrows. Frontal region is divided into 2 contiguous main lobes. A small, blunt tubercle is present between each orbital groove and lobe. The spines in the suborbital region are obtuse.

***Menippe nodifrons* Stimpson, 1859**

Figure 37 and 38.

Menippe rudis A Milne Edwards, 1879.

Menippe nanus A. Milne Edwards and Bouvier, 1898. – Capart, 1951:140.

Menippe nodifrons. – Frade, 1950:11. – Capart, 1951:138. – Monod, 1956:222. – Longhurst, 1957:374. – Rossignol, 1957:82. – Buchanan, 1958:20. – Longhurst, 1958:88. - Gauld and Buchanan, 1959:127. – Gauld, 1960:70. – Rossignol, 1962:116. - Guinot and Ribeiro, 1962:50. – Monod, 1967:180. - Le Loeuff and Intés, 1968. – Guinot, 1968b:156. – Uschakov, 1970:445. - Guinot 1971:1076.

Menippe. - Gauld and Buchanan 1959:128.

Type locality: Florida, USA.

Material examined: Grab station C2 (1 juvenile specimen), C13 (2 juvenile). Trawl station 1332 (1 specimen).

Previous reported distribution: From the Cape Verde Islands and Senegal to Angola, from shore to about 20 m.

Nansen samples distribution: Off Cameroon, 24-101 m.

Habitat: Epifaunal, soft sediments.

Measurements: Carapace length: 4-23 mm. Carapace width: 4-30 mm.

Characteristics: The anterolateral margin is divided into 4 lobes; the last lobe is pointy and carves into the carapace in a streamlined fashion. The chela are smooth with small cavities on the outer surface, some arranged in longitudinal lines. The fingers have a black colour. Walking legs are robust and have hair on the upper edge of carpus and on either side of the propodus and dactylus.

Figure 37 *Menippe nodifrons*. Habitus: left: dorsal view; right: ventral view. The specimen has a carapace width of 30 mm and a carapace length of 23 mm.

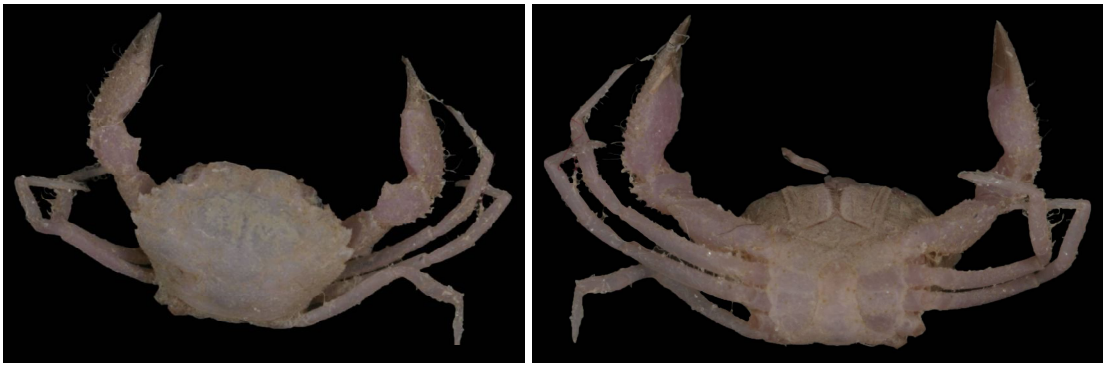


Figure 38 *Menippe nodifrons* juvenile. Habitus: left: dorsal view; right: ventral view. The specimen has a carapace width of 4.5 mm and a carapace length of 4 mm.

Family OZIIDAE Dana, 1851

Characteristics: Carapace with a transversely oval shape.

Genus *Epixanthus* Heller, 1861

Characteristics: The wide frontal area of carapace is cut in to 4 lobes/teeth. Carapace has distinctly marked regions on the dorsal surface. The anterolateral margins are long and strongly arched.

Epixanthus hellerii A. Milne Edwards, 1867

Figure 39.

Ozius corrugatus Osorio, 1887.

Epixanthus helleri, Monod 1956:236; Longhurst 1958:88; Gauld 1960:70; Guinot and Ribeiro 1962:51; Ribeiro 1964:8; Forest and Guinot 1966:68; Garth 1968:314; Uschakov 1970:445.

Type locality: Gabon.

Material examined: Trawl station 288 (1 specimen).

Previous reported distribution: From the Cape Verde Islands and Senegal to Angola, littoral zone.

Nansen samples distribution: Off Congo, 88 m.

Habitat: Epifaunal, rocky shores.

Measurements: Carapace length: 7 mm. Carapace width: 11 mm.

Characteristics: The grand basal joint (2 +3) of the antennular peduncles touches the frontal area. Chelipeds very uneven, the fingers are small, very slender and pointed. Carapace and chelipeds are weakly granulated.

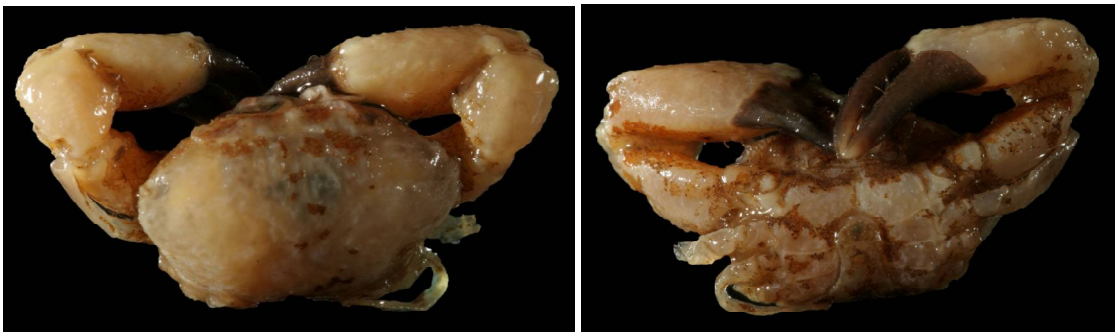


Figure 39 *Epixanthus hellerii*. Habitus: left: dorsal view; right: ventral view. The specimen has a carapace width of 11 mm and a carapace length of 7 mm.

Family PARTHENOPIDAE MacLeay, 1838

Characteristics: Carapace has a triangular or pentagonal shape. The basal segent of the antennae is small and not fused with the epistome or front. The chelipeds are stouter than the other pereiopods.

Genus *Heterocrypta* Stimpsom, 1871

Characteristics: Carapace with a triangular form and with distinct, linuar granulation on the outer margins of carapace and chelipeds. Further more, the branchial and hepatic regions, and hepatic and gastric regions, are separates by tubercles arranged in lines.

***Heterocrypta maltzami* Miers, 1881**

Figure 40.

Heterocrypta Maltzami Miers, 1881a:209.

Heterocrypta Maltzani. – Miers, 1881a:364. - A. Milne Edwards and Bouvier, 1900:121. – Balss, 1921:54. – Bouvier, 1940:315.

Heterocrypta maltzani. – Ortmann, 1893b:417. – Rathbun, 1900a:296. – Sourie, 1954b:150. – Monod, 1956:589. – Longhurst, 1958:89. – Gauld, 1960:72. - Guinot and Ribeiro, 1962:80. – Rossignol, 1962:123. – Ribeiro, 1964:21. - Forest and Guinot, 1966:120. – Maurin, 1968b:486. – Türkay, 1975a:71.

Type locality: Gorée, Senegal.

Material examined: Grab station N2 (1 specimen), N9 (1), N13 (1), G1 (1), G9 (1).

Previous reported distribution: Bay of Biscay, the Mediterranean, the Azores, North of the Cape Verde Islands, and from tropical West Africa, 3-400 m.

Nansen samples distribution: Off Nigeria and Gabon, 19-83 m.

Habitat: Epifaunal, soft sediments.

Measurements: Carapace length: 3-6 mm. Carapace width: 2.5-6 mm.

Characteristics: Carapace has lateral wing shaped expansions which create a “roof” above the 2-5 pereiopod, partially covering them.

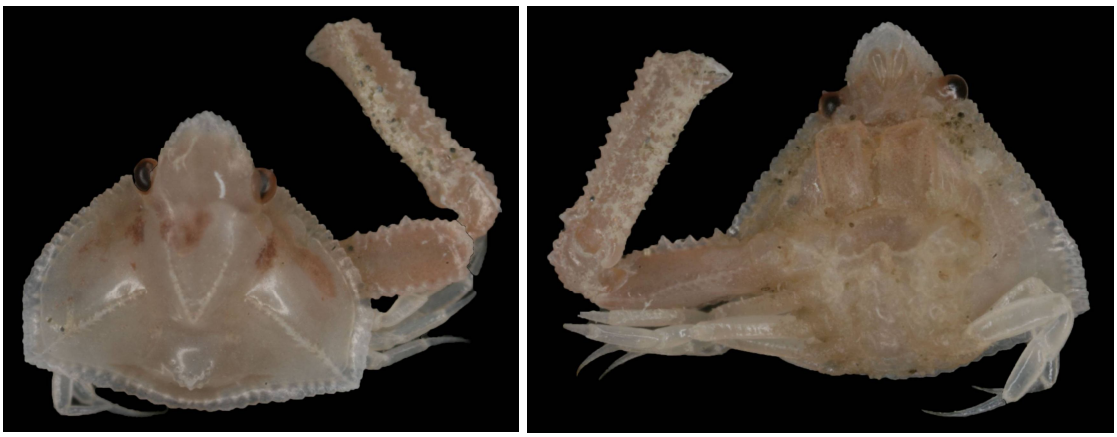


Figure 40 *Heterocrypta maltzami*. Habitus: left: dorsal view; right: ventral view. The specimen has a carapace width of 4 mm and a carapace length of 4 mm.

Genus *Parthenope* Weber, 1795

Characteristics: Basal segment of antenna is very short and do not reach the corner of the orbit. The fingers of the chela are strongly curved inwards.

***Parthenope massena* (Roux, 1830)**

Figure 41.

?Parthenope contracta Costa, 1840.

?Parthenope hexacantha Costa, 1840.

Lambrus pumilus Costa, 1851.

Lambrus rugosus Stimpson, 1857.

Lambrus setubalensis De Brito Capello, 1866.

Lambrus pulchellus A. Milne Edwards, 1868.

Lambrus massena var. *atlanticus* Miers, 1881.

Lambrus massena var. *spinifer* Miers, 1881.

Lambrus massena var. *Goreensis* Miers, 1881.

Lambrus bicarinatus Miers, 1881.

?Lambrus massena. – Capart, 1951:105.

Lambrus massena. – Sourie, 1954b:147. – Monod, 1956:572. – Gauld, 1960:72. – Rossignol, 1962:123. – Crosnier, 1964:31. - Forest and Guinot, 1966:118.

Lambrus sp. – Monod, 1956:583.

Lambrus massenae. – Longhurst, 1958:89.

Type locality: Sicily, Italy.

Material examined: Grab station G3 (1 specimen). Trawl station 877 (1 specimen).

Previous reported distribution: Eastern Atlantic, from Brittany, Atlantic coast of France, southward to Congo, including the Mediterranean, 5-500 m.

Nansen samples distribution: Off Nigeria and Gabon, 60-147 m.

Habitat: Epifaunal, soft sediments with shell debris and/or calcareous algae.

Measurements: Carapace length: 4.5-9 mm. Carapace width: 5-10 mm.

Characteristics: This taxa show great variation in the various species characteristic. The most important characteristic however, that the rostrum lacks spines on the lateral margins, applies to each specimen. The chelipeds are asymmetrical and have a brown colour on the fingertips.

Figure 41 *Parthenope massena*. Habitus: left: dorsal view; right: ventral view. The specimen has a carapace width of 10 mm and a carapace length of 9 mm.

***Parthenope notialis* Manning and Holthuis, 1981**

Figure 42.

Cancer macrochelos Herbst, 1790.

Lambrus mediterraneus. – Studer, 1882:335.

Lambrus Mediterraneus. – Studer, 1883:9.

Lambrus macrochelos. – Rathbun, 1900a:295. – Monod, 1956:585. – Longhurst, 1958:89. – Gauld, 1960:72. - Guinot and Ribeiro, 1962:80. – Rossignol, 1962:123. – Crosnier, 1964:34.

Lambrus macrocheles. – Doflein, 1904:87. – Balss, 1921:54. – Odhner, 1923:20. – Capart, 1951:102. - Forest and Guinot, 1966:119. - ?Maurin, 1968a:59. - 1968b:480. – Crosnier, 1970:1215.

Lambrus (*Lambrus*) *macrocheles*. – Monod, 1933b:498.

Parthenope. – Voss, 1966:19.

Lambrus. - ?Maurin, 1968b.

Type locality: Tropical West Africa.

Material examined: Trawl station 878 (1 specimen), 966 (1).

Previous reported distribution: Senegal to Angola, 18-162 m.

Nansen samples distribution: Off Nigeria and Cameroon, 47-81 m.

Habitat: Epifaunal, soft sediments mixed with broken shells, bryozoans, branched or foliate Foraminifera, corals or rocks.

Measurements: Carapace length: 14-20 mm. Carapace width: 14-19 mm.

Characteristics: The carapace is notably wider than long, and it can reach a fairly large size. The claws of the chelipeds have many small, and some larger tubercles. The upper margin of the orbit has a strong tubercle, behind which a smaller tubercle might be visible. The four tubercles in the middle of the gastric region form a trapezium with the widest margin anteriorly. The anterolateral margin of the carapace has a row of about 7 teeth, which are distinctly shorter and narrower than the outer posterolateral tooth. The subhepatic region just lateral of the oral cavity is smooth.

Figure 42 *Parthenope notialis*. Habitus: left: dorsal view; right: ventral view. The specimen has a carapace width of 19 mm and a carapace length of 20 mm.

Family PILUMNIDAE Samouelle, 1819

Characteristics: Carapace and appendages covered with covered with hair. The carapace has a globular or subglobular shape. The chelipeds are slightly unequal.

Genus *Pilumnus* Leach, 1815

Characteristics: The anterolateral edges of carapace with 3-4 spines or spine-shaped teeth (not included orbitaire spines).

Pilumnus inermis A. Milne Edwards and Bouvier, 1894

Figure 43.

Pilumnus inermis. – Monod, 1956:247. – Longhurst, 1958:88. – Gauld, 1960:70. – Rossignol, 1962:117. – Crosnier, 1964:31. - Forest and Guinot, 1966:70. – Uschakov, 1970:455. – Türkay, 1976a:25; 1976b:61.

Type locality: The Azores.
Material examined: Grab station C14 (1 specimen).
Previous reported distribution: The eastern Atlantic from Portugal, and the African coast from Morocco southward to Congo and possibly Gabon, 4-400 m.
Nansen samples distribution: Off Cameroon, 20 m.
Habitat: Epifaunal, rough bottom.
Measurements: Carapace length: 2 mm. Carapace width: 3 mm.
Characteristics: Carapace is quite subtly spinulated. Pereiopods without spines or at most a very small thorn right on the edge of the distal merus.

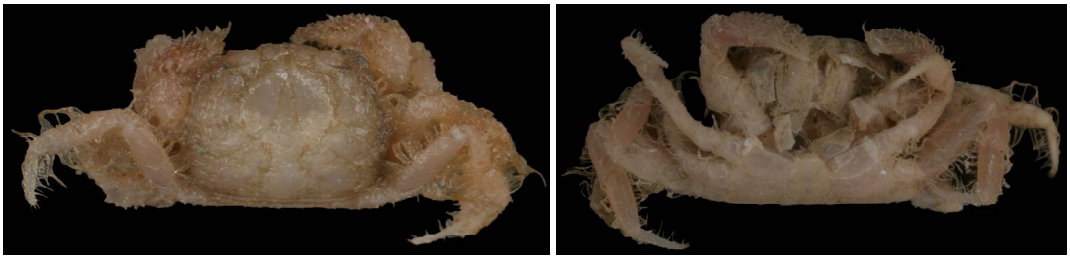


Figure 43 *Pilumnus inermis.* Habitus: left: dorsal view; right: ventral view. The specimen has a carapace width of 3 mm and a carapace length of 2 mm.

Pilumnus perrieri A. Milne Edwards and Bouvieri, 1898

Figure 44.

Pilumnus perrieri. – Capart, 1951:143. – Monod, 1956:244. – Rossignol, 1962:117. - Forest and Guinot, 1966:70. – Uschakov, 1970:455.

Type locality: The Cape Verde Islands.

Material examined: Trawl station 983 (2 specimens), 986 (2), 1360 (6).

Previous reported distribution: The Cape Verde Islands and Senegal to Gabon, 20-91 m.

Nansen samples distribution: Off São Tomé, 54-73 m.

Habitat: Epifaunal, rough bottom.

Measurements: Carapace length: 4-13 mm. Carapace width: 6-15 mm.

Characteristics: Carapace and appendages covered with many spines and though, stiff hair. The spines on merus and carpus of the pereiopods, are long and curved.

Figure 44 *Pilumnus perrieri.* Habitus: left: dorsal view; right: ventral view. The specimen has a carapace width of 12 mm and a carapace length of 11 mm.

Family PORTUNIDAE Rafinesque, 1815

Characteristics: The carapace usually has a round or oval form. The chelipeds are unequal; the right being larger than the left. 5th pereiopod flattened, and adapted for swimming. There is usually a small lobe at the inner angle of the endopodite (laterally directed branch-like structure of the coax of the first seven thoracic coxae) of first maxilliped.

Genus *Bathynectes* Stimpson, 1871

Characteristics: The 5th antero-lateral tooth is twice as long as the previous ones. The front has 4 strong lobes/teeth.

Bathynectes piperitus Manning and Holthuis, 1981

Figure 45.

Bathynectes superba. - A. Milne Edwards and Bouvier, 1900:65. – Bouvier, 1922:59. – Monod, 1933b:510. – Capart, 1951:121.

Bathynectes superbus. – Monod, 1956:183. – Longhurst, 1958:87. – Monod, 1967. – Maurin, 1968b:492. - Intès and Le Loeuff, 1976103. - Lewis and Haefner, 1978:164.

Bathynectes suberbus. – Gauld, 1960:69.

Bathynectes. – Voss, 1966:19. – Maurin, 1968a; 1968b.

Type locality: Angola, 10˚36'S, 13˚12'E, ca 366m

Material examined: Trawl station 263 (1 specimen).

Previous reported distribution: The Cape Verde Islands and the west coast of Africa from Senegal to Angola, 200-628 m.

Nansen samples distribution: Off Gabon, 329 m.

Habitat: Epifaunal, soft sediments.

Measurements: Carapace length: 25 mm. Carapace width: 30 mm.

Characteristics: The front of the carapace has 4 rounded teeth, the inner 2 about half as wide as the outer. The chelipeds are unequal. The carapace has an orange-red colour, with a white spot at the front; one just behind either of the large lateral teeth, one in each posterolateral angle, and one in the middle of the posterior margin. The apex of the lateral spine is very dark, almost black. The chelipeds are orange with white teeth and spines. The walking legs have a broad orange band over the distal part of the merus, one over the carpus and one over the proximal half of the propodus. The rest of the leg is white. The lateral spine is curved forward in adults.

Figure 45 *Bathynectes piperitus*. Habitus: left: dorsal view; right: ventral view. The specimen has a carapace width of 30 mm and a carapace length of 25 mm.

Genus *Cronius* Stimpson, 1860

Characteristics: This genus has 9 antero-lateral teeth, including the one by each orbital cavity.

Cronius ruber (Lamarck, 1818)

Figure 46

Portunus ruber Lamarck, 1818.

Goniosoma millerii A. Milne Edwards, 1867.

Cronius ruber. – Capart, 1951:128. – Monod, 1956:189. – Rossignol, 1957:81. – Longhurst, 1958:87. – Buchanan, 1958:20. – Gauld, 1960:69. – Rossignol, 1962:115. -

Guinot and Ribeiro, 1962:46. – Ribeiro, 1964:5. - Forest and Guinot, 1966:61. – Monod, 1967:180. - Le Loeuff and Intès, 1968:40; 1969:63. – Uschakov, 1970:455.
Charybdis. – Voss, 1966:19.

Type locality: Brazil.
Material examined: Trawl station 905 (1 specimen).
Previous reported distribution: The Atlantic Ocean and the East Pacific Ocean, off West Africa it has been recorded from Mauritania to Angola, 4-69 m.
Nansen samples distribution: Off Nigeria, 24 m.
Habitat: Epifaunal, various bottom types.
Measurements: Carapace length: 55 mm. Carapace width: 78 mm.
Characteristics: The chelae are unequal. The movable finger of the cheliped has a dark colour. The transverse lines of tubercles forming the main ridge of the larger chela, are not inflated. On the smaller chela the tubercles are scattered in a random manner.
Remarks: Manning and Holthuis (1981) proposed a name change for the American population of *Cronius ruber*, from *C. ruber* to *Cronius millerii*. This would be done to distinguish if from the West African population of *C. ruber*. There seem to be a difference in the ornamentation and colouration of the chela between the two "forms".

Figure 46 *Cronius ruber*. Habitus: left: dorsal view; right: ventral view. The specimen has a carapace width of 78 mm and a carapace length of 55 mm.

Genus *Macropipus* Prestandrea, 1833

Characteristics: Carapace is broader than long and have 5 antero lateral teeth and 3 frontal lobes. Iridescent patches are present on the surface of carapace and on the pereiopods. The chelipeds are unequal and shorter than the walking legs. Merus of walking legs with distal ventral tooth, carpus with strong inner tooth and dactylus with 2 dorsal ridges.

***Macropipus rugosus* (Doflein, 1904)**

Figure 47.

Portunus sp. – Leach, 1818:413. – Monod, 1970:66.

Elliptodactylus rugosus Doflein, 1904:94.

Portunus tuberculatus. – Capart, 1951:117. – Monod, 1956:180. – Rossignol, 1957:80. – Longhurst, 1958:87. – Rossignol, 1962:115. – Maurin, 1968b:484. - Le Loeuff and Intès, 1968:44.

Macropipus rugosus. – Guinot, 1961:2. - Guinot and Ribeiro, 1962:32. – Crosnier, 1964:34. – Forest and Guinot, 1966:60. – Le Loeuff and Intès, 1968:63. – Türkay, 1976a:25.

Macropipus. – Voss, 1966:27.

Portunus. – Maurin, 1968b.

Portunus (*Macropipus*) *tuberculatus*. – Maurin, 1968b:486.

Macropipus tuberculatus. – Maurin, 1968b:491. - Bas, Arias and Guerra, 1976.

Type locality: Off the coast of West Africa.

Material examined: Trawl station 856 (1 specimen), 865 (1), 871 (2), 890 (6), 903 (1), 977 (2), 274 (2).

Previous reported distribution: Mauritania to Angola, 5-400 m.

Nansen samples distribution: Off Nigeria, Principe and Congo, 36-152 m.

Habitat: Epifaunal, soft sediments with bryozoans, Foraminifera or broken shell.

Measurements: Carapace length: 14-26 mm. Carapace width: 16-32 mm.

Characteristics: The 5th antero lateral tooth is more than twice as long as the previous ones. There are 3 pointy and more or less uniform teeth on the front of carapace.

Figure 47 *Macropipus rugosus*. Habitus: left: dorsal view; right: ventral view. The specimen has a carapace width of 32 mm and a carapace length of 26 mm.

Family RANINIDAE de Haan, 1839

Characteristics: The claws are modified into tools for digging, and the body is a rounded shape that makes it easy to bury in sand. Unlike most other true crabs, the abdomen of raninids is not curled under the cephalothorax.

Genus *Raninoides* H. Milne Edwards, 1837

Characteristics: Have an almost retangular shaped carapace with 2 strong spines just laterally of the orbital cavity. A trilobed projection is present at the front.

Raninoides bouvieri Capart, 1951

Figure 48.

Raninoides bouvieri Capart, 1951:59. – Monod, 1956:54. – Longhurst, 1958:87. – Forest, 1959:15. – Gauld, 1960:68. – Rossignol, 1962:113. – Crosnier, 1964:35. - Forest and Guinot, 1966:42. - Le Loeuff and Intès, 1968.

Type locality: Banana, Congo.

Material examined: Grab station C1 (1 specimen), C7 (1), C11 (2), G11 (2), G12 (2), G16 (3).

Previous reported distribution: Senegal to Zaire, Angola, 5-70 m.

Nansen samples distribution: Off Cameroon and Gabon, 37-105 m.

Habitat: Epifaunal, soft sediments.

Measurements: Carapace length: 5-33 mm. Carapace width: 3-14 mm.

Characteristics: Carapace smooth. Pereiopod 5 shorter and more slender than pereiopod 4. Manus with a tooth in its upper margin but without thorns at the base of the dactylus. Differs from all other Atlantic species of this genus in lacking a distal spine on the carpus of the chela.

Figure 48 *Raninoides bouvieri*. Habitus: left: dorsal view; right: ventral view. The specimen has a carapace width of 10 mm and a carapace length of 15 mm.

Family XANTHIDAE MacLeay, 1838

Characteristics: Carapace is broadened anteriorly and has an oval to hexagonal shape. Branchial regions of carapace are not swollen. There is no inner lobe on the endopodite of the first maxilliped.

Genus *Leopoldius* Serène, 1971

Characteristics: Chelipeds with strong tubercles, which are granular or mushroom shaped (at least on merus and carpus).

***Leopoldius pisifer* (MacLeay, 1838)**

Figure 49.

Pilumnus verrucosipes Stimpson, 1858.

Parapilumnus pisifer. – Capart, 1951:146. – Sourie, 1954b:150. – Monod, 1956:254. – Longhurst, 1958:88. – Gauld, 1960:70. – Rossignol, 1962:117. - Guinot and Ribeiro, 1962:52. - Forest and Guinot, 1966:71. – Crosnier, 1969:535. – Uschakov, 1970:439. – Takeda, 1974:216.

Type locality: Cape Town, South Africa.

Material examined: Grab station C11 (2 specimens).

Previous reported distribution: West Africa (Mauritania to Gabon), and Southern Africa to Mozambique, intertidal zone down to 50 m.

Nansen samples distribution: Off Cameroon, 37 m.

Habitat: Epifaunal, found on a wide range of substrates.

Measurements: Carapace length: 4-5 mm. Carapace width: 5-6 mm.

Characteristics: Carapace covered with a thick coat of more or less symmetrically arranged setae, and with 3 broad posterior anterolateral teeth with granulated borders. The chelipeds have pointy and granular tubercles.

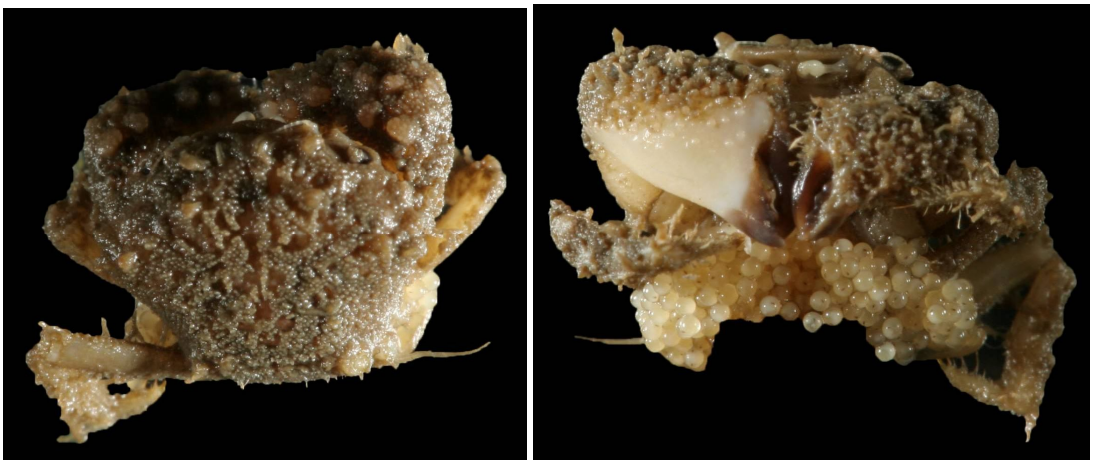


Figure 49 *Leopoldius pisifer*. Habitus: left: dorsal view; right: ventral view. The specimen has a carapace width of 6 mm and a carapace length of 5 mm. In this particular specimen eggs attached to the abdominal pleopods are visible.

Genus *Microcassiope* Guinot, 1967

Characteristics: The anterolateral teeth of carapace are of small or medium size and have a triangular, straight form. Chelipeds and walking legs are granulated.

***Microcassiope minor* (Dana, 1852)**

Figure 50.

Xanthodes rufopunctaus A. Milne Edwards, 1869.

Xanthodes granosus A. Milne Edwards and Bouvier, 1898.

Xantho minor Dana, 1852b:169. – Miers, 1881a:214; 1886:124.

Micropanope granosa. - Chapman and Santler, 1955:374.

Micropanope rufopunctata. – Monod, 1956:313. – Gauld, 1960:70. - Guinot and Ribeiro, 1962:59. – Monod, 1963. – Ribeiro, 1964:10. - Forest and Guinot, 1966:81. – Chace, 1966:639. – Guinot, 1967c:348. - Le Loeuff and Intés, 1968. – Türkay, 1976b:61.

Microcassiope rufopunctata. – Guinot, 1967c; 1971:1076.

Xanthodes rufopunctata. – Guinot, 1967c:359.

Xanthodes rufopunctatus. – Garth, 1968:314.

Microcassiope granulimanus. – Guinot, 1971:1076.

Type locality: The Cape Verde Islands.
Material examined: Grab station N1 (1 specimen), N13 (1). Trawl station 970 (1 specimen), 983 (1), 986 (4), 1347 (15), 1353 (3).
Previous reported distribution: The Atlantic Ocean. In the eastern Atlantic from the eastern Mediterranean to Ghana and the offshore Gulf of Guinea islands, intertidal to 220 m.
Nansen samples distribution: Off Nigeria and São Tomé and Principe, 58-98 m.
Habitat: Epifaunal, on hard substrates, often with rocks and corall.
Measurements: Carapace length: 2-8 mm. Carapace width: 2-10 mm.
Characteristics: A small species with a carapace with well marked regions. There are also several transverse lines of granules on the carapace. The dactyli of chela lacks a large basal tooth.

Figure 50 *Microcassiope minor*. Habitus: left: dorsal view; right: ventral view. The specimen has a carapace width of 8 mm and a carapace length of 6 mm.

Genus *Monodaeus* Guinot, 1967

Characteristics: The male pleopod generally has subdistal feathery bristles.

Monodaeus rouxi (Capart, 1951)

Figure 51.

Micropanope rouxi Capart, 1951:153. – Forest, 1965a:380. - Forest and Guinot, 1966:81. – Guinot, 1967c:348. – Forest, 1976:66.

Medaeus (?) *rouxi*. – Monod, 1956:312. - Guinot and Ribeiro, 1962:58. – Crosnier, 1967:335.

Medaeus rouxi. – Forest, 1959:15.

Monodaeus rouxi. – Guinot, 1967c:371; 1971:1074. – Forest, 1976:68.

Type locality: Banana, Congo.

Material examined: Grab station N1 (1 specimen), N2 (1), C4 (4), G16 (2).

Previous reported distribution: Senegal to Angola, 46-220 m.

Nansen samples distribution: Off Nigeria, Cameroon and Gabon, 49-98 m.

Habitat: Epifaunal, soft sediments.

Measurements: Carapace length: 2-8 mm. Carapace width: 3-10 mm.

Characteristics: A small species. The granular carapace has a ridge of tubercles on the branchial area. The front is almost straight and is only weakly incised. The chelipeds are uneven, the pereiopods long and slender.

Figure 51 *Monodaeus rouxi*. Habitus: left: dorsal view; right: ventral view. The specimen has a carapace width of 6 mm and a carapace length of 4 mm.

Genus *Nanocassiope* Guinot, 1967

Characteristics: The anterolateral teeth are either very small or of medium size. They have a triangular shape and are straight. The pereiopods including chela are more or less faintly spinulated.

Nanocassiope melanodactylus (A. Milne Edwards, 1867)

Figure 52.

Xanthodes melanodactylus A. Milne Edwards, 1867.

Micropanope polita. – Rathbun, 1893b:238; 1930:440. – Garth, 1946:459.

Xanthodes melanodactylus var. *rufopunctatus*. - A. Milne Edwards and Bouvier, 1900:87.

Micropanope melanodactylus. – Capart, 1951:151. – Chace, 1966:637.

Micropanope melanodactyla. – Monod, 1956:320. – Gauld, 1960:70. - Guinot and Ribeiro, 1962:60. – Ribeiro, 1964:12. - Forest and Guinot, 1966:83. – Guinot, 1967c:348. - Le Loeuff and Intés, 1968.

Xanthodes melanodactylus. – Guinot, 1967c:358.

Nanocassiope melanodactyla. – Guinot, 1967c; 1971:1075. – Türkay, 1976b:61.

Nanocassiope polita. – Guinot, 1971:1075.

Type locality: The Cape Verde islands.

Material examined: Trawl station 1347 (2 specimens).

Previous reported distribution: Eastern Pacific, central Atlantic, and eastern Atlantic; from the Azores, Madeira, Ilhas Desertas, the Canary Islands and the Cape Verde Islands and Senegal southwards to Angola, subtidal to more than 600 m.

Nansen samples distribution: Off Principe, 60 m.

Habitat: Epifaunal, soft sediments with coralline algae or Foraminifera.

Measurements: Carapace length: 8 mm. Carapace width: 10 mm.

Characteristics: Have a relatively wide and transversely grooved front. 2^{nd}-5^{th} pereiopods are slender and sparsely setose. The chelae are granulated. Carapace with a distinctly shaped groove in the gastric region.

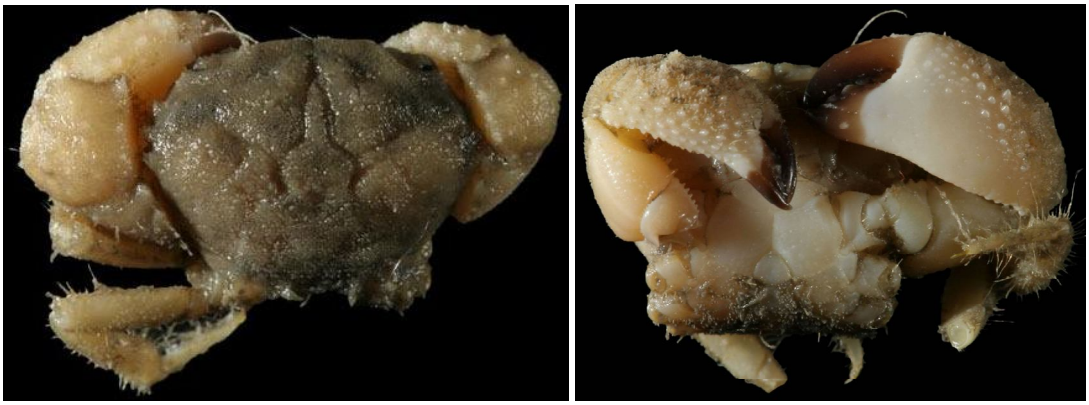


Figure 52 *Nanocassiope melanodactylus*. Habitus: left: dorsal view; right: ventral view. The specimen has a carapace width of 10 mm and a carapace length of 8 mm.

Genus *Paractaea* Guinot, 1969

Characteristics: Carapace, chelipeds and pereiopods are granulated**.**

Paractaea margaritaria (A. Milne Edwards, 1867)

Figure 53.

Actea margaritaria A. Milne Edwards, 1867. – Capart, 1951:159. – Gauld, 1960:70. – Serène, 1961:197. – Rossignol, 1962:117. – Chace, 1966:637. - Forest and Guinot, 1966:77. – Guinot, 1969d:224.

Actea (*Actea*) *margaritaria*. – Monod, 1956:294. - Guinot and Ribeiro, 1962:56. – Ribeiro, 1964:9.

Paracetaea margaritaria. – Guinot, 1976:251.

Type locality: St. Vincent, Cape Verde Islands.

Material examined: Trawl station 246 (2 specimens).

Previous reported distribution: West coast of Africa and Saint Helena, 4-91 m.

Nansen samples distribution: Off Gabon, 18 m.

Habitat: Epifaunal, rough bottom.

Measurements: Carapace length: 4-4.5 mm. Carapace width: 5.5-6 mm.

Characteristics: Carapace with an intese red colour, quite strongly curved, and with rounded lobes which are separated by fairly broad furrows. The lobes are covered with pearl-shaped small granulations. The frontal area consists of 2 wide lobes. The chelipeds are short, uneven, and with strongly granulated carpus and pincers. Pereiopod 2-5 are covered by nodules and setae.

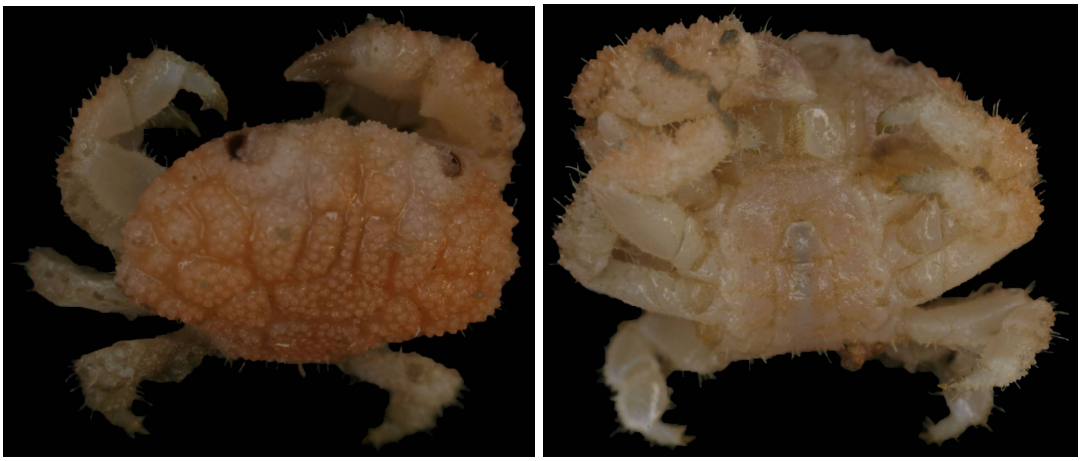


Figure 53 *Paracetaea margaritaria*. Habitus: left: dorsal view; right: ventral view. The specimen has a carapace width of 5.5 mm and a carapace length of 4 mm.

Genus *Pseudomedaeus* Guinot, 1968

Characteristics: This genus has a stout build, large chelipeds and long, slender walking legs. The median frontal is either V-shaped or U-shaped.

***Pseudomedaeus africanus* (Monod, 1956)**

Figure 54.

?*Paraxanthias eriphiodes*. – Capart, 1951:161.

Xanthias tuberculidens. – Capart, 1951.

Medaeus africanus Monod, 1956:306. – Longhurst, 1958:88. – Gauld, 1960:70. – Rossignol, 1962:118. - Guinot an Ribeiro, 1962:58. – Crosnier, 1964:34. - Forest and Guinot, 1966:80. – Crosnier, 1967:328. – Guinot, 1968a:718.

Pseudomedaeus africanus. – Guinot, 1968a:726; 1971:1069. – Williams, 1978:553.

Type locality: West Africa.
Material examined: Trawl station 983 (1 specimen).
Previous reported distribution: Spanish Sahara to Angola, 34-200 m.
Nansen samples distribution: Off São Tomé, 66 m.
Habitat: Epifaunal, soft sediments.
Measurements: Carapace length: 18 mm. Carapace width: 21 mm.
Characteristics: The median frontal notch is V-shaped, and the frontal region of carapace has a rather convex form. Carapace has many furrows carving into the surface, creating a distinct pattern. Chelipeds are strongly granulated, and both chelipeds and the other pereiopods have seta irregulary dispersed on their surface.

Figure 54 *Pseudomedaeus africanus*. Habitus: left: dorsal view; right: ventral view. The specimen has a carapace width of 21 mm and a carapace length of 18 mm.

4.5. ABUNDANCE AND DISTRIBUTION OF BRACHYURA

Ebalia cranchii, *Ilia nucleus* and *Herbstia condyliata* were observed in the Gulf of Guinea for the first time in this study. *Acanthocarpus brevispinis*, *Goneplax rhomboides*, *Philyra laevidorsalis*, *Parthenope notialis*, *Cronius ruber* and *Microcassiope minor* had not been recorded in Nigeria until the current study. In addition, *Goneplax rhomboides*, *Leopoldius pisifer*, *Menippe nodifrons* and *Monodaeus rouxi* were observed in Cameroon for the first time, while *Ebalia affinis* and *Monodaeus rouxi* were recorded in Gabon for the first time in this study. Of the taxa that were only found on stations off São Tomé and Principe or Congo (*Ethusa rosacea*, *Homola barbata*, *Pisa carinimana*, *Epixanthus hellerii*, *Nanocassiope melanodactylus*, *Pilumnus perrieri* and *Pseudomedaeus africanus*), were *H. barbata*, *P. carinimana*, *P. perrieri* and *P. africanus* recorded in São Tomé, and E. *rosacea* in Congo, for the first time respectively. New depth ranges were recorded for *Ethusa rosacea*, *Phyllodorippe armata*, *Stenorhynchus lanceolatus*, *Raninoides bouvieri*, *Epixanthus hellerii* and *Menippe nodifrons*.

Brachyura species were found in 70 of the 79 grab and trawl stations investigated. A total of 291 specimens were identified, divided on 20 families, 38 genera and 45 species level taxa. 275 specimens (94.5%) were identified to species level. The remaining 16 specimens could only be identified to Brachyura, as 6 of the specimens had been destroyed during sampling or fixation, and 11 were juveniles without recognisable characteristics. Station 1347 contained 18 specimens, which was the highest number of specimens all stations compared. This corresponded to a total of 6.5% of all brachyuran specimens identified. No specimens were recorded at stations N5, N8, C3, C5, C12, C17, G6, G7 or G10.

The crustacean grab fauna was dominated by the family Goneplacidae, with 29.4% of the identified specimens belonging to this taxa. In fact the Goneplacidae grab fauna comprised of one species only, *Goneplax rhomboides*. In addition, families Leucosiidae and Xanthidae were represented with 20.2% and 11.0% of the identified specimens respectively. Including *G. rhomboides*, *Ebalia cranchii*, *Lambdophallus sexpes*,

Raninoides bouvieri and *Monodaeus rouxi* comprised 67.9% of the identified grab fauna (Table 7).

Table 7 Recorded species of Brachyura at grab stations with number of specimens, % of total number of Brachyura specimens, number of stations and % of total number of stations at which each taxon is occurring.

Taxa	Specimens	% specimens	Stations	% stations
Goneplax rhomboides (Linnaeus)	32	29,4	11	26,2
Ebalia cranchii (Leach)	12	11,0	9	21,4
Lamdophallus sexpes (Alcock)	11	10,1	2	4,8
Raninoides bouvieri (Capart)	11	10,1	6	14,3
Monodaeus rouxi (Capart)	8	7,3	4	9,5
Herbstia condyliata (Fabircius)	6	5,5	5	11,9
Heterocrypta maltzami (Miers)	5	4,6	5	11,9
Ebalia affinis (Miers)	3	2,8	3	7,1
Menippe nodifrons (Stimpson)	3	2,8	2	4,8
Phyllodorippe armata (Miers)	3	2,8	2	4,8
Leopoldius pisifer (MacLeay)	2	1,8	1	2,4
Microcassiope minor (Dana)	2	1,8	2	4,8
Pseudomyra mbizi (Capart)	2	1,8	2	4,8
Achaeus monodi (Capart)	1	0,9	1	2,4
Ebalia tuberculata (Miers)	1	0,9	1	2,4
Ilia nucleus (Linnaeus)	1	0,9	1	2,4
Ilia spinosa (Miers)	1	0,9	1	2,4
Machaerus oxyacantha (Monod)	1	0,9	1	2,4
Parthenope massena (Roux)	1	0,9	1	2,4
Philyra cristata (Miers)	1	0,9	1	2,4
Philyra laevidorsalis (Miers)	1	0,9	1	2,4
Pilumnus inermis (A. Milne Edwards and Bouvier)	1	0,9	1	2,4
Total	**109**	**100,0**	**42**	**—**

Xanthidae was the dominating family in the trawl fauna, cointaining 17.5% of the identified specimens. Other abundant families were Calappidae (15.7%), Leucosiidae (13.3%), Inachidae (12.7%) and Dorippidae (12.7%). *Microcassiope minor*, *Acanthocarpus brevispinis*, *Medorippe lanata*, *Pseudomyra mbizi* and *Macropipus rugosus* comprised 55.9% of the trawl fauna in this study (Table 8).

The fauna sampled with grab were quite distinct from the the fauna sampled with demersal trawls. 23 out of the 32 species identified in the trawl samples, were found exclusively in the trawl material (Table 8). Furthermore, 13 out of the 22 species encountered in the grab material, were not collected at the trawl stations (Table 7). There were also a difference in the number of specimens caught with the two methods; 125 (including the unidentifiable Brachyura) were found in the grab material, while 166 were collected from the trawl samples (Table 7 and 8).

Table 8 Recorded species of Brachyura at trawl stations with number of specimens, % of total number of Brachyura specimens, number of stations and % of total number of stations at which each taxon is occurring. Specimens collected off São Tomé, Principe and Congo are included.

Taxa	Specimens	% specimens	Stations	% stations
Microcassiope minor (Dana)	24	14,5	5	13,5
Acanthocarpus brevispinis (Monod)	20	12,0	5	13,5
Medorippe lanata (Linnaeus)	18	10,8	6	16,2
Pseudomyra mbizi (Capart)	16	9,6	7	18,9
Macropipus rugosus (Doflein)	15	9,0	7	18,9
Pilumnus perrieri (A. Milne Edwards and Bouvier)	10	6,0	3	8,1
Stenorhynchus lanceolatus (Brullé)	8	4,8	5	13,5
Calappa pelii (Herklots)	6	3,6	3	8,1
Macropodia gilsoni (Capart)	6	3,6	3	8,1
Goneplax barnardi (Capart)	5	3,0	3	8,1
Ilia spinosa (Miers)	5	3,0	2	5,4
Inachus angolensis (Capart)	4	2,4	3	8,1
Homola barbata (Fabricius)	3	1,8	3	8,1
Pachygrapsus gracilis (De Saussure)	3	1,8	3	8,1
Achaeus monodi (Capart)	2	1,2	1	2,7
Nanocassiope melanodactylus (A. Milne Edwards)	2	1,2	1	2,7
Paractaea margaritaria (A. Milne Edwards)	2	1,2	1	2,7
Parthenope notialis (Manning and Holthuis)	2	1,2	2	5,4
Phyllodorippe armata (Miers)	2	1,2	2	5,4
Bathynectes piperitus (Manning and Holthuis)	1	0,6	1	2,7
Capartiella longipes (Capart)	1	0,6	1	2,7
Cronius ruber (Lamarck)	1	0,6	1	2,7
Ebalia tuberculata (Miers)	1	0,6	1	2,7
Epixanthus hellerii (A. Milne Edwards)	1	0,6	1	2,7
Ethusa rosacea (A. Milne Edwards and Bouvier)	1	0,6	1	2,7
Machaerus oxyacantha (Monod)	1	0,6	1	2,7
Maja goltziana (d'Oliveira)	1	0,6	1	2,7
Mebeli michaelseni (Balss)	1	0,6	1	2,7
Menippe nodifrons (Stimpson)	1	0,6	1	2,7
Parthenope massena (Roux)	1	0,6	1	2,7
Pisa carinimana (Miers)	1	0,6	1	2,7
Pseudomedaeus africanus (Monod)	1	0,6	1	2,7
Total	**166**	**100,0**	**37**	**—**

More grab stations than trawl stations were investigated (42 grab stations and 37 trawl stations (30 when disregarding São Tomé, Principe and Congo)). Although it is not possible to directly compare the efficiency of the two methods, a summary of the number

of species sampled in each country using both methods are given in Table 9. The mean number of brachyurans found at each grab station was 3.0, whereas the mean number of brachyurans found at each trawl station was 3.9 (30 stations). Furthermore, the majority of the specimens were collected in restricted areas, mainly off Nigeria. The region north of Port Harcourt in Nigeria was the area containing the highest number of specimens. The number of speciemens decreased east of Port Harcourt and remained low in Cameroon. There was a slight increase of species in the easternmost part of Cameroon and in Gabon. Distribution maps for the most common taxa (collected at 5 or more stations) and an overview of all stations containing Brachyura are given in appendix III.

Table 9 Summary of number of brachyuran specimens and species sampled by the use of respectively grab and trawl in Nigeria, Cameroon and Gabon. Specimens collected off São Tomé, Principe and Congo are not included.

	GRAB			TRAWL		
Country	**Number of specimens**	**Number of species**	**Number of stations**	**Number of specimens**	**Number of species**	**Number of stations**
Nigeria	33	13	9	81	19	22
Cameroon	43	8	12	13	9	4
Gabon	49	12	12	23	3	4
Total	125	33	33	117	31	30

4.6. COMPARISON WITH EARLIER WORK ON WEST AFRICAN BRACHYURA

All the identified specimens, with the exception of *Ebalia cranchii*, *Ilia nucleus* and *Herbstia condyliata*, have previously been recorded in the southern Gulf of Guinea. Many of the taxa, however, were not sampled in previous investigations in the area (Table 10). *Phyllodorippe armata* was identified in this study as well as in the Atlantide samples from 1945-1946, by Capart (1951) and in the Pillsbury expedition (Manning and Holthuis, 1981). *Calappa pelii* and *Machaerus oxyacantha* was identified in this study as well as by Capart (1951), Forest and Guinot (1966) and in the Pillsbury material (Manning and Holthuis, 1981).

Table 10 Brachyura species off Nigeria, Cameroon and Gabon recorded in different investigations: this study, the Atlantide expedition (Bruun, 1950), Capart (1951), Forest & Guinot (1966) and the Pillsbury expedition (Manning and Holthuis, 1981). An x indicates that the species was present in the study, - indicates absence.

Family	Species	Nansen 2005-2007	Atlantide 1945-1946	Capart 1948-1949	Forest & Guinot 1956	Pillsbury 1964-1965
Calappidae	*Acanthocarpus brevispinis*	x	—	x	—	x
Calappidae	*Calappa pelii*	x	—	x	x	x
Calappidae	*Calappa rubroguttata*	—	—	—	x	x
Dorippidae	*Medorippe lanata*	x	—	x	—	x
Dorippidae	*Phyllodorippe armata*	x	x	x	—	x
Dromiidae	*Dromia monodi*	—	—	—	—	x
Dromiidae	*Sternodromia spinirostris*	—	—	x	—	x
Epialtidae	*Apiomithrax violaceus*	—	—	—	x	—
Epialtidae	*Herbstia condyliata (juv)*	x	—	—	—	—
Epialtidae	*Pisa armata*	—	—	x	—	x
Epialtidae	*Pisa carinimana*	x	—	—	x	x
Ethusidae	*Ethusa rosacea*	x	—	x	—	—
Ethusidae	*Ethusa vossi*	—	—	—	—	x
Euryplacidae	*Machaerus oxyacantha*	x	—	x	x	x
Goneplacidae	*Goneplax barnardi*	x	—	x	—	x
Goneplacidae	*Goneplax rhomboides (juv)*	x	—	—	—	—
Grapsidae	*Geograpsus lividus*	—	—	—	—	x
Grapsidae	*Goniopsis pelii*	—	x	—	—	x
Grapsidae	*Pachygrapsus gracilis*	x	—	—	—	x
Grapsidae	*Pachygrapsus transversus*	—	—	x	—	x
Grapsidae	*Plagusia depressa*	—	—	—	—	x
Hexapodidae	*Lamdophallus sexpes*	x	—	—	—	—
Homolidae	*Homola barbata*	x	—	—	—	x
Inachidae	*Achaeus monodi*	x	—	—	x	—
Inachidae	*Achaeus turbator*	—	—	—	—	x
Inachidae	*Calypsachaeus calypso*	—	—	—	x	x
Inachidae	*Capartiella longipes*	x	—	—	—	x
Inachidae	*Inachus angolensis*	x	—	x	—	x
Inachidae	*Inachus biceps*	—	—	—	x	x
Inachidae	*Inachus dorsettensis*	—	—	x	—	—
Inachidae	*Inachus grallator*	—	—	x	—	x
Inachidae	*Inachus leptochirus*	—	—	—	x	—
Inachidae	*Inachus nanus*	—	—	—	—	x
Inachidae	*Macropodia gilsoni*	x	—	x	—	x
Inachidae	*Macropodia hesperiae*	—	—	—	—	x
Inachidae	*Macropodia macrocheles*	—	—	x	—	x
Inachidae	*Macropodia spinulosa*	—	—	—	x	x
Inachidae	*Macropodia straeleni*	—	—	x	—	x
Inachidae	*Stenorhynchus lanceolatus*	x	—	—	x	x
Leucosiidae	*Atlontotlos rhombifer*	—	—	x	—	x

Leucosiidae	*Ebalia affinis*	x	—	—	—	x
Leucosiidae	*Ebalia cranchii*	x	—	—	—	—
Leucosiidae	*Ebalia tuberculata*	x	—	—	x	x
Leucosiidae	*Ilia nucleus*	x	—	—	—	—
Leucosiidae	*Ilia spinosa*	x	—	—	x	x
Leucosiidae	*Philyra cristata*	x	—	—	—	—
Leucosiidae	*Philyra laevidorsalis*	x	—	—	—	—
Leucosiidae	*Pseudomyra mbizi*	x	—	—	x	x
Majidae	*Eurynome aspera*	—	—	—	x	—
Majidae	*Maja goltziana*	x	—	—	—	—
Matutidae	*Mebeli michaelseni*	x	—	—	—	—
Menippidae	*Menippe nodifrons*	x	—	—	—	—
Ocypodidae	*Ocypode cursor*	—	—	—	x	x
Ocypodidae	*Uca tangeri*	—	—	x	—	x
Oziidae	*Epixanthus hellerii*	x	—	—	—	—
Panopeidae	*Panopeus africanus*	—	—	x	—	x
Parthenopidae	*Heterocrypta maltzamii*	x	—	—	—	x
Parthenopidae	*Parthenope massena*	x	—	—	x	x
Parthenopidae	*Parthenope notialis*	x	—	—	x	x
Parthenopidae	*Solenolambrus noordendei*	—	—	—	—	x
Pilumnidae	*Pilumnopeus africanus*	—	—	—	—	x
Pilumnidae	*Pilumnus inermis*	x	—	—	—	—
Pilumnidae	*Pilumnus perrieri*	x	—	—	x	x
Pilumnidae	*Pilumnus stebbingi*	—	—	x	—	—
Portunidae	*Bathynectes piperitus*	x	—	—	—	—
Portunidae	*Callinectes amnicola*	—	—	x	x	x
Portunidae	*Callinectes marginatus*	—	—	x	—	x
Portunidae	*Callinectes pallidus*	—	—	x	x	x
Portunidae	*Cronius ruber*	x	—	—	—	—
Portunidae	*Macropipus rugosus*	x	—	—	x	x
Portunidae	*Portunus inaequalis*	—	—	—	x	x
Portunidae	*Portunus validus*	—	—	x	—	x
Portunidae	*Thalamita poissonii*	—	—	—	x	—
Raninidae	*Raninoides bouvieri*	x	—	—	x	x
Sesarmidae	*Metagrapsus curvatus*	—	—	x	—	x
Sesarmidae	*Sesarma angolense*	—	x	—	—	—
Sesarmidae	*Sesarma buettikoferi*	—	—	—	—	x
Sesarmidae	*Sesarma elegans*	—	x	—	—	—
Sesarmidae	*Sesarma huzardi*	—	x	—	—	—
Varunidae	*Cyclograpsus integer*	—	—	—	—	x
Xanthidae	*Leopoldius pisifer*	x	—	—	x	x
Xanthidae	*Microcassiope minor*	x	—	—	—	—
Xanthidae	*Monodaeus rouxi*	x	—	—	—	x
Xanthidae	*Nanocassiope melanodactylus*	x	—	x	—	—
Xanthidae	*Paractaea margaritaria*	x	—	—	—	—
Xanthidae	*Pseudomedaeus africanus*	x	—	—	—	—

Brachyura from 23 of the Atlantide sampling stations, were available in the collections of the Zoological Museum in Copenhagen. Two of these stations were located in Nigeria and one in Cameroon. There is currently no report available from the Atlantide expedition which states where and how many brachyurans that were found during the expedition. One can therefore only assume that these 23 stations were the only one where brachyurans were collected. Different sampling gear was used at the different stations and random data for bottom type, depth and bottom temperature were recorded for the two expeditions (Appendix IV).

Capart investigated the brachyuran species collected on a Belgian cruise in West Africa in 1948-1949. 100 brachyuran species were identified in total and 15 of these were found in Nigeria, Cameroon or Gabon. Ten of these 15 species were found in the current study as well (Table 10). Forest and Guinot studied the brachyuran material collected in the Gulf of Guinea "Calypso" expedition in 1956. 108 species were identified of which 24 were found in Nigeria, Cameroon or Gabon, 14 in the Nansen samples, 4 in Capart's investigation and 20 in the Pillsbury expedition (Table 10). A total of 98 brachyuran species were collected in the Gulf of Guinea during the two Pillsbury cruises. Of these were 57 recorded in Nigeria, Cameroon and Gabon, and 25 were also identified in the current study.

4.7. ORDINATION OF THE FAUNA

Grab and trawl data were treated separately. Species and environmental variable raw data for the Canoco analyses are given in appendix V. An indication of the correlation between the measured environmental variables, grab stations and the identified Brachyuran fauna is illustrated in figure 55. This ordination diagram shows positive correlations between salinity and depth, and between temperature and oxygen. It is also worth to notice that there is a clustering of stations and species in the area where salinity and depth increases. Decreasing temperature and oxygen content however, seem to have the opposite effect.

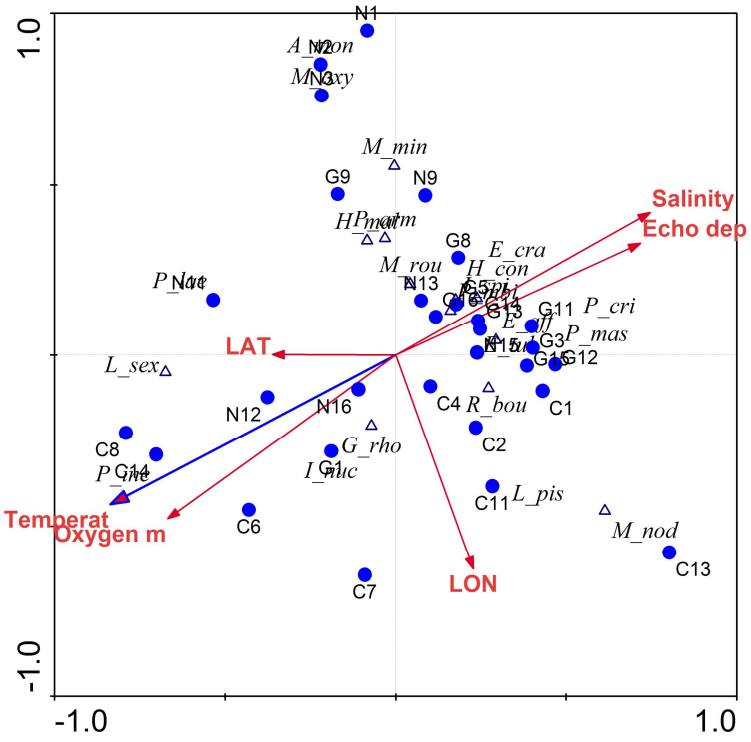


Figure 55 CCA ordination diagram showing the grab stations, the identified species, and their correlation with the environmental variables (salinity, temperature, depth, oxygen, latitude (LAT) and longitude (LON). A list of species abbreviations can be found in Appndix V.

To give a clearer picture of the position of each of the species in figure 55, a plot showing only the species was drawn up (Figure 56).

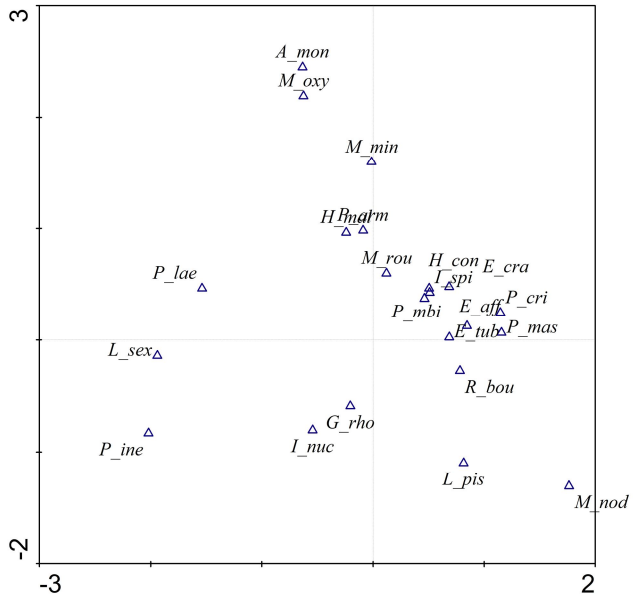


Figure 56 The location of each brachyuran species found in the grab samples based on the ordination analysis presented in figure 55. Species abbreviations are listed in Appendix V.

Figure 57 shows the relationship between the grab stations and environmental variables.

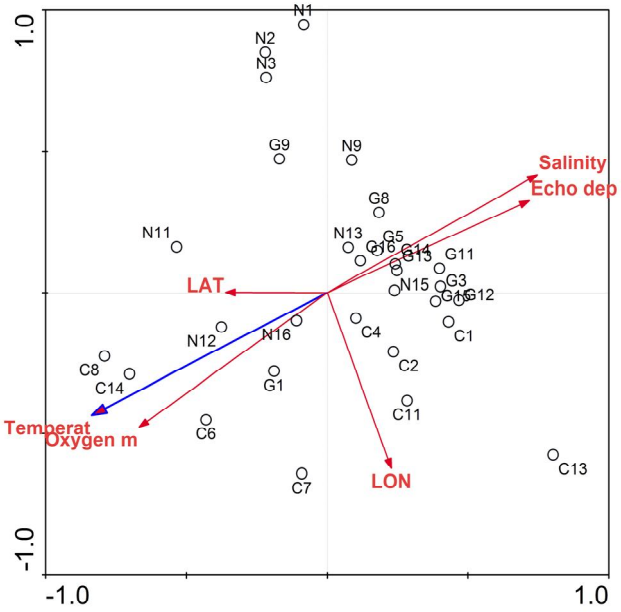


Figure 57 CCA ordination diagram showing the grab stations and their possible correlation with the measured environmental variables (salinity, temperature, detpth, oxygen, latitude (LAT) and longitude (LON).

The results from the Canonical Correspondence Analysis (CCA) test conducted on the grab material, with forward selection and a significant p-value level of 0.05, are given in Table 11. Temperature emerged as the only significant variable.

Table 11 P-values for the environmental variables obtained for the grab fauna in the Canonical Correspondence Analysis (CCA) with forward selection and Monte Carlo testing of variables. Significant values are presented with numbers; non significant p-values are given as n.s.

Environmental variables	Fauna
Temperature	0.0020
Longitude	n.s.
Latitude	n.s.
Salinity	n.s.
Depth	n.s.
Oxygen	n.s.

An ordination diagram investigating possible correlations between trawl stations, identified species and measured environmental values were conducted for the trawl samples as well (Figure 58). Compared to the grab ordination diagram, the trawl diagram did not display a strong clustering in one direction. Rather, there seemed to be a tendency of species to occur at high longitudes and low latitudes. Furtheremore, some species seemed to have a preference for deep waters.

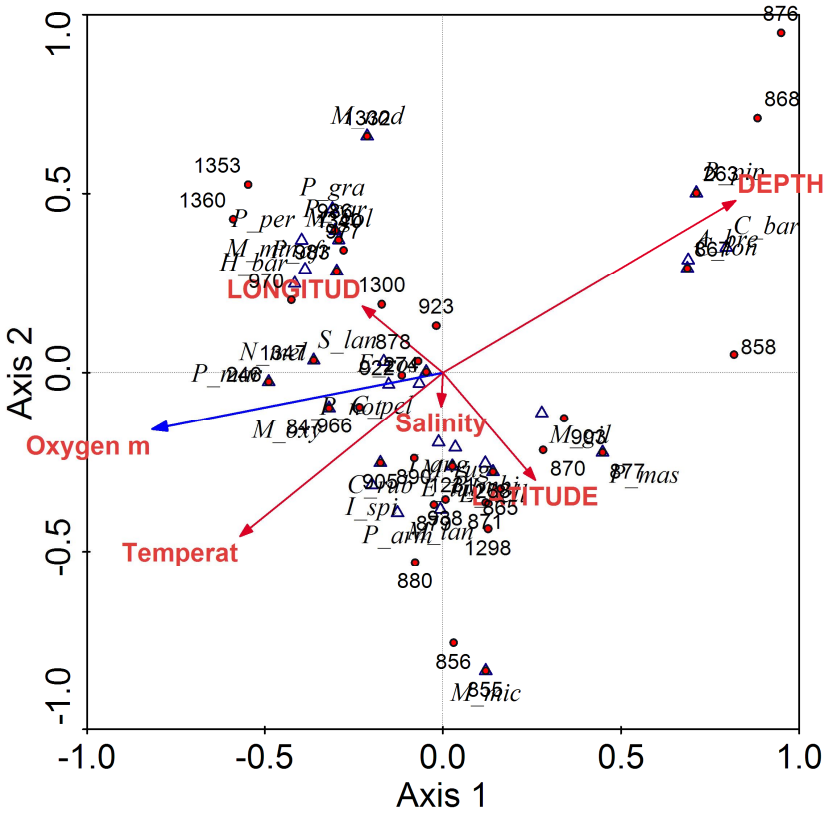


Figure 58 CCA ordination diagram showing the trawl stations, the identified species, and their correlation with the environmental variables (salinity, temperature, depth, oxygen, latitude and longitude). A list of species abbreviations are given in Appendix V.

A diagram was constructed to illustrate the position of the species in figure 58 (Figure 59).

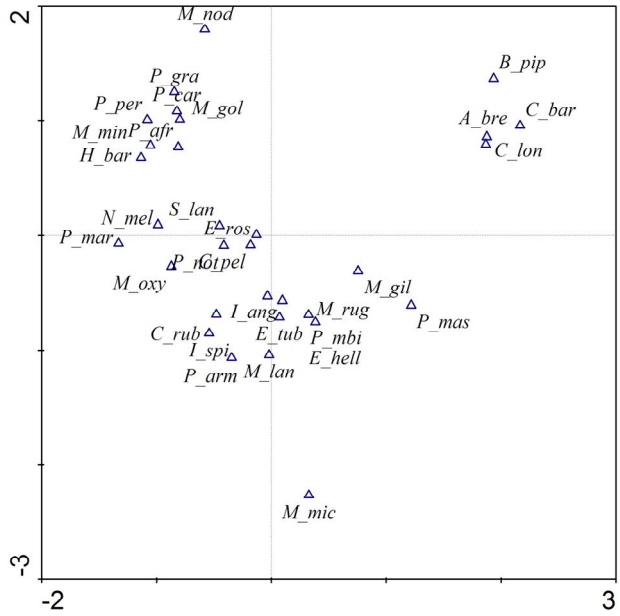


Figure 59 The location of the Brachyran species from the trawl samples, based on the ordination analysis presented in figure 58. Species abbreviations are listed in Appendix V.

Figure 60 shows the relationship between the trawl stations and environmental variables.

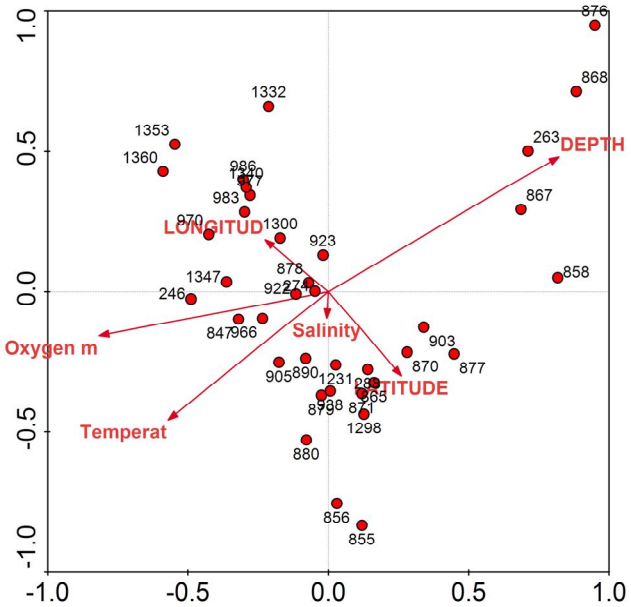


Figure 60 CCA ordination diagram showing the trawl stations and their possible correlation with the measured environmental variables (salinity, temperature, depth, oxygen, latitude and longitude).

The results from the Canonical Correspondence Analysis (CCA) test conducted on the trawl material, with forward selection and a significant p-value level of 0.05, are given in Table 12. Temperature, depth and oxygen emerged as significant variables, where temperature and depth were the most significant ones. Salinity, latitude and longitude did not significantly affect the position of the species.

Table 12 P-values for the environmental variables obtained for the trawl fauna in the Canonical Correspondence Analysis (CCA) with forward selection and Monte Carlo testing of variables. Significant values are presented with numbers; non significant p-values are given as n.s.

Environmental variable	Fauna
Temperature	0.0020
Depth	0.0020
Oxygen	0.0420
Salinity	n.s.
Latitude	n.s.
Longitude	n.s.

4.8. BAR-CODING

A sequence of the CO1-gene was obtained from three out of the ten species; *Calappa pelii*, *Pseudomyra mbizi* and *Macropodia gilsoni* (Figure 61). The full CO1 sequences are presented in fasta-format in appendix VI.

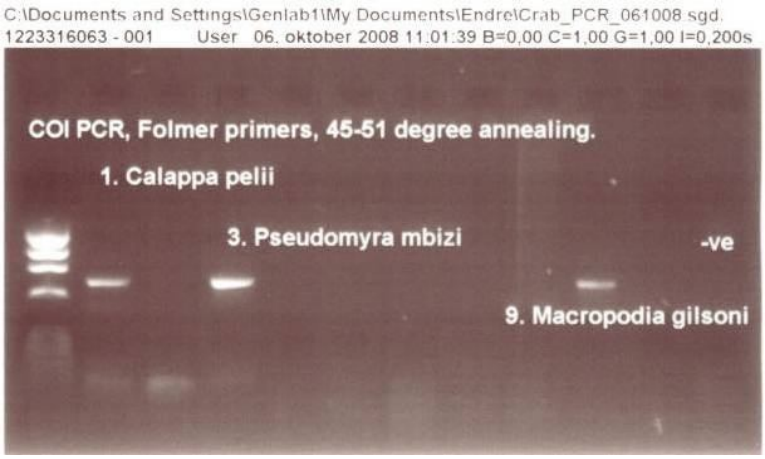


Figure 61 Photograph of the electrophorized agarose gel showing PCR products from using "Folmer" CO1-primers on DNA extracts from *Calappa pelli*, *Pseudomyra mbizi* and *Macropodia gilsoni*.

Matching sequences were searched for in the BOLD (Barcode of Life Data Systems) and NCBI- data bases, the former with the BOLD identification engine, and the latter with nucleotide BLAST (Basic Local Alignment Search Tool) in the nucleotide collection (nr/nt). The closest match obtained in both databases is reported for each species (Table 13).

Table 13 Results of nucleotide blasts performed in BOLD and BLAST search engines for the three species from whom a CO1 sequence was obtained. The most significant alignment and its match in percent are recorded for each species.

	BOLD search		BLAST search	
Species	**Closest match (species)**	**% similarity**	**Closest match (species)**	**% similarity**
Calappa pelli	*Thalamita sp.*	84.8	*Charybdis vadorum*	85.0
Pseudomyra mbizi	*Ebalia nux*	86.3	*Pugettia gracilis*	85.0
Macropodia gilsoni	*Macropodia longipes*	99.9	*Munida notata*	83.0

5. DISCUSSION

5.1. DISCUSSION OF METHODS

5.1.1. SAMPLING

Benthic and infaunal crustaceans can be sampled by a wide range of trawls, dredges, sledges, grabs, cores and suction pumps (McLaughlin et al., 1982). Manning (1960) also suggested that the poison "Pro-noxfish" could be a useful method for collecting Crustacea. In addition, collection from a fishing boat using double-rig nets has proven successful, but only at shallow depths (Bertini et al., 2004). In the current study, samples were obtained using a demersal trawl and a Van Veen grab.

The 0.1 m² Van Veen grab has been adopted by biologists as a standard quantitative sampling device for macrofauna (Holme and McIntyre, 1984). Reliability (i.e. how consistent and correct the grab performs in all types of sediments and weather conditions), digging performance and capture efficiency (amount of fauna sampled) are important factors when evaluating grab efficiency (Holme and McIntyre, 1984). Lie and Pamatmat (1965) investigated the 0.1 m² Van Veen grab and found that it was efficient in sampling the benthos when operated from a stationary (anchored) ship and under good weather conditions. Replicates were only investigated for a limited number of stations in this study, hence factors which affect the repeatability of samples, e.g. the stability of the ship, were not important here. A more general problem with grabs is the down rush of water created by the grab's decent. This could cause disturbance of the sediment and loss of superficial fauna (Holme and McIntyre, 1984). In addition, the abundance of species that either migrate actively or are passively transported by tidal currents will be underestimated in a grab sample compared to less mobile species. This is particularly a problem with species in class Crustacea (Lie and Pamatmat, 1965). Furthermore, the reliability of a grab also depends on the person operating it. It is crucial for the grab to land on the bottom in a condition that allows it to operate properly (Holme and McIntyre, 1984). The grab samples in the current study were collected in open-sea and in generally good weather conditions (Krakstad et al., 2006a). The Smith-McIntyre grab has been

proposed as an alternative to the Van Veen grab because of its apparent ability to perform better in open-sea conditions (Holme and McIntyre, 1984).

Demersal trawling is a qualitative method of sampling the benthos. Its efficiency is measured by the ability of the trawl to capture all the fauna living on or just above the bottom, within its sweep. The efficiency is seldom more than 10% (Holme and McIntyre, 1984). Several bottom configurations may be encountered during one tow, and this greatly affects the performance of the trawl. In addition, the behaviour of the ship and the towing speed are important factors which may complicate and/or reduce catches. To increase efficiency depressors or diving plates, and tickler chains can be fitted to the trawl (Holme and McIntyre, 1984). This was not done during the current study.

The two methods, grab and trawl, applied for sampling soft-sediment benthic fauna in the current study, cannot be compared, but they complement each other well. The grab is quantitative and samples epifauna and infauna from small, randomly selected areas of the shelf. The demersal trawl on the other hand, covers large areas in one sweep and only collects epifauna. The mesh size of the trawl determines the size of the animals caught with this method (Holme and McIntyre, 1984). Soft-sediment benthos are known for a high patchiness in species distribution (Morrisey et al., 1992) and this impacts the efficiency of a grab more than a trawl, due to the small area sampled with a grab. It should also be noted that while every crustacean specimen caught with grab was collected, only a selection of the specimens sampled with trawl were retained for species identification (pers. komm. Kongsrud 2009). Furthermore, trawl appeared to be a much more gentle method than grab. Most specimens in the grab samples were missing pereiopods or had other damages. It was also only grab specimens which were damaged so severely that identification was impossible.

The mesh size used for sieving the grab samples (0.5 mm) was appropriate for sampling even the smaller Crustacea like copepods (McLaughlin et al., 1982).

5.1.2. HANDLING OF BIOLOGICAL SAMPLES AND SPECIMEN IDENTIFICATION

The animals die quickly after exposure to air temperatures and must therefore be preserved quickly before they disintegrate. Formaldehyde is considered the best fixative for crustaceans, but alcohol should be used for long-term storage (McLaughlin et al., 1982, Schander and Halanych, 2003). Although 50% of the grab samples were initially fixed in formalin in this study, they were transferred to 70% ethyl alcohol at a later stage. Alcohol tend to make the specimens brittle, hence careful handling was necessary to avoid damaging them. Up until sorting the Crustacea into groups, the grab samples were handled by other people. It is therefore difficult to determine if the damaged specimens were a result of the sampling method itself, or if it was a result of rough/careless treatment at a later stage. Furthermore, errors could have occurred during the identification process due to inexperience of the student.

5.1.3. BAR-CODING

The so-called Folmer primers (Folmer et al., 1994) were used to amplify a 650-710-bp fragment of the COI gene. This resulted in a COI sequence for three of the ten species investigated. A common agreement seems to be that the Folmer primers are “universal” and should be applicable for COI amplification in most invertebrates (Folmer et al., 1994, Hebert et al., 2003b, Schander and Willassen, 2005, Costa et al., 2007, Hultgren and Stachowicz, 2008). Hence it was anticipated that these primers would also yield sequences for the COI gene in brachyurans. The poor result obtained from barcoding in this study can be a result of factors other than low primer affinity, such as initial treatment of the samples, fixation and method of DNA extraction. In addition, the DNA extracts were only amplified in one PCR run. Reamplification with a higher annealing temperature could have yielded sufficient product for sequencing (Folmer et al., 1994).

5.1.4. ORDINATION OF THE FAUNA

Sample sizes were too small to run any statistical analysis on the data for crustacean biodiversity. In addition, statistical analysis of the brachyuran fauna was complicated

since two methods, one quantitative and one qualitative, were used to collect the specimens. An alternative could have been to estimate species richness for both grab and trawl brachyuran fauna. A species-accumulation curve is needed before species-richness can be estimated. Although the species-accumulation curve does not depend on species abundance distributions, it is strongly influenced by the distribution of species among samples as well as the spatial relationship of the samples (Ugland et al., 2003). Hence, the sample sizes would have been too small in this scenario, and it would be difficult to draw any conclusions. Correspondence analysis (CCA) however, proved useful in terms of predicting the abundance of brachyurans from environmental data. Both exploratory ordinations about how community composition varies with the environment and confirmatory predictions concerning the statistical significance of each environmental variable were possible. The ordinations were conducted using presence-absence data (trawl) and abundance data (grab) where the environmental variables were fewer than the number of samples, an assumption for CCA analysis (ter Braak and Smilauer, 2002). Sediment analyses were not included in the ordination or correlation analyses, since sediment data was only available for Nigeria and Cameroon.

5.2. DISCUSSION OF RESULTS

5.2.1. ABUNDANCE OF MAIN TAXA OF CRUSTACEA

The sample number included in the current study was too low to get an accurate understanding of the abundance of crustaceans off Nigeria, Cameroon or Gabon. Patchiness of the fauna and the random fashion with which grab samples were conducted are likely to impact on the results. It could contribute to over- or underestimation of some crustacean groups and it could lead to an over- or underestimate of the total abundance in an area. With this in mind, some assumptions based on the results of the current study will be discussed.

Specimens of order Amphipoda were the main component of the crustacean grab fauna in Nigeria, Cameroon and Gabon. Order Decapoda were the second most abundant

crustacean order in Nigeria, whereas Tanaidacea were the second most abundant order in Cameroon and Gabon. Jayaraj et al. (2008) studied the soft-bottom infaunal macrofauna in tropical shelf waters off the coast of India. In conformity with the current study, they found Amphipoda to be the main component of the crustacean fauna, whereas isopods were the second and decapods the third most abundant order, respectively. The importance of isopods and decapods in tropical soft-bottom communities is also highlighted by Lenihan and Micheli (2001). Alongi and Christoffersen (1992) found amphipods, followed by tanaeids and decapods to be dominant taxa, whereas Isopoda was a minor taxa in terms of abundance. Abundance of isopods in the current study was overall quite low. There was an increase in catch rate of isopods in Gabon, but compared to total number of specimens sampled in Gabon, the abundance of isopods was still low. In the current study grab was the method of choice for sampling crustacean fauna, while box corers were used in the investigation by Alongi and Christoffersen (1992). Both methods have been proven to sample low numbers of some macrofaunal taxa, including isopoda. An increase in catch rate of isopoda and other crustaceans would probably been achieved by the use of an epifaunal sledge (Brandt, 2004).

The number of crustaceans sampled in the grab fauna of Gabon was five times as high as the number of crustaceans sampled in Nigeria and Cameroon. Compared to Nigeria and Cameroon, Gabon had colder sea surface temperatures and slightly lower oxygen content in deeper waters. Both Nigeria and Gabon had quite stable sea surface salinities compared to Cameroon. The colder water mass in Gabon is a consequence of upwelling of nutrient rich water from the deep sea (Philander, 1979). In constant, large upwelling areas, such as the one off the coast of Namibia, upwelling is associated with cold nutrient rich surface water and anoxic bottom waters (Macpherson, 1991) and an accumulation of hydrogen sulphide (Jørgensen, 1980). Such conditions typically result in low diversity and abundance of benthic species (Jørgensen, 1980). The upwelling cell affecting the hydrography off the coast of Gabon, however, has an opposite effect on the benthic community. Upwelling off Gabon occurs during short, seasonally dependent periods (Philander, 1979). There is not enough time for anoxic bottom waters to build up, hence the benthic fauna benefits from extra nutrients and abundance is typically high (Alongi

and Christoffersen, 1992). A study on West African marine benthic fauna (Le Læuff and von Cosel, 1998) identified different hydroclimatic regions based on if the region was subject to upwelling (alternance regions), if it was affected by cold waters from upwelling areas (atypical tropical regions), or if the hydroclimatic conditions remained uniform throughout the year (typical tropical regions). Alternance regions were found to have the highest species biomass, whereas typical tropical regions had the lowest. Gabon is situated in an alternance region, while Nigeria and Cameroon are located in typical tropical regions (Le Læuff and von Cosel, 1998). Specific benthic faunas inhabited the various hydroclimatic regions. Fauna in typical tropical regions was very specific and little species exchange occurred with surrounding areas. This was especially evident in Cameroon, where the benthic fauna must tolerate great fluctuations in salinity due to heavy rain and river runoff (Le Læuff and von Cosel, 1998). The fauna of alternance regions was found to be more dynamic. The crustacean fauna was not investigated in detail in the current study and it is not possible to validate the findings of Le Læuff and von Cosel (1998) in terms of species specificity and community patterns. It is however, possible to assume that the different hydroclimatic regimes had a large impact on species richness and abundance in the marine soft-bottom communities of Nigeria, Cameroon and Gabon. There was no apparent difference in the abundance of specimens between the area sampled north of Port Gentil, and that sampled south of Port Gentil in Gabon.

Sediment composition has been shown to be one of the most important factors impacting benthic communities (Chou et al., 2004). Unfortunately, analysis of sediment composition and total organic matter was only available for Nigeria and Cameroon and therefore it is not possible to utilize this data to explain the variation in species abundance between Nigeria, Cameroon and Gabon. On a general note, however, the shelf off Nigeria is typically dominated by silt/clay (Koranteng, 2001), while the shelves off Cameroon and Gabon are dominated by sandy sediments (Bianchi, 1992). The sediment data in the current analysis were not sufficient to support these findings, hence more data is needed. The effect of sediment type on soft-bottom assemblages should be considered in future studies of benthic assemblages in the Gulf of Guinea.

5.2.2. THE BRACHYURAN FAUNA

The brachyuran fauna constituted 7 to 8% of the crustacean grab fauna off Nigeria and Camerooon, and 3% of the fauna off Gabon. A total of 45 species of Brachyura were identified in the current study. Of these, 15 were sampled exclusively off Nigeria, 6 were found only off Cameroon, and 7 were collected off Gabon. In addition, 7 species of Brachyura were sampled exclusively off Saõ Tomé and Principe, or off Congo. The shelves of Saõ Tome and Principe consist primarily of coral and other rough bottom substrates (Floeter et al., 2007) whereas the shelf area off Congo is dominated by soft sediments (Bianchi, 1992). Particular habitat preferences of these seven species however, were not evident in the current study.

New distributions were recorded for some of the species. *Ebalia cranchii*, *Ilia nucleus* and *Herbstia condyliata* were observed in the southern part of the Gulf of Guinea for the first time. *E. cranchii* and *H. condyliata* seemed to prefer medium depths (50-90 m) and stable salinity levels of 35.7-35.9‰, whereas *I. nucleus* was found in shallower waters of lower salinity. Preferences in regards to sediment type or total organic matter were difficult to indicate due to the limited number of investigated samples, and because data from Gabon was missing. *E. cranchii*, *I. nucleus* and *H. condyliata* have a relatively broad distribution in the Atlantic Ocean (d'Udekem d'Acoz, 1999). There are previous reports of *E. cranchii* as far south as Senegal, of *I. nucleus* to the Cape Verde Islands, and of *H. condyliata* south to Ghana (d'Udekem d'Acoz, 1999). Hence, the expansion in their distribution ranges is realistic. Furthermore, a number of species were recorded for the first time in one of the investigated countries: 6 species off Nigeria, 4 species off Cameroon and 2 species off Gabon. New depth ranges were recorded for six species. The most remarkable new depth range was that of *Menippe nodifrons*. It is recorded as a littoral or sublittoral species, off shore to about 20 m (Manning and Holthuis, 1981). In the current study it was recorded as deep as 101 m. Three specimens of *M. nodifrons* were collected in this study; one from 24 m, one at 60 m depth, and one from 101 m. The one collected from a depth of 24 m, was an adult and sampled with demersal trawl. The

other two specimens were juveniles sampled with grab. It could be hypothesised that juvenile and adult *M. nodifrons* have different depth distributions, although more data is needed to verify this.

The fauna sampled with grab and trawl was quite distinct. Of the 32 species identified from Nigeria, only 3 were found in both grab and trawl material. Similarly, of the 17 species collected off Cameroon, 6 were distinct for grab and 7 were distinct for trawl. None of the brachyurans sampled in Gabon were found with both sampling devices. Furthermore, there was a clear tendency of larger specimens being sampled with trawl, while small specimens were collected in the grab samples. The distinct fauna caught with grab and trawl highlights the importance of using different gears to get a representative picture of the epibenthic fauna.

5.2.3. COMPARISON WITH PREVIOUS STUDIES

A total of 218 species of Brachyura have been recorded from localities within the Gulf of Guinea (Manning and Holthuis, 1981). It is not certain however, how many brachyuran species are located off the coasts of Nigeria, Cameroon and Gabon. Only an assumption, based on findings in this and in previous investigations in the area, is possible. Identified brachyuran species from four investigations (Bruun, 1950, Capart, 1951, Forest and Guinot, 1966, Manning and Holthuis, 1981) in addition to the current study were compared. The result was a list of 86 species of Brachyura found off Nigeria, Cameroon and/or Gabon. Slightly more than half of these species were recorded in this study. Five families, Dromiidae, Ocypodidae, Panopeidae, Sesarmidae and Varunidae, had no representative species in the current study. This is most likely explained by the habitats these families prefer. Members of Ocipodidae inhabit sandy beaches, Panopeidae are commonly found in intertidal estuaries and lagoons, Sesarmidae dwell in intertidal mangrove areas, while family Varunidae are found under rocks in the intertidal zone (Manning and Holthuis, 1981). As for the two species in family Dromiidae; one is

intertidal while the other (*Sternodromia spinirostris*) is subtidal (Manning and Holthuis, 1981) and could potentially have been sampled in the current study.

Another difference between the previous studies and the current study is that two species of the family Portunidae, *Callinectes amnicola* and *Callinectes pallidus*, were found in three of the four previous studies, but did not appear in the Nansen samples. Habitat seems to be the determining factor in these cases as well, since *C. amnicola* and *C. pallidus* are inshore, estuarine species, often found together (Manning and Holthuis, 1981).

The relevance of the investigations conducted by Capart (1951), Forest and Guinot (1966) and the Pillsbury expedition (Manning and Holthuis, 1981) when studying distributions of West African brachyurans, where accentuated by Manning and Holthuis (1981). Especially the Pillsbury cruises recorded many species in Nigeria, Cameroon and Gabon, and it was also the study which was most similar to the current study in terms of findings. The material sampled during the Atlantide expedition was not as relevant as expected. The brachyuran material from the Atlantide expedition had not been properly processed and their findings have not yet been published. Furthermore, brachyurans were only found at two stations off Nigeria and one station off Cameroon, and sampling was mostly by hand collection in the littoral zone.

The main difference between the previous studies and the current seemed to be the depth of sampling. RV Dr. Fridtjof Nansen did not attempt to sample shallower than 20 m (IGCC, 2005). Many of the species collected by Capart (1951), Forest and Guinot (1966) and the Pillsbury cruises (Manning and Holthuis, 1981) but not by the current study, were littoral and intertidal species. This study focused on subtidal soft-sediment brachyurans. Sampling method also has a great impact on the results. The Pillsbury cruise sampled with trawl and dredge (Manning and Holthuis, 1981). Perhaps dredging is more efficient than a grab in sampling brachyurans, which could be why more species were found during the Pillsbury cruises than during the current investigation. An important point,

however, is that almost no replicate samples were sorted in the current study. More samples would have meant more specimens and probably more species. As previously mentioned, grab and trawl is a good method of collecting Brachyura when used together, as they sample different parts of the fauna. The material investigated in the current study offers an appreciable amount of new knowledge about the distribution of West African Brachyura. Further research is needed to develop a complete understanding of the distribution, biodiversity and abundance of brachyuran fauna in Nigeria, Cameroon and Gabon.

5.2.4. LOCAL DISTRIBUTION OF BRACHYURA IN REGARDS TO ENVIRONMENTAL ASPECTS

Ordination analysis to explore any possible patterns of species distribution in relation to environmental factors (Hill and Gauch, 1980), was conducted separately for species recorded from grab and demersal trawl stations. It is important to keep in mind that grab data were quantitative whereas trawl data were based on presence-absence (qualitative). Furthermore, sample sizes were too small for any conclusions to be made based on the current analysis. Grab species seemed to prefer water bodies of medium depth and salinity levels. Most grab stations sampled off Gabon had these characteristics. Grab stations off Cameroon seemed to be dominated by water masses of slightly decreased temperatures and oxygen levels, conditions which apparently attracted fewer species. No specific pattern was detectable for Nigerian grab stations. It is interesting though, that the only environmental parameter significant when tested was temperature. For demersal trawl species and stations, none of the environmental parameters emerged as more important determinants for distribution than others. Four species (*Bathynectes piperitus*, *Acanthocarpus brevispinis*, *Goneplax barnardi* and *Capartiella longipes*), however, seemed to prefer deep waters. The unclear pattern in terms of environmental preference was reflected when testing significance of each parameter; temperature, oxygen and depth were all significant. This is probably a reflection of reality, as species are affected by temperature, oxygen and salinity levels and depth simultaneously (Gray, 2002). Ordinations obtained in the current study were utilized to obtain a better understanding of the distribution range of the identified brachyuran species. Information about the specific

distribution patterns for each species is listed in the brachyuran fauna section of the results.

Distribution of Brachyura (and Crustacea) is affected by many factors, not just environmental parameters. Pollution, for instance oil spills (Nwilo and Badejo, 2006), habitat alterations and degradations (d'Udekem d'Acoz, 1999), and genetic effects of selective harvest (Jamieson, 2000) are some of the anthropogenic disturbances brachyurans and other marine organisms are subjected to. These problems, however, were not within the scope of this study.

5.2.5. BAR-CODING

No close matches were found for *Calappa pelli* or *Pseudomyra mbizi* in nucleotide searches performed in either BOLD or BLAST gene databases. The match obtained for *Macropodia gilsoni* in the BOLD database however, was quite remarkable. A 99.9% match was found between *M. gilsoni* and *Macropodia longipes*. Instinctively, such a result triggers questions about the relatedness of the two species. Are *M. gilsoni* and *M. longipes* in fact one species? Could *M. longipes* have been misidentified? Or could it be that diversity in the amino acid sequences coded by the 5' section of the COI gene (Hebert et al., 2003b) was insufficient to distinguish between these two species? The depth range of *M. gilsoni* recorded in the current study, is deeper than the depth range for *M. gilsoni* recorded in the literature. Actually, the depth range recorded in this thesis corresponds more to the range of *M. longipes* (Manning and Holthuis, 1981). However, the morphology of the two species differ in that *M. gilsoni* has dorsal spines on the orbital margin, whereas *M. longipes* lack these (Manning and Holthuis, 1981). Due to the differences in morphology the specimens collected in the Nansen samples were kept as *M. gilsoni*. It is important to note that BOLD and BLAST arrange their "closest match" lists based on the number of different base pairs between sequences, i.e. they look at percent divergence, but do not say anything about where these differences occur in the sequence (pers. comm. Willassen 2008).

The BOLD and BLAST gene databases contain a collection of gene sequences. They represent a start to the vision of a fully developed DNA identification system (Hebert et al., 2003a). It is possible to publish, store, search and compare sequences within these databases (Ratnasingham and Hebert, 2007). Nucleotide searches performed with the sequences obtained in the current study resulted in different results in the two databases. The most probable reason for this is that the databases contain different sequence collections (Ratnasingham and Hebert, 2007). In addition, the two databases arrange their searches differently. While the BLAST database will give a result for every search (Altschul et al., 1990), the BOLD database only gives results of a certain similarity to the sequence it is compared to (Ratnasingham and Hebert, 2007).

The sampling protocol used in the collection of the Nansen samples was organised to ensure the possibility of future DNA analysis (Appendix VII). The current study has shown that such analyses are possible for the brachyuran specimens. Molecular barcoding will be the natural next step for further studies of this material.

5.3. CONCLUDING REMARKS

The main objective of the GCLME project is to obtain knowledge of their marine resources so sustainable management of these resources is possible. The current study provides an informative baseline study on the assemblages of crustaceans on the continental shelves of Nigeria, Cameroon and Gabon. The highest abundance of crustacean specimens were encountered in the Gabon samples, while abundance was lowest in grab samples from Nigeria. Specimens of infraorder Brachyura was most frequently encountered in grab samples off the coast of Cameroon. The importance of Brachyura is demonstrated by the great species diversity identified in the grab and trawl samples. Of the 291 brachyuran specimens examined, 45 species were identified. Brachyurans are one of the main components of benthic communities due to size, energy contribution and often predatory behaviour. Many brachyuran species are also an important fishery resource. Protection of the brachyuran fauna is therefore important for both environmental and economical sustainability in the Gulf of Guinea. The information

on species distribution and abundance gained in this study should be taken into account when the development of new oil installations and other industries are considered within the region. Further studies to map species distribution against environmental parameters, are needed to explore habitat preferences so that important nursery and/or assembly grounds can be protected, ideally as marine sanctuaries. Variation in spatial and temporal species distribution and abundance could be expected due to differences in sampling methods between studies. The study which was most similar to the current, the Pillsbury expedition, shared a 50% similarity in terms of species identified. The discrepancies between the previous and current studies in the region highlight the importance of species description. The current study has indicated that molecular level technologies could be useful for defining species, and therefore it would be natural to include sequencing and barcoding in this process.

6. REFERENCES

ADOBE (2007) Adobe Photoshop CS3 Extended Version 10.0. San Jose, CA, Adobe Systems Incorporated.

AHYONG, S. T., LAI, J. C. Y., SHARKEY, D., COLGAN, D. J. & NG, P. K. L. (2007) Phylogenetics of the brachyuran crabs (Crustacea: Decapoda): The status of Podotremata based on small subunit nuclear ribosomal RNA. *Molecular Phylogenetics and Evolution*, 45, 576-586.

ALONGI, D. M. & CHRISTOFFERSEN, P. (1992) Benthic infauna and organism-sediment relations in a shallow, tropical, coastal area: influence of outwelled mangrove detritus and physical disturbance. *Marine Ecology Progress Series*, 81, 229-245.

ALTSCHUL, S. F., GISH, W., MILLER, W., MYERS, E. W. & LIPMAN, D. J. (1990) Basic local alignment search tool. *Journal of Molecular Biology*, 215, 403-410.

AMBROSE, W. G. J. (1984) Role of predatory infauna in structuring marine soft-bottom communities. *Marine Ecology Progress Series,* 17, 109-115.

ARTÜZ, M. L. (2007) First record of Medorippe lanata (Linnaeus, 1767) in Sea of Marmara. *Zoonatantia*, 71, 64-65.

BERTINI, G., FRANSOZO, A. & DE MELO, G. A. S. (2004) Biodiversity of brachyuran crabs (Crustacea:Decapoda) from non-consolidated sublittoral bottom on the northern coast of Saõ Paulo State,Brazil. *Biodiversity and Conservation*, 13, 2185-2207.

BIANCHI, G. (1992) Study of the demersal assemblages of the continental shelf and upper slope off Congo and Gabon, based on the trawl surveys of the RV "Dr Fridtjof Nansen". *Marine Ecology Progress Series*, 85, 9-23.

BINET, D., GOBERT, B. & MALOUEKI, L. (2001) El Niño-like warm events in the Eastern Atlantic (6˚N, 20˚S) and fish availability from Congo to Angola (1964-1999). *Aquatic Living Resources*, 14, 99-113.

BRANDT, A. (2004) Abundance, diversity, and community patterns of Isopoda (Crustacea) in the Weddell Sea and in the Bransfield Strait, Southern Ocean. *Antarctic Science*, 16, 5-10.

BRUUN, A. F. (1950) *Atlantide-report No. 1. Scientific Results of the Danish Expedition to the Coasts of Tropical West Africa 1946-1946*, Copenhagen, Bianco Lunos Bogtrykkeri.

CAPART, A. (1951) *Expédition océanographique Belge dans les Eaux Côtières Africaines de l'Antique Sud (1948-1949)*, Bruxelles, Institut Royal des Sciences Naturelles de Belgique.

CHAVAN, V. S., INGOLE, B. S., REDDY, R., CHANDRAMOHAN, D., CHHAPGAR, B. F., KAVLEKAR, D. & KULKARNI, V. (1998) *CDROM on Marine Crabs of India [NIO's Database on Marine Life of India (NIODMLI)] [CDROM] Module 2, ver. 1.0.*, Bioinformatics Center, National Institute of Oceanography, Dona Paula, Goa, India.

CHOU, L. M., YU, J. Y. & LOH, T. L. (2004) Impacts of sedimentation on soft-bottom benthic communities in the southern islands of Singapore. *Hydrobiologica*, 515, 91-106.

CHRISTIANSEN, M. E. (1969) *Crustacea Decapoda Brachyura*, Oslo, Universitetsforlaget.

CIA (2008) The world factbook: Gabon. https://www.cia.gov/library/publications/the-world-factbook/geos/gb.html Accessed 19.11.2008.

COSTA, F. O., DEWAARD, J. R., BOUTILLIER, J., RATNASINGHAM, S., DOOH, R. T., HAJIBABAEI, M. & HEBERT, P. D. N. (2007) Biological identifications through DNA barcodes: the case of the Crustacea. *Canadian Journal of Fisheries and Aquatic Sciences*, 64, 272-295.

D'UDEKEM D'ACOZ, C. (1999) Inventaire et distribution des crustacés décapodes de l'Antique nord-oriental, de la Méditerranée et des eux continentales adjacentes au nord de 25˚N. IN MAURIN, H. *Patrimoines Naturels*. Paris, Le Muséum National d'Histoire Naturelle.

EDC (2003) Oceans and the World Summit on Sustainable Development: A large marine ecosystems strategy for the assessment and management of international coastal waters. Large Marine Ecosystems of the World. Kingston, RI, http://www.edc.uri.edu/lme/intro.htm Accessed 23.07.2007.

ENCKELL, P. H. (1980) *Kräftdjur*, Odense, AiO Tryk as.

FAO (2005a) FAO fact sheet. ftp://ftp.fao.org/fi/stat/summary/summ_05/a-0a.pdf. Accesseed 09.02.2009.

FAO (2005b) Review of the state of world marine fishery resources. *FAO Fisheries Technical Paper*. Rome, Food and Agriculture Organization of the United Nations.

FLOETER, S., FERREIRA, C. E. L., ROCHA, L. A., SOLÉ-CAVA, A., WIRTZ, P., SAMPAIO, C. & GASPARINI, J. L. (2007) The evolution and ecology of a poorly known Atlantic biodiversity hotspot. Brasil, *National Geographic Society*, Grant # 7937-05

FOLMER, O., BLACK, M., HOEH, W., LUTZ, R. & VRIJENHOEK, R. (1994) DNA primers for amplification of mitochondrial cytochrome c oxidase subunit 1 from diverse metazoan invertebrates. *Molecular Marine Biology and Biotechnology*, 3, 294-299.

FOREST, J. & GUINOT, D. (1966) Campagne de la "Calypso" dans le Golfe de Guinée et aux îles Principe, São Tomé et Annabon (1956). 16. Crustacés décapods: brachyoures. *Résultats scientifiques des campagnes de la « Calypso », fasc. 7*. Paris, Annales de l'Institut océanographique de Monaco.

GOLDENSOFTWARE (2002) Surfer version 8.0. *Surface Mapping Systems*. Colorado, Golden Software, Inc.

GRAY, J. S. (1974) Animal-sediment relationships. *Oceanography and Marine Biology: an Annual Review*, 12, 223-261.

GRAY, J. S. (2002) Species richness of marine soft sediments. *Marine Ecology Progress Series*, 244, 285-297.

GUINOT, D. & RICHER DE FORGES, B. (1995) Crustacea Decapoda Brachyura: Revision of the family Homolidae. IN CROSNIER, A. *Mémoires du Muséum National d'Histoire Naturelle: Résultats des Campagnes Musorstom*. Paris.

GYORY, J., BISCHOF, B., MARIANO, A. J. & RYAN, E. H. (2005) The Guinea Current. Ocean Surface Currents. Large Marine Ecosystems 2003. http://oceancurrents.rsmas.miami.edu/atlanic/guinea.html Accessed 12.01.2008.

HALL, T. A. (1999) Bioedit: a user friendly biological sequence alignment editor and analysis programme for Windows 95/98/NT. *Nucleic Acids Symposium Service*, 41, 95-98.

HARDMAN-MOUNTFORD, N. J. & MCGLADE, J. M. (2003) Seasonal and interannual variability of oceanographic processes in the Gulf of Guinea: an investigation using AVHRR sea surface temperature data. *International Journal of Remote Sensing*, 24, 3247-3268.

HEBERT, P. D. N., CYWINSKA, A., BALL, S. L. & DEWAARD, J. R. (2003a) Biological identifications through DNA barcodes. *Proceedings of the Royal Society of London*, 270, 313-321.

HEBERT, P. D. N., RATNASINGHAM, S. & DEWAARD, J. R. (2003b) Barcoding animal life: cytochrome c oxidase subunit 1 divergence among closely related species. *Proceedings of the Royal Society of London*, 270, S96-S99.

HENDRICKX, M. E. & CERVANTES, J. L. (2003) A new species of Loxorhynchus Stimpson (Decapoda, Majoidea, Pisidae) from the Pacific Coast of Mexico. *Crustaceana*, 76, 103-113.

HEWITT, J. E., THRUSH, S. F., LEGENDRE, P., FUNNELL, G. A., ELLIS, J. & MORRISON, M. (2004) Mapping of marine soft-sediment communities: integrated sampling for ecological interpretation. *Ecological Applications*, 14, 1203-1216.

HILL, M. O. & GAUCH, J. H. G. (1980) Detrended correspondence analysis: an improved ordination technique. *Vegetatio*, 42, 47-58.

HOLME, N. A. & MCINTYRE, A. D. (1984) Efficiency of benthos sampling gear. *Methods for the study of marine benthos*. 2nd ed. Oxford, Blackwell Scientific Publications.

HULTGREN, K. M. & STACHOWICZ, J. J. (2008) Molecular phylogeny of the brachyuran crab superfamily Majoidea indicates close congruence with trees based on larval morphology. *Molecular Phylogenetics and Evolution*, 48, 986-996.

IGCC (2005) Report of the experts' workshop on plankton and benthic fauna analysis. *Guinea Current Large Marine Ecosystem Project*. Accra, Ghana, Interim Guinea Current Commission.

ISEBOR, C. E. (2004) Marine biodiversity in Nigeria - the known and the unknown. National Report. Lagos, Nigerian Insitute for Oceanography and Marine Research, 46-63. http://hdl.handle.net/1834/359 Accessed 15.10.2008.

JAMIESON, G. S. (2000) Selective effects of fishing on the population dynamics of crustaceans. IN VON VAUPEL KLEIN, J. C. & SCHRAM, F. R. *The Biodiversity Crisis and Crustacea: Proceedings of the Fourth International Crustacean Congress, Amsterdam, Netherlands, 20-24 July 1998*. United Kingdom, CRC Press.

JAYARAJ, K. A., JOSIA, J. & KUMAR, D. P. K. (2008) Infaunal macrobenthic community of soft bottom sediment in a tropical shelf. *Journal of Coastal Research*, 24, 708-718.

JØRGENSEN, B. B. (1980) Seasonal oxygen depletion in the bottom waters of a Danish fjord and its effect on the benthic community. *Oikos*, 34, 68-76.

KORANTENG, K. A. (2001) Diversity and stability of demersal species assemblages in the Gulf of Guinea. *West African Journal of Applied Ecology*, 2, 49-63.

KRAKSTAD, J.-O., ALVHEIM, O. & OLSEN, M. (2006a) Surveys of the fish resources of the eastern Gulf of Guinea: Nigeria, Cameroon, São Tomé and Principe, Gabon and Congo. Survey of the pelagic and demersal resources 4 June-15 July 2005. *Cruise reports "Dr. Fridtjof Nansen"*. Bergen, Institute of Marine Research.

KRAKSTAD, J.-O., ALVHEIM, O. & ZAERA, D. (2008) Surveys of the fish resources of the Gulf of Guinea: Côte d'Ivoire, Ghana, Benin, Togo, Cameroon, São Tomé and Principe, Gabon and Congo. Survey of the pelagic and demersal resources 3 June - 6 July 2007. *Cruise reports "Dr. Fridtjof Nansen"*. Bergen, Institute of Marine Research.

KRAKSTAD, J.-O., ISEBOR, C. E. & ALVHEIM, O. (2006b) Surveys of the fish resources of the eastern Gulf of Guinea: Nigeria, Cameroon, São Tomé and Principe, Gabon and Congo. Survey of the pelagic and demersal resources 9 June-20 July 2006. *Cruise reports "Dr. Fridtjof Nansen"*. Bergen, Institute of Marine Research.

LE LÆUFF, P. & VON COSEL, R. (1998) Biodiversity patterns of the marine benthic fauna on the Atlantic coast of tropical Africa in relation to hydroclimatic conditions and paleogeographic events. Acta *Oecologica*, 19, 309-321.

LENIHAN, H. S. & MICHELI, F. (2001) Soft-sediment communities. IN BERTNESS, M. D., GAINES, S. D. & HAY, M. E. *Marine community ecology*. Sunderland, MA, Sinauer Associates, Inc.

LIE, U. & PAMATMAT, M. M. (1965) Digging characteristics and sampling efficiency of the 0.1 m² Van Veen grab. *Limnology and Oceanography*, 10, 379-384.

MACPHERSON, E. (1991) Biogeography and community structure of the decapod crustacean fauna off Namibia (Southeast Atlantic). *Journal of Crustacean Biology*, 11, 401-415.

MANNING, R. B. (1960) A useful method for collecting Crustacea. *Crustaceana*, 1, 372-373.

MANNING, R. B. & HOLTHUIS, L. B. (1981) *West African Brachyuran Crabs (Crustacea: Decapoda)*, Washington, Smithsonian Institution Press.

MARCOVECCHIO, J. E. (1994) Trace metal residues in tissues of two Crustacean species from the Bahia Blanca Estuary, Argentina. *Environmental Monitoring and Assessment*, 29, 65-73.

MARTENS, E. E. (1992) Causes of biodiversity loss in coastal ecosystems. IN BENNUN, L. A., AMAN, R. A. & CRAFTER, S. A. *Conservation of biodiversity in Africa: local initiatives and institutional roles. Proceedings of the conference held at the national museums of Kenya 30. August-3. September, 1992*. Nairobi, Centre for biodiversity, National Museums of Kenya.

MARTIN, J. W. & DAVIS, G. E. (2001) *An updated classification of the recent Crustacea*. Science Series. Los Angeles, USA, Natural History Museum of Los Angeles County

MARTIN, J. W. & DAVIS, G. E. (2006) Historical trends in crustacean systematics. *Crustaceana*, 79, 1347-1368.

MCLAUGHLIN, P. A., TAYLOR, G. T. & TRACEY, M. L. (1982) Systematic methods in research. IN ABELE, L. G. *The biology of Crustacea: Systematics, the fossil record and biogeorgraphy*. New York, Academic Press Inc.

MEYERS, J. B., ROSENDAHL, B. R., HARRISON, C. G. A. & DING, Z. D. (1998) Deep-imaging seismic and gravity results from the offshore Cameroon Volcanic LIne, and speculation of African hotlines. *Tectonophysics*, 284, 31-63.

MICROSOFT (2003) Microsoft Office Excel 2003. *Microsoft Office Standard Edition 2003*. USA, Microsoft Corporation.

MONOD, T. (1956) *Hippidea et Brachyura: ouest-africains*, Dakar, Ifan.

MORRISEY, D. J., HOWITT, L., UNDERWOOD, A. J. & STARK, J. S. (1992) Spatial variation in soft-sediment benthos. *Marine Ecology Progress Series*, 81, 197-204.

NG, P. K. L., GUINOT, D. & DAVIE, P. J. F. (2008) Systema Brachyurorum: Part 1. An annotated checklist of extant brachyuran crabs of the world. The Raffles Bulletin of Zoology, 17, 1-286.

NORAD (2008) Økologisk nysatsing for "Dr. Fridtjof Nansen". Oslo, http://www.norad.no/default.asp?MARK_SEARCH=YES&SEARCH_ID=s1&V_ITEM_ID=6755 Accessed 12.02.2009.

NWILO, P. C. & BADEJO, O. T. (2006) Impacts and management of oil spill pollution along the Nigerian coastal areas. *Administering Marine Spaces: International Issues*, 36. Copenhagen, The International Federation of Surveyors (FIG).

OLSGARD, F., SCHAANNING, M. T., WIDDICOMBE, S., KENDALL, M. A. & AUSTEN, M. C. (2008) Effects of bottom trawling on ecosystem functioning. *Journal of Experimental Marine Biology and Ecology*, 366, 123-133.

PALLAORO, A. & DULČIĆ, J. (2004) On the occurence of the spider crab Maja goltziana (Crustacea: Majidae) an alien species in the Adriatic Sea. *Journal of the Marine Biological Association of the United Kingdom*, 84, 1007-1008.

PHILANDER, S. G. H. (1979) Upwelling in the Gulf of Guinea. *Journal of Marine Research*, 37, 23-33.

PORTER, M. L., PÉREZ-LOSADA, M. & CRANDALL, K. A. (2005) Model-based multi-locus estimation of decapod phylogeny and divergence times. *Molecular Phylogenetics and Evolution*, 37, 355-369.

QIAGEN (2003) DNeasy Blood and Tissue Kit. *QIAGEN Sample and Assay Technologies*. Germany.

RATHBUN, M. J. (1921) The brachyuran crabs collected by the American Congo expedition, 1909-1915. *Bulletin of the American Museum of Natural History*, 43, 379-466.

RATNASINGHAM, S. & HEBERT, P. D. N. (2007) BOLD: The Barcode of Life Data System. *Molecular Ecology Notes*, 7, 355-364.

RHOADS, D. C. (1974) Organism-sediment relations on the muddy sea floor. *Oceanography and Marine Biology: an Annual Review*, 12, 263-300.

SCHANDER, C. & HALANYCH, K. M. (2003) DNA, PCR and formalinized animal tissue - a short review and protocols. *Organisms, Diversity and Evolution*, 3, 195-205.

SCHANDER, C. & WILLASSEN, E. (2005) What can biological barcoding do for marine biology? *Marine Biology Research*, 1, 79-83.

SCHEREN, P. A., IBE, A. C., JANSSEN, F. J. & LEMMENS, A. M. (2002) Environmental pollution in the Gulf of Guinea - a regional approach. *Marine Pollution Bulletin*, 44, 633-641.

SCHNEIDER, W. (1990) *Field guide to the commercial marine resources of the Gulf of Guinea*, Rome, Food and Agriculture Organization of the United Nations.

TAUPIN, J.-D., COUDRAIN-RIBSTEIN, A., GALLAIRE, R., ZUPPI, G. M. & FILLY, A. (2000) Rainfall characteristics ($\delta 18O$, δ^2H, ΔT and ΔHr) in western Africa: Regional scale and influence of irrigated areas. *Journal of Geophysical Research*, 105, 911-924.

TER BRAAK, C. J. F. & SMILAUER, P. (2002) Canoco Reference manual and CanoDraw for Windows User's guide: *Software for Canonical Community Ordination (version 4.5)*, Ithaca, NY, USA, Microcomputer Power.

UGLAND, K. I., GRAY, J. S. & ELLINGSEN, K. E. (2003) The species-accumulation curve and estimation of species richness. *Journal of Animal Ecology*, 72, 888-897.

UKWE, C. N., IBE, C. A., ALO, B. I. & YUMKELLA, K. K. (2003) Achieving a paradigm shift in the Gulf of Guinea: the large marine ecosystem approach. *Marine Pollution Bulletin*, 47, 219-225.

UKWE, C. N., K.., IBE, A. C. & SHERMAN (2006) A sixteen-country mobilization for sustainable fisheries in the Guinea Current Large Marine Ecosystem. *Ocean and Coastal Management*, 49, 385-412.

WILSON, H. W. (1991) Competition and predation in marine soft sediment communities. *Annual Review of Ecology and Systematics*, 21, 221-241.

WINSTON, J. E. (1999) *Describing species: practical taxonomic procedure for biologists*, Columbia, Columbia University Press.

APPENDIX I

Sediment analyses by Mr. Akanbi Bambikole Williams, Principal Research Officer, Marine Biology Section, Nigerian Institute for Oceanography and Marine Research.

Country	Station	Texture	Colour	Shell Present	Coarse Sand (>500)	Medium Sand (>250)	Fine Sand (>63)	Silt+Clay (<63)	TOM (%)
Nigeria	N1	Muddy	Dark Grey	No	24,3	26,5	31,7	17,5	11,6
	N2	Muddy	Dark Grey	No	19,8	18,1	45,1	17,0	10,9
	N3	Muddy	Dark Grey	No	24,3	12,6	31,1	32,0	8,4
	N5	Muddy	Dark Grey	No	13,1	22,4	48,8	15,7	2,7
	N8	Muddy	Dark Grey	No	17,8	23,4	25,5	33,3	6,2
	N9	Muddy	Dark Grey	Yes	14,9	15,6	36,9	32,6	9,6
	N11	Muddy	Dark Grey	Yes	11,1	19,1	40,3	29,5	9,8
	N12	Muddy	Dark Grey	No	16,0	17,5	33,4	33,1	12,1
	N13	Muddy	Dark Grey	No	4,9	13,4	49,0	32,7	7,2
	N15	Muddy	Dark Grey	No	27,1	20,5	34,0	18,4	5,4
	N16	Muddy	Dark Grey	No	10,2	25,5	31,4	32,9	10,6
Cameroon	C1	Muddy	Dark Grey	No	27,3	21,1	29,4	22,2	5,6
	C2	Muddy	Dark Grey	No	25,7	20,8	32,2	21,3	3,2
	C3	Muddy	Dark Grey	No	19,4	20,8	34,5	25,3	14,6
	C4	Muddy	Dark Grey	No	11,4	13,4	44,8	30,4	2,4
	C5	Muddy	Dark Grey	No	16,9	12,7	44,8	25,6	12,1
	C6	Muddy	Dark Grey	Yes	14,4	22,4	43,5	19,7	13,0
	C7	Muddy	Dark Grey	No	10,5	31,5	33,9	24,1	5,5
	C8	Muddy	Dark Grey	No	18,8	19,5	38,8	22,9	2,5
	C9	Muddy	Dark Grey	No	9,0	13,6	42,7	34,7	13,2
	C11	Muddy	Dark Grey	No	13,2	23,4	43,9	19,5	14,6
	C12	Muddy	Dark Grey	No	10,2	19,4	40,9	29,5	16,1
	C13	Muddy	Dark Grey	No	23,9	14,1	30,2	31,8	9,9
	C14	Sandy	Light Brown	Yes	4,1	14,5	73,2	8,2	5,5
	C15	Muddy	Dark Grey	No	21,2	20,7	38,4	19,7	3,5
	C17	Sandy	Light Brown	Yes	15,1	23,2	56,4	5,3	7,2
	C18	Muddy	Dark Grey	No	16,4	20,8	27,9	34,9	5,1

APPENDIX II

An overview of each sorted grab sample and the crustacean groups they contained. The grab samples were collected in 2005 on board R/V Dr. Fridtjof Nansen with a Van Veen grab.

Country	Station	Date	Mesh size	Fixation	Group	Number of specimens
Nigeria	1B	05.06.2005	0.5/1.0mm	75% ETOH	Brachyura	4
Nigeria	2C	06.06.2005	0.5mm	96% ETOH	Fragments	5
Nigeria	2C	06.06.2005	0.5mm	96% ETOH	Natantia	1
Nigeria	2C	06.06.2005	0.5mm	96% ETOH	Amphipoda	4
Nigeria	2C	06.06.2005	0.5mm	96% ETOH	Brachyura	1
Nigeria	2C	06.06.2005	0.5mm	96% ETOH	Tanaidacea	3
Nigeria	2D	06.06.2005	0.5/1.0mm	75% ETOH	Fragments	2
Nigeria	2D	06.06.2005	0.5/1.0mm	75% ETOH	Brachyura	4
Nigeria	2D	06.06.2005	0.5/1.0mm	75% ETOH	Cumacea	2
Nigeria	2D	06.06.2005	0.5/1.0mm	75% ETOH	Natantia	2
Nigeria	2D	06.06.2005	0.5/1.0mm	75% ETOH	Amphipoda	13
Nigeria	2D	06.06.2005	0.5/1.0mm	75% ETOH	Isopoda	2
Nigeria	3B	07.06.2005	0.5mm	96% ETOH	Crustacea	1
Nigeria	3B	07.06.2005	0.5mm	96% ETOH	Brachyura	1
Nigeria	3B	07.06.2005	0.5mm	96% ETOH	Amphipoda	9
Nigeria	3B	07.06.2005	0.5mm	96% ETOH	Isopoda	2
Nigeria	3B	07.06.2005	0.5mm	96% ETOH	Natantia	1
Nigeria	5B	08.06.2005	0.5mm	96% ETOH	Mysidacea	1
Nigeria	5B	08.06.2005	0.5mm	96% ETOH	Amphipoda	18
Nigeria	5B	08.06.2005	0.5mm	96% ETOH	Natantia	3
Nigeria	8D	10.06.2005	0.5mm	96% ETOH	Fragments	8
Nigeria	8D	10.06.2005	0.5mm	96% ETOH	Natantia	5
Nigeria	8D	10.06.2005	0.5mm	96% ETOH	Tanaidacea	1
Nigeria	8D	10.06.2005	0.5mm	96% ETOH	Amphipoda	3
Nigeria	9C	10.06.2005	0.5/1.0mm	75% ETOH	Fragments	9
Nigeria	9C	10.06.2005	0.5/1.0mm	75% ETOH	Cumacea	2
Nigeria	9C	10.06.2005	0.5/1.0mm	75% ETOH	Amphipoda	17
Nigeria	9C	10.06.2005	0.5/1.0mm	75% ETOH	Tanaidacea	5
Nigeria	9D	10.06.2005	0.5/1.0mm	96% ETOH	Fragments	3
Nigeria	9D	10.06.2005	0.5/1.0mm	96% ETOH	Amphipoda	11
Nigeria	9D	10.06.2005	0.5/1.0mm	96% ETOH	Tanaidacea	12
Nigeria	9D	10.06.2005	0.5/1.0mm	96% ETOH	Cumacea	5
Nigeria	9D	10.06.2005	0.5/1.0mm	96% ETOH	Brachyura	4
Nigeria	9D	10.06.2005	0.5/1.0mm	96% ETOH	Isopoda	2
Nigeria	9D	10.06.2005	0.5/1.0mm	96% ETOH	Anomura	1
Nigeria	11B	12.06.2005	0.5mm	96% ETOH	Ostracoda	3
Nigeria	11B	12.06.2005	0.5mm	96% ETOH	Anumura	1
Nigeria	11B	12.06.2005	0.5mm	96% ETOH	Amphipoda	24
Nigeria	11B	12.06.2005	0.5mm	96% ETOH	Brachyura	7
Nigeria	11B	12.06.2005	0.5mm	96% ETOH	Fragments	26

Nigeria	11B	12.06.2005	0.5mm	96% ETOH	Natantia	4
Nigeria	11B	12.06.2005	0.5mm	96% ETOH	Reptantia	9
Nigeria	11B	12.06.2005	0.5mm	96% ETOH	Callianassidae	14
Nigeria	12B	13.06.2005	0.5mm	96% ETOH	Natantia	2
Nigeria	12D	13.06.2005	0.5mm	75% ETOH	Brachyura	1
Nigeria	12D	13.06.2005	0.5mm	75% ETOH	Fragments	16
Nigeria	12D	13.06.2005	0.5mm	75% ETOH	Anomura	5
Nigeria	12D	13.06.2005	0.5mm	75% ETOH	Cumacea	30
Nigeria	12D	13.06.2005	0.5mm	75% ETOH	Amphipoda	31
Nigeria	12D	13.06.2005	0.5mm	75% ETOH	Natantia	19
Nigeria	12D	13.06.2005	0.5mm	75% ETOH	Ostracoda	13
Nigeria	13C	14.06.2005	0.5mm	75% ETOH	Isopoda	2
Nigeria	13C	14.06.2005	0.5mm	75% ETOH	Fragments	14
Nigeria	13C	14.06.2005	0.5mm	75% ETOH	Amphipoda	5
Nigeria	13C	14.06.2005	0.5mm	75% ETOH	Cumacea	3
Nigeria	13C	14.06.2005	0.5mm	75% ETOH	Natantia	5
Nigeria	13C	14.06.2005	0.5mm	75% ETOH	Tanaidacea	3
Nigeria	13C	14.06.2005	0.5mm	75% ETOH	Brachyura	8
Nigeria	15C	20.06.2005	0.5mm	75% ETOH	Cumacea	3
Nigeria	15C	20.06.2005	0.5mm	75% ETOH	Amphipoda	13
Nigeria	15C	20.06.2005	0.5mm	75% ETOH	Brachyura	4
Nigeria	15C	20.06.2005	0.5mm	75% ETOH	Ostracoda	2
Nigeria	15C	20.06.2005	0.5mm	75% ETOH	Natantia	4
Nigeria	15C	20.06.2005	0.5mm	75% ETOH	Isopoda	3
Nigeria	15D	20.06.2005	0.5mm	96% ETOH	Fragments	7
Nigeria	15D	20.06.2005	0.5mm	96% ETOH	Amphipoda	4
Nigeria	15D	20.06.2005	0.5mm	96% ETOH	Cumacea	1
Nigeria	15D	20.06.2005	0.5mm	96% ETOH	Brachyura	2
Nigeria	15D	20.06.2005	0.5mm	96% ETOH	Natantia	4
Nigeria	15D	20.06.2005	0.5mm	96% ETOH	Anomura	1
Nigeria	16B	20.06.2005	0.5mm	96% ETOH	Crustacea	10
Nigeria	16B	20.06.2005	0.5mm	96% ETOH	Brachyura	1
Nigeria	16B	20.06.2005	0.5mm	96% ETOH	Amphipoda	3
Nigeria	16B	20.06.2005	0.5mm	96% ETOH	Natantia	3
Cameroon	1B	21.06.2005	0.5mm	75% ETOH	Crustacea	1
Cameroon	1B	21.06.2005	0.5mm	75% ETOH	Natantia	1
Cameroon	1B	21.06.2005	0.5mm	75% ETOH	Amphipoda	7
Cameroon	1B	21.06.2005	0.5mm	75% ETOH	Tanaidacea	1
Cameroon	1C	21.06.2005	1.0mm	75% ETOH	Brachyura	1
Cameroon	2B	21.06.2005	0.5mm	96% ETOH	Amphipoda	7
Cameroon	2B	21.06.2005	0.5mm	96% ETOH	Brachyura	2
Cameroon	2B	21.06.2005	0.5mm	96% ETOH	Natantia	1
Cameroon	2B	21.06.2005	0.5mm	96% ETOH	Tanaidacea	7
Cameroon	2B	21.06.2005	0.5mm	96% ETOH	Isopoda	2
Cameroon	3B	21.06.2005	0.5mm	75% ETOH	Amphipoda	1
Cameroon	4B	21.06.2005	0.5mm	96% ETOH	Fragments	4
Cameroon	4B	21.06.2005	0.5mm	96% ETOH	Cumacea	1
Cameroon	4B	21.06.2005	0.5mm	96% ETOH	Amphipoda	26
Cameroon	4B	21.06.2005	0.5mm	96% ETOH	Natantia	2

Cameroon	4B	21.06.2005	0.5mm	96% ETOH	Tanaidacea	17
Cameroon	4B	21.06.2005	0.5mm	96% ETOH	Brachyura	11
Cameroon	4B	21.06.2005	0.5mm	96% ETOH	Isopoda	2
Cameroon	4B	21.06.2005	0.5mm	96% ETOH	Ostracoda	2
Cameroon	5B	21.06.2005	0.5mm	96% ETOH	Amphipoda	2
Cameroon	6B	21.06.2005	0.5mm	75% ETOH	Natantia	1
Cameroon	6B	21.06.2005	0.5mm	75% ETOH	Brachyura	1
Cameroon	6B	21.06.2005	0.5mm	75% ETOH	Tanaidacea	2
Cameroon	7B	22.06.2005	0.5mm	75% ETOH	Fragments	5
Cameroon	7B	22.06.2005	0.5mm	75% ETOH	Ostracoda	2
Cameroon	7B	22.06.2005	0.5mm	75% ETOH	Amphipoda	21
Cameroon	7B	22.06.2005	0.5mm	75% ETOH	Tanaidacea	99
Cameroon	7B	22.06.2005	0.5mm	75% ETOH	Cumacea	3
Cameroon	7B	22.06.2005	0.5mm	75% ETOH	Brachyura	7
Cameroon	7B	22.06.2005	0.5mm	75% ETOH	Natantia	5
Cameroon	7B	22.06.2005	0.5mm	75% ETOH	Isopoda	11
Cameroon	8B	22.06.2005	0.5mm	96% ETOH	Fragments	1
Cameroon	8B	22.06.2005	0.5mm	96% ETOH	Tanaidacea	3
Cameroon	8B	22.06.2005	0.5mm	96% ETOH	Amphipoda	29
Cameroon	8B	22.06.2005	0.5mm	96% ETOH	Brachyura	7
Cameroon	9B	22.06.2005	0.5mm	75% ETOH	Fragmenter	3
Cameroon	9B	22.06.2005	0.5mm	75% ETOH	Natantia	1
Cameroon	9B	22.06.2005	0.5mm	75% ETOH	Tanaidacea	11
Cameroon	9B	22.06.2005	0.5mm	75% ETOH	Brachyura	1
Cameroon	9B	22.06.2005	0.5mm	75% ETOH	Amphipoda	3
Cameroon	11B	23.06.2005	0.5mm	75% ETOH	Fragments	7
Cameroon	11B	23.06.2005	0.5mm	75% ETOH	Anumura	2
Cameroon	11B	23.06.2005	0.5mm	75% ETOH	Cumacea	5
Cameroon	11B	23.06.2005	0.5mm	75% ETOH	Amphipoda	19
Cameroon	11B	23.06.2005	0.5mm	75% ETOH	Brachyura	4
Cameroon	11B	23.06.2005	0.5mm	75% ETOH	Natantia	3
Cameroon	11B	23.06.2005	0.5mm	75% ETOH	Isopoda	1
Cameroon	12B	23.06.2005	0.5mm	75% ETOH	Fragments	4
Cameroon	12B	23.06.2005	0.5mm	75% ETOH	Isopoda	1
Cameroon	12B	23.06.2005	0.5mm	75% ETOH	Tanaidacea	1
Cameroon	12B	23.06.2005	0.5mm	75% ETOH	Amphipoda	7
Cameroon	13B	24.06.2005	0.5mm	96% ETOH	Anomura	1
Cameroon	13B	24.06.2005	0.5mm	96% ETOH	Cumacea	1
Cameroon	13B	24.06.2005	0.5mm	96% ETOH	Brachyura	3
Cameroon	13B	24.06.2005	0.5mm	96% ETOH	Amphipoda	11
Cameroon	13B	24.06.2005	0.5mm	96% ETOH	Tanaidacea	11
Cameroon	13B	24.06.2005	0.5mm	96% ETOH	Natantia	3
Cameroon	13B	24.06.2005	0.5mm	96% ETOH	Isopoda	1
Cameroon	14B	24.06.2005	0.5mm	96% ETOH	Fragments	4
Cameroon	14B	24.06.2005	0.5mm	96% ETOH	Ostracoda	8
Cameroon	14B	24.06.2005	0.5mm	96% ETOH	Cumacea	2
Cameroon	14B	24.06.2005	0.5mm	96% ETOH	Brachyura	2
Cameroon	14B	24.06.2005	0.5mm	96% ETOH	Amphipoda	12
Cameroon	15B	24.06.2005	0.5mm	75% ETOH	Fragmenter	2

Cameroon	15B	24.06.2005	0.5mm	75% ETOH	Isopoda	2
Cameroon	15B	24.06.2005	0.5mm	75% ETOH	Tanaidacea	27
Cameroon	15B	24.06.2005	0.5mm	75% ETOH	Amphipoda	14
Cameroon	15B	24.06.2005	0.5mm	75% ETOH	Cumacea	1
Cameroon	15B	24.06.2005	0.5mm	75% ETOH	Brachyura	3
Cameroon	17B	24.06.2005	0.5mm	96% ETOH	Fragments	1
Cameroon	17B	24.06.2005	0.5mm	96% ETOH	Amphipoda	5
Cameroon	17B	24.06.2005	0.5mm	96% ETOH	Ostracoda	2
Cameroon	17B	24.06.2005	0.5mm	96% ETOH	Mysidacea	2
Cameroon	17B	24.06.2005	0.5mm	96% ETOH	Tanaidacea	11
Cameroon	17B	24.06.2005	0.5mm	96% ETOH	Natantia	1
Cameroon	17B	24.06.2005	0.5mm	96% ETOH	Anomura	1
Cameroon	18B	25.06.2005	0.5mm	96% ETOH	Fragments	1
Cameroon	18B	25.06.2005	0.5mm	96% ETOH	Ostracoda	1
Cameroon	18B	25.06.2005	0.5mm	96% ETOH	Brachyura	1
Cameroon	18B	25.06.2005	0.5mm	96% ETOH	Amphipoda	12
Cameroon	18B	25.06.2005	0.5mm	96% ETOH	Isopoda	1
Cameroon	18B	25.06.2005	0.5mm	96% ETOH	Tanaidacea	23
Gabon	1B	30.06.2005	0.5mm	75% ETOH	Isopoda	20
Gabon	1B	30.06.2005	0.5mm	75% ETOH	Amphipoda	362
Gabon	1B	30.06.2005	0.5mm	75% ETOH	Ostracoda	23
Gabon	1B	30.06.2005	0.5mm	75% ETOH	Brachyura	14
Gabon	1B	30.06.2005	0.5mm	75% ETOH	Tanaidacea	60
Gabon	1B	30.06.2005	0.5mm	75% ETOH	Euphausiacea	1
Gabon	1B	30.06.2005	0.5mm	75% ETOH	Anomura	1
Gabon	1B	30.06.2005	0.5mm	75% ETOH	Natantia	8
Gabon	1B	30.06.2005	0.5mm	75% ETOH	Cumacea	10
Gabon	1B	30.06.2005	0.5mm	75% ETOH	Fragments	9
Gabon	2B	01.07.2005	0.5mm	75% ETOH	Brachyura	1
Gabon	2B	01.07.2005	0.5mm	75% ETOH	Anomura	1
Gabon	2B	01.07.2005	0.5mm	75% ETOH	Isopoda	27
Gabon	2B	01.07.2005	0.5mm	75% ETOH	Ostracoda	1
Gabon	2B	01.07.2005	0.5mm	75% ETOH	Natantia	17
Gabon	2B	01.07.2005	0.5mm	75% ETOH	Amphipoda	27
Gabon	2B	01.07.2005	0.5mm	75% ETOH	Tanaidacea	64
Gabon	2B	01.07.2005	0.5mm	75% ETOH	Fragments	28
Gabon	2B	01.07.2005	0.5mm	75% ETOH	Cumacea	2
Gabon	3B	01.07.2005	0.5mm	75% ETOH	Fragments	20
Gabon	3B	01.07.2005	0.5mm	75% ETOH	Ostracoda	2
Gabon	3B	01.07.2005	0.5mm	75% ETOH	Amphipoda	38
Gabon	3B	01.07.2005	0.5mm	75% ETOH	Brachyura	6
Gabon	3B	01.07.2005	0.5mm	75% ETOH	Cumacea	10
Gabon	3B	01.07.2005	0.5mm	75% ETOH	Tanaidacea	9
Gabon	3B	01.07.2005	0.5mm	75% ETOH	Isopoda	7
Gabon	3B	01.07.2005	0.5mm	75% ETOH	Natantia	3
Gabon	5B	02.07.2005	0.5mm	96% ETOH	Natantia	1
Gabon	5B	02.07.2005	0.5mm	96% ETOH	Amphipoda	8
Gabon	5B	02.07.2005	0.5mm	96% ETOH	Ostracoda	6
Gabon	5B	02.07.2005	0.5mm	96% ETOH	Brachyura	2

Gabon	5B	02.07.2005	0.5mm	96% ETOH	Tanaidacea	5
Gabon	5B	02.07.2005	0.5mm	96% ETOH	Cumacea	4
Gabon	6B	05.07.2005	0.5mm	96% ETOH	Amphipoda	28
Gabon	6B	05.07.2005	0.5mm	96% ETOH	Isopoda	12
Gabon	6B	05.07.2005	0.5mm	96% ETOH	Ostracoda	9
Gabon	6B	05.07.2005	0.5mm	96% ETOH	Mysidacea	2
Gabon	6B	05.07.2005	0.5mm	96% ETOH	Tanaidacea	1
Gabon	6B	05.07.2005	0.5mm	96% ETOH	Cumacea	8
Gabon	7B	06.07.2005	0.5mm	75% ETOH	Fragments	3
Gabon	7B	06.07.2005	0.5mm	75% ETOH	Tanaidacea	11
Gabon	7B	06.07.2005	0.5mm	75% ETOH	Isopoda	8
Gabon	7B	06.07.2005	0.5mm	75% ETOH	Ostracoda	13
Gabon	7B	06.07.2005	0.5mm	75% ETOH	Natantia	4
Gabon	7B	06.07.2005	0.5mm	75% ETOH	Amphipoda	51
Gabon	7B	06.07.2005	0.5mm	75% ETOH	Anomura	3
Gabon	7B	06.07.2005	0.5mm	75% ETOH	Cumacea	1
Gabon	8B	06.07.2005	0.5mm	96% ETOH	Brachyura	1
Gabon	8B	06.07.2005	0.5mm	96% ETOH	Isopoda	21
Gabon	8B	06.07.2005	0.5mm	96% ETOH	Amphipoda	54
Gabon	8B	06.07.2005	0.5mm	96% ETOH	Ostracoda	9
Gabon	8B	06.07.2005	0.5mm	96% ETOH	Natantia	12
Gabon	8B	06.07.2005	0.5mm	96% ETOH	Tanaidacea	29
Gabon	8B	06.07.2005	0.5mm	96% ETOH	Mysidacea	1
Gabon	8B	06.07.2005	0.5mm	96% ETOH	Fragments	4
Gabon	8B	06.07.2005	0.5mm	96% ETOH	Cumacea	33
Gabon	9B	07.07.2005	0.5mm	96% ETOH	Fragments	3
Gabon	9B	07.07.2005	0.5mm	96% ETOH	Natantia	1
Gabon	9B	07.07.2005	0.5mm	96% ETOH	Brachyura	1
Gabon	9B	07.07.2005	0.5mm	96% ETOH	Isopoda	8
Gabon	9B	07.07.2005	0.5mm	96% ETOH	Amphipoda	324
Gabon	9B	07.07.2005	0.5mm	96% ETOH	Natantia	6
Gabon	9B	07.07.2005	0.5mm	96% ETOH	Ostracoda	7
Gabon	9B	07.07.2005	0.5mm	96% ETOH	Brachyura	1
Gabon	9B	07.07.2005	0.5mm	96% ETOH	Cumacea	10
Gabon	9B	07.07.2005	0.5mm	96% ETOH	Tanaidacea	57
Gabon	9B	07.07.2005	0.5mm	96% ETOH	Lepostraca	2
Gabon	9B	07.07.2005	0.5mm	96% ETOH	Fragments	5
Gabon	9C	07.07.2005	1.0mm	75% ETOH	Brachyura	1
Gabon	10B	07.07.2005	0.5mm	75% ETOH	Natantia	3
Gabon	10B	07.07.2005	0.5mm	75% ETOH	Amphipoda	6
Gabon	10B	07.07.2005	0.5mm	75% ETOH	Fragments	1
Gabon	10B	07.07.2005	0.5mm	75% ETOH	Ostracoda	6
Gabon	10B	07.07.2005	0.5mm	75% ETOH	Tanaidacea	1
Gabon	10B	07.07.2005	0.5mm	75% ETOH	Cumacea	5
Gabon	10B	07.07.2005	0.5mm	75% ETOH	Isopoda	3
Gabon	11B	08.07.2005	0.5mm	96% ETOH	Isopoda	4
Gabon	11B	08.07.2005	0.5mm	96% ETOH	Tanaidacea	7
Gabon	11B	08.07.2005	0.5mm	96% ETOH	Decapoda	2
Gabon	11B	08.07.2005	0.5mm	96% ETOH	Amphipoda	58

Gabon	11B	08.07.2005	0.5mm	96% ETOH	Brachyura	4
Gabon	11B	08.07.2005	0.5mm	96% ETOH	Ostracoda	14
Gabon	11B	08.07.2005	0.5mm	96% ETOH	Fragments	5
Gabon	11B	08.07.2005	0.5mm	96% ETOH	Cumacea	9
Gabon	11B	08.07.2005	0.5mm	75% ETOH	Natantia	1
Gabon	11B	08.07.2005	0.5mm	75% ETOH	Euphausiacea	1
Gabon	11B	08.07.2005	0.5mm	75% ETOH	Amphipoda	25
Gabon	11B	08.07.2005	0.5mm	75% ETOH	Brachyura	2
Gabon	11B	08.07.2005	0.5mm	75% ETOH	Ostracoda	2
Gabon	11B	08.07.2005	0.5mm	75% ETOH	Decapoda	1
Gabon	11B	08.07.2005	0.5mm	75% ETOH	Cumacea	5
Gabon	11B	08.07.2005	0.5mm	75% ETOH	Tanaidacea	4
Gabon	11D	08.07.2005	0.5mm	75% ETOH	Brachyura	2
Gabon	12B	08.07.2005	0.5mm	75% ETOH	Tanaidacea	1
Gabon	12B	08.07.2005	0.5mm	75% ETOH	Ostracoda	4
Gabon	12B	08.07.2005	0.5mm	75% ETOH	Natantia	6
Gabon	12B	08.07.2005	0.5mm	75% ETOH	Brachyura	4
Gabon	12B	08.07.2005	0.5mm	75% ETOH	Amphipoda	9
Gabon	12B	08.07.2005	0.5mm	75% ETOH	Isopoda	1
Gabon	13B	09.07.2005	0.5mm	75% ETOH	Tanaidacea	32
Gabon	13B	09.07.2005	0.5mm	75% ETOH	Cumacea	30
Gabon	13B	09.07.2005	0.5mm	75% ETOH	Ostracoda	19
Gabon	13B	09.07.2005	0.5mm	75% ETOH	Natantia	6
Gabon	13B	09.07.2005	0.5mm	75% ETOH	Amphipoda	373
Gabon	13B	09.07.2005	0.5mm	75% ETOH	Brachyura	1
Gabon	13B	09.07.2005	0.5mm	75% ETOH	Anomura	1
Gabon	13B	09.07.2005	0.5mm	75% ETOH	Fragments	20
Gabon	13B	09.07.2005	0.5mm	75% ETOH	Isopoda	11
Gabon	13B	09.07.2005	0.5mm	75% ETOH	Pycnogonida	1
Gabon	14B	09.07.2005	0.5mm	96% ETOH	Ostracoda	13
Gabon	14B	09.07.2005	0.5mm	96% ETOH	Amphipoda	36
Gabon	14B	09.07.2005	0.5mm	96% ETOH	Cumacea	11
Gabon	14B	09.07.2005	0.5mm	96% ETOH	Isopoda	8
Gabon	14B	09.07.2005	0.5mm	96% ETOH	Tanaidacea	5
Gabon	14B	09.07.2005	0.5mm	96% ETOH	Brachyura	4
Gabon	14B	09.07.2005	0.5mm	96% ETOH	Natantia	1
Gabon	15B	10.07.2005	0.5mm	75% ETOH	Brachyura	2
Gabon	15B	10.07.2005	0.5mm	75% ETOH	Isopoda	10
Gabon	15B	10.07.2005	0.5mm	75% ETOH	Ostracoda	8
Gabon	15B	10.07.2005	0.5mm	75% ETOH	Decapoda	3
Gabon	15B	10.07.2005	0.5mm	75% ETOH	Amphioda	71
Gabon	15B	10.07.2005	0.5mm	75% ETOH	Anomura	2
Gabon	15B	10.07.2005	0.5mm	75% ETOH	Fragments	3
Gabon	15B	10.07.2005	0.5mm	75% ETOH	Cumacea	15
Gabon	16B	11.07.2005	0.5mm	75% ETOH	Mysidacea	5
Gabon	16B	11.07.2005	0.5mm	75% ETOH	Fragments	15
Gabon	16B	11.07.2005	0.5mm	75% ETOH	Isopoda	21
Gabon	16B	11.07.2005	0.5mm	75% ETOH	Brachyura	6
Gabon	16B	11.07.2005	0.5mm	75% ETOH	Amphipoda	114

Gabon	16B	11.07.2005	0.5mm	75% ETOH	Natantia	13
Gabon	16B	11.07.2005	0.5mm	75% ETOH	Ostracoda	25
Gabon	16B	11.07.2005	0.5mm	75% ETOH	Anomura	2
Gabon	16B	11.07.2005	0.5mm	75% ETOH	Cumacea	17
Gabon	16B	11.07.2005	0.5mm	75% ETOH	Tanaidacea	2
Gabon	16B	11.07.2005	0.5mm	75% ETOH	Decapoda	2
Gabon	16B	11.07.2005	0.5mm	75% ETOH	Amphipoda?	10
Gabon	16D	11.07.2005	0.5mm	96% ETOH	Brachyura	4
Total number of specimens						**3674**

APPENDIX III

Table AIII.1 All grab stations containing brachyurids, taxa and number of specimens. All stations are based on 1 sorted replica, except station N2, N9, N12, N15, C1, G9, G11 and G16, which are based on 2 sorted replicas. All stations were taken with a Van Veen grab.

Station N1

Taxa	Specimens
Microcassiope minor	1
Monodaeus rouxi	1
Sum	2

Station N2

Taxa	Specimens
Achaeus monodi	1
Ebalia cranchii	1
Heterocrypta maltzami	1
Monodaeus rouxi	1
Sum	4

Station N3

Taxa	Specimens
Machaerus oxyacantha	1
Sum	1

Station N9

Taxa	Specimens
Ebalia cranchii	1
Herbstia condyliata	1
Heterocrypta maltzami	1
Pseudomyra mbizi	1
Sum	4

Station N11

Taxa	Specimens
Lamdophallus sexpes	5
Philyra laevidorsalis	1
Sum	6

Station N12

Taxa	Specimens
Goneplax rhomboides	1
Sum	1

Station N13

Taxa	Specimens
Goneplax rhomboides	2
Herbstia condyliata	2
Heterocrypta maltzami	1
Microcassiope minor	1
Brachyura	2
Sum	8

Station N15

Taxa	Specimens
Ebalia affinis	1
Ebalia cranchii	1
Ebalia tuberculata	1
Goneplax rhomboides	2
Herbstia condyliata	1
Sum	6

Station N16

Taxa	Specimens
Goneplax rhomboides	1
Sum	1

Station C1

Taxa	Specimens
Raninoides bouvieri	1
Sum	1

Station C2

Taxa	Specimens
Menippe nodifrons	1
Pseudomyra mbizi	1
Sum	2

Station C4

Taxa	Specimens
Goneplax rhomboides	7
Monodaeus rouxi	4
Sum	11

Station C6

Taxa	Specimens
Goneplax rhomboides	1
Sum	1

Station C7

Taxa	Specimens
Goneplax rhomboides	6
Raninoides bouvieri	1
Sum	7

Station C8

Taxa	Specimens
Goneplax rhomboides	1
Lamdophallus sexpes	6
Sum	7

Station C9

Taxa	Specimens
Brachyura	1
Sum	1

Station C11

Taxa	Specimens
Leopoldius pisifer	2
Raninoides bouvieri	2
Sum	4

Station C13

Taxa	Specimens
Menippe nodifrons	2
Brachyura	1
Sum	3

Station C14

Taxa	Specimens
Goneplax rhomboides	1
Pilumnus inermis	1
Sum	2

Station C15

Taxa	Specimens
Brachyura	3
Sum	3

Station C18

Taxa	Specimens
Brachyura	1
Sum	1

Station G1

Taxa	Specimens
Goneplax rhomboides	6
Heterocrypta maltzami	1
Ilia nucleus	1
Brachyura	3
Sum	11

Station G2

Taxa	Specimens
Brachyura	1
Sum	1

Station G3

Taxa	Specimens
Ebalia affinis	1
Ebalia cranchii	2
Herbstia condyliata	1
Parthenope massena	1
Brachyura	1
Sum	6

Station G5

Taxa	Specimens
Herbstia condyliata	1
Ilia spinosa	1
Sum	2

Station G8

Taxa	Specimens
Ebalia cranchii	1
Sum	1

Station G9

Taxa	Specimens
Heterocrypta maltzami	1
Phyllodorippe armata	2
Sum	3

Station G11

Taxa	Specimens
Ebalia cranchii	1
Philyra cristata	1
Raninoides bouvieri	2
Sum	4

Station G12

Taxa	Specimens
Raninoides bouvieri	2
Brachyura	3
Sum	5

Station G13

Taxa	Specimens
Phyllodorippe armata	1
Sum	1

Station G14

Taxa	Specimens
Ebalia affinis	1
Ebalia cranchii	2
Sum	3

Station G15

Taxa	Specimens
Ebalia cranchii	2
Sum	2

Station G16

Taxa	Specimens
Ebalia cranchii	1
Goneplax rhomboides	4
Monodaeus rouxi	2
Raninoides bouvieri	3
Sum	10

Sum grand total	125

Table AIII.2 All trawl stations containing brachyurans.

Station 847

Taxa	Specimens
Ilia spinosa	2
Machaerus oxyacantha	1
Stenorhynchus lanceolatus	2
Sum	3

Station 855

Taxa	Specimens
Mebeli michaelseni	1
Sum	1

Station 856

Taxa	Specimens
Macropipus rugosus	1
Medorippe lanata	4
Sum	5

Station 858

Taxa	Specimens
Acanthocarpus brevispinis	15
Goneplax barnardi	2
Sum	17

Station 865

Taxa	Specimens
Macropipus rugosus	1
Pseudomyra mbizi	1
Sum	2

Station 867

Taxa	Specimens
Acanthocarpus brevispinis	2
Capartiella longipes	1
Goneplax barnardi	1
Macropodia gilsoni	1
Sum	5

Station 868

Taxa	Specimens
Goneplax barnardi	2
Sum	2

Station 870

Taxa	Specimens
Acanthocarpus brevispinus	1
Sum	1

Station 871

Taxa	Specimens
Macropipus rugosus	2
Pseudomyra mbizi	2
Sum	4

Station 876

Taxa	Specimens
Acanthocarpus brevispinis	1
Sum	1

Station 877

Taxa	Specimens
Parthenope massena	1
Pseudomyra mbizi	1
Sum	2

Station 878

Taxa	Specimens
Inachus angolensis	2
Parthenope notialis	1
Pseudomyra mbizi	1
Sum	4

Station 879

Taxa	Specimens
Medorippe lanata	1
Sum	1

Station 880

Taxa	Specimens
Ilia spinosa	3
Medorippe lanata	9
Phyllodorippe armata	1
Sum	13

Station 890

Taxa	Specimens
Macropipus rugosus	6
Stenorhynchus lanceolatus	1
Sum	7

Station 903

Taxa	Specimens
Macropipus rugosus	1
Sum	1

Station 905

Taxa	Specimens
Cronius ruber	1
Phyllodorippe armata	1
Sum	2

Station 922

Taxa	Specimens
Medorippe lanata	1
Stenorhynchus lanceolatus	3
Sum	4

Station 923

Taxa	Specimens
Stenorhynchus lanceolatus	1
Sum	1

Station 938

Taxa	Specimens
Inachus angolensis	1
Macropodia gilsoni	4
Medorippe lanata	2
Pseudomyra mbizi	1
Sum	8

Station 966

Taxa	Specimens
Parthenope notialis	1
Sum	1

Station 970

Taxa	Specimens
Microcassiope minor	1
Sum	1

Station 977

Taxa	Specimens
Calappa pelii	1
Macropipus rugosus	2
Sum	3

Station 983

Taxa	Specimens
Homola barbata	1
Microcassiope minor	1
Pilumnus perrieri	2
Pseudomedaeus africanus	1
Sum	5

Station 986

Taxa	Specimens
Microcassiope minor	4
Pilumnus perrieri	2
Pisa carinimana	1
Sum	7

Station 1231

Taxa	Specimens
Ebalia tuberculata	1
Inachus angolensis	1
Pseudomyra mbizi	1
Sum	3

Station 1298

Taxa	Specimens
Calappa pelii	1
Sum	1

Station 1300

Taxa	Specimens
Pachygrapsus gracilis	1
Sum	1

Station 1332

Taxa	Specimens
Menippe nodifrons	1
Pachygrapsus gracilis	1
Sum	2

Station 1340

Taxa	Specimens
Maja goltziana	1
Stenorhynchus lanceolatus	1
Sum	2

Station 1347

Taxa	Specimens
Homola barbata	1
Microcassiope minor	15
Nanocassiope melanodactylus	2
Sum	18

Station 1353

Taxa	Specimens
Microcassiope minor	3
Pachygrapsus gracilis	1
Sum	4

Station 1360

Taxa	Specimens
Achaeus monodi	2
Homola barbata	1
Pilumnus perrieri	6
Sum	7

Station 246

Taxa	Specimens
Paraceta margaritaria	2
Sum	2

Station 263

Taxa	Specimens
Acathocarpus brevispinis	1
Bathynectes piperitus	1
Sum	2

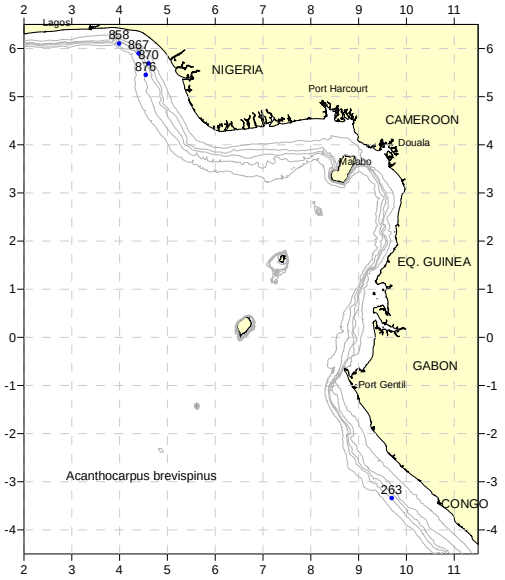
Station 274

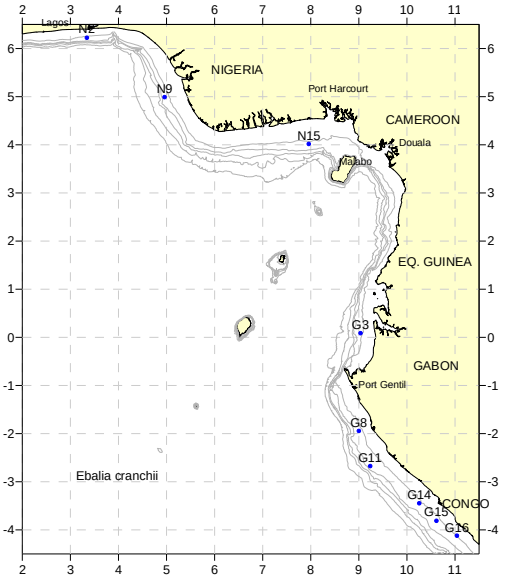
Taxa	Specimens
Calappa pelii	4
Ethusa rosacea	1
Macropipus rugosus	2
Sum	7

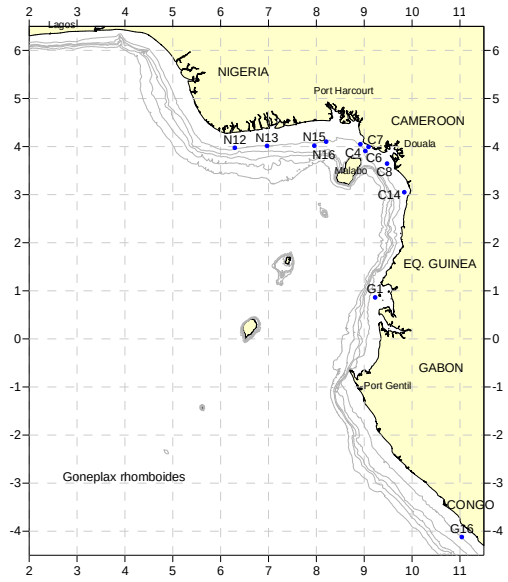
Station 288

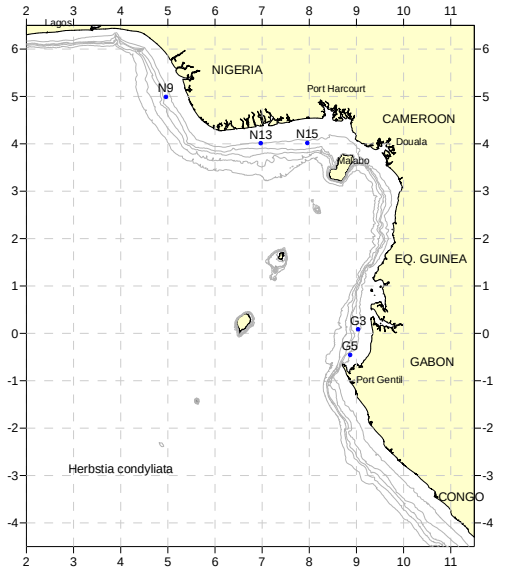
Taxa	Specimens
Epixanthus hellerii	1
Macropodia gilsoni	1
Medorippe lanata	1
Pseudomyra mbizi	9
Sum	12
Grand total	166

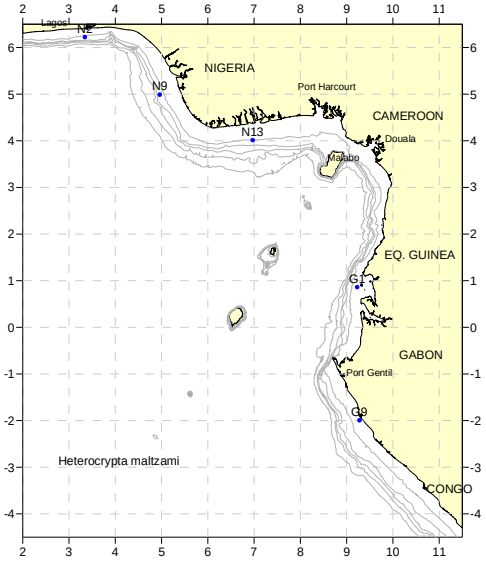
The following figures are distribution maps of the most common Brachyuran taxa (collected at 5 or more stations, both grab and trawl).







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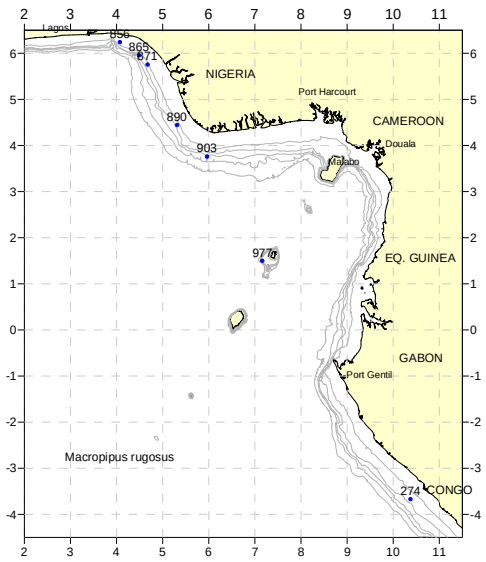
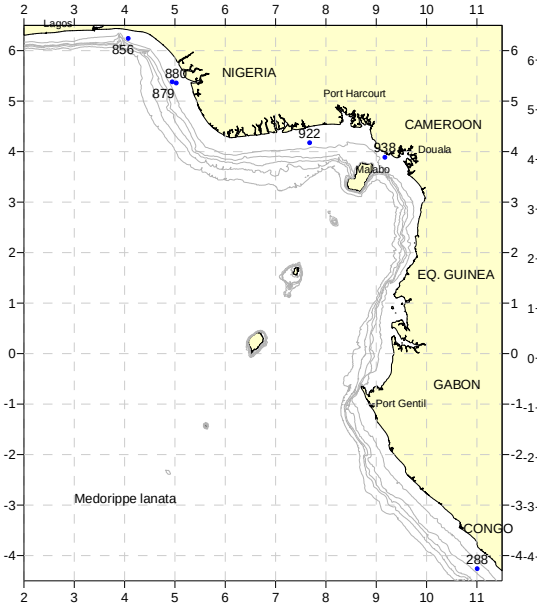
N2
NIGERIA
N9
Port Harcourt
CAMEROON
N13
Douala
Malabo
EQ. GUINEA
G1
GABON
Port Gentil
G9
Heterocrypta maltzami
CONGO


Lagos
856
865
871
NIGERIA
Port Harcourt
890
CAMEROON
903
Douala
Malabo
970
EQ. GUINEA
GABON
Port Gentil
Macropipus rugosus
274
CONGO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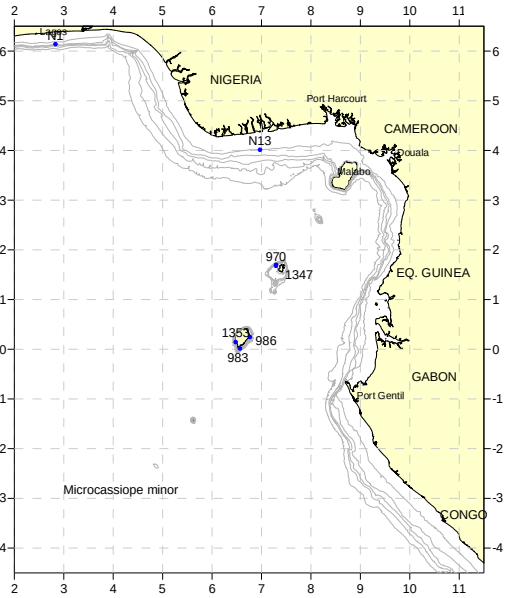
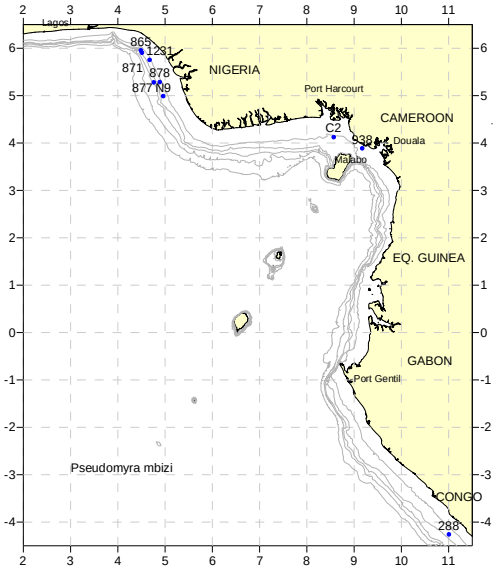
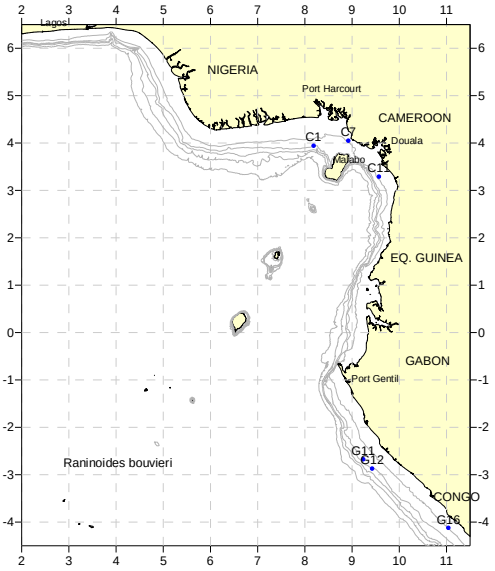
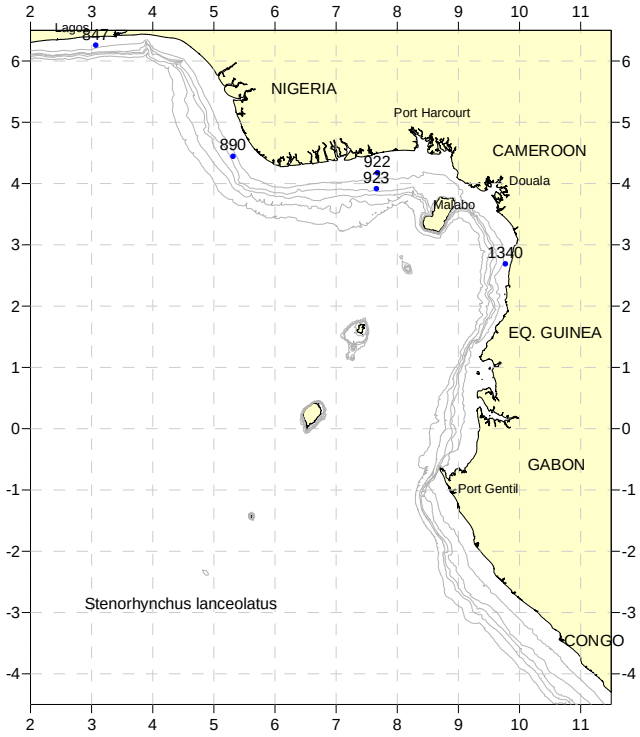
880
879
NIGERIA
Port Harcourt
922
CAMEROON
938
Douala
Malabo
EQ. GUINEA
GABON
Port Gentil
Medorippe lanata
CONGO
288


N1
NIGERIA
Port Harcourt
CAMEROON
N13
Douala
Malabo
970
1347
EQ. GUINEA
1353
986
983
GABON
Port Gentil
Microcassiope minor
CONGO


Lagos
865
1231
871
878
877
N9
NIGERIA
Port Harcourt
CAMEROON
C2
938
Douala
Malabo
EQ. GUINEA
GABON
Port Gentil
Pseudomyra mbizi
CONGO
288


Lagos
NIGERIA
Port Harcourt
CAMEROON
C1
C7
Douala
Malabo
C11
EQ. GUINEA
GABON
Port Gentil
Raninoides bouvieri
G11
C12
CONGO
G16


Lagos
847
NIGERIA
Port Harcourt
890
922
923
CAMEROON
Douala
Malabo
1340
EQ. GUINEA
GABON
Port Gentil
Stenorhynchus lanceolatus
CONGO

APPENDIX IV

Table AIV.1 Brachyuran crabs found during the Atlantide Expedition 1945-1946, and which are currently located at the Zoological Museum in Copenhagen. Information regarding sampling station, country, species, sampling gear, bottom type, depth and bottom temperature are given. Species data was collected on a study trip to the Zoological Museum in Copenhagen. Environmental and samling data are obtained from Bruun (1950).

Station	Country	Species	Gear	Bottom type	Depth (m)	Bottom tem. ˚C
44	French Guinea	Ilia nucleus	VG	Sand, shells	41	—
45	French Guinea	Parthenope massena	ST	Sand	34	27,1
47	Sierra Leone	Metapograpsus sp.	H	Sand, rocks	Tidal zone	—
47	Sierra Leone	Pachygrapsus sp.	H	Sand, rocks	Tidal zone	—
49	Sierra Leone	Ethusa rugulosa	VG	Muddy sand	74-79	16,5
49	Sierra Leone	Medorippe lanata	VG	Muddy sand	74-79	16,5
60	Liberia	Ebalia sp.	ST	Sand, mud	78	—
85	Gold Coast	Homola barbata	ST	Greyish mud	50	—
85	Gold Coast	Machaerus oxycantha	ST	Greyish mud	50	—
90	Gold Coast	Meheli michaelsen	OT	—	30	—
93	Nigeria	Goniopsis pelii	H	Swamp, stone	Tidal zone	—
93	Nigeria	Sesarma elegans	H	Swamp, stone	Tidal zone	—
93	Nigeria	Sesarma hujardi	H	Swamp, stone	Tidal zone	—
102	Nigeria	Phyllodorippe armata	DT	—	29	—
118	Cameroon	Sesarma angolense	H	—	Tidal zone	—
120	Spanish Guinea	Carcinoplax barnardi	ST	Mud	530-850	—
120	Spanish Guinea	Inachus sp.	ST	Mud	530-850	—
120	Spanish Guinea	Pseudomyra mbizi	ST	Mud	530-850	—
123	French Equ. Guinea	Parthenope sp.	DT	Mud	50	—
135	Angola	Bathynectes piperitus	ST	Mud	440-360	—
135	Angola	Ethusa rosacea	ST	Mud	440-360	—
137	Angola	Callinectes amnicola	H	Stone	Tidal zone	—
141	Sierra Leone	Dromia marmorea	CT	—	15	—
145	French Guinea	Ilia spinosa	ST	—	32	—
145	French Guinea	Portunus inaequalis	ST	—	32	—
146	French Guinea	Ethusa vossi	ST	—	51	—
147	French Guinea	Cronius ruber	ST	—	45	—
147	French Guinea	Pilumnus sp.	ST	—	45	—
153	French Guinea	Actumnus sp.	PG	Grey sand	42	17,6
153	Portugese Guinea	Detocarcinus balssi	PG	Grey sand	42	17,6
154	French Guinea	Calappa pelii	ST	Bluish mud	80	—
155	Gambia	Ocypode sp.	NDL	—	n.a*	—
161	Gambia	Philyra laevidorsalis	DT	Very fine sand	18	—
163	Senegal	Macropipus rugosus	ST	—	65	—

*n.a = not applicable

Abbrevations	
CT	Commercial Otter Trawl
DT	Triangular dredge 45 cm (toothed)
H	Hand collecting, shooting, Dip Net etc.
NDL	Dip Net used at light
NH	Herring Net (Drift Net)
OT	Otter Trawl
PG	Petersen Grab (Bottom-sampler= 0.1 sq. M
ST	Agassiz Trawl (Sigsbee Trawl) 100 cm
VG	van Veen Grab (Bottom-sampler) 0.1 sq. M

APPENDIX V

Included in this appendix is the raw data used in the CCA Conoco analysis.

Table AV.1 An overview of the species abbreviations used in Canoco.

Scientific name	Abbrevation
Acantocarpus brevispinis	A_bre
Achaeus monodi	A_mon
Bathynectes piperitus	B_pip
Calappa pelii	C_pel
Capartiella longipes	C_lon
Cronius ruber	C_rub
Ebalia affinis	E_aff
Ebalia cranchii	E_cra
Ebalia tuberculata	E_tub
Epixanthus hellerii	E_hell
Ethusa rosacea	E_ros
Goneplax barnardi	C_bar
Goneplax rhomboides	G_rho
Herbstia condyliata	H_con
Heterocrypta maltzami	H_mal
Homola barbata	H_bar
Ilia nucleus	I_nuc
Ilia spinosa	I_spi
Inachus angolensis	I_ang
Lamdophallus sexpes	L_sex
Leopoldius pisifer	L_pis
Machaerus oxyacantha	M_oxy
Macropipus rugosus	M_rug

Scientific name	Abbrevation
Macropodia gilsoni	M_gil
Maja goltziana	M_gol
Mebeli michaelseni	M_mic
Medorippe lanata	M_lan
Menippe nodifrons	M_nod
Microcassiope minor	M_min
Monodaeus rouxi	M_rou
Nanocassiope melanodactylus	N_mel
Pachygrapsus gracilis	P_gra
Paractaea margaritaria	P_mar
Parthenope massena	P_mas
Parthenope notialis	P_not
Philyra cristata	P_cri
Philyra laevidorsalis	P_lae
Phyllodorippe armata	P_arm
Pilumnus inermis	P_ine
Pilumnus perrieri	P_per
Pisa carinimana	P_car
Pseudomedaeus africanus	P_afr
Pseudomyra mbizi	P_mbi
Raninoides bouvieri	R_bou
Stenorhynchus lanceolatus	S_lan
Unidentifiable Brachyura	U_bra

Table AV.2 Grab raw data.

Species abr.	N1	N2	N3	N9	N11	N12	N13	N15	N16	C1	C2	C4	C6	C7	C8	C9	C11	C13	C14	C15	C18	G1	G2	G3	G5	G8	G9	G11	G12	G13	G14	G15	G16
A_mon	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
E_aff	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	1	0	0
E_cra	0	1	0	1	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	0	1	0	1	0	0	2	2	1
E_tub	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
G_rho	0	0	0	0	0	1	2	2	1	0	0	7	1	6	1	0	0	0	1	0	0	6	0	0	0	0	0	0	0	0	0	0	4
H_con	0	0	0	1	0	0	2	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	0	0	0	0	0	0	0	0
H_mal	0	1	0	1	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	1	0	0	0	0	0	0
I_nuc	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0
I_spi	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0
L_sex	0	0	0	0	5	0	0	0	0	0	0	0	0	0	6	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
L_pis	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
M_oxy	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
M_nod	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
M_min	1	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
M_rou	1	1	0	0	0	0	0	0	0	0	0	4	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2
P_mas	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0
P_cri	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0
P_lae	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
P_arm	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	0	0	1	0	0	0
P_ine	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0
P_mbi	0	0	0	1	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
R_bou	0	0	0	0	0	0	0	0	0	1	0	0	0	1	0	0	2	0	0	0	0	0	0	0	0	0	0	2	2	0	0	0	3
U_bra	0	0	0	0	0	0	2	0	0	0	0	0	0	0	0	1	0	1	0	3	1	3	1	1	0	0	0	0	3	0	0	0	0

Table AV.3 Trawl raw data.

Species abr.	847	855	856	858	865	867	868	870	871	876	877	878	879	880	890	903	905	922	923	938	966	970	977	983	986	1231	1298	1300	1332	1340	1347	1353	1360	246	263	274	288
A_bre	0	0	0	1	0	1	0	1	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0
A_mon	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0
B_pip	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0
C_pel	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	1	0	0	0	0	0	0	0	1	0
C_lon	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
C_bar	0	0	0	1	1	0	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
C_rub	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
E_rub	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	1
E_hell	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
E_cos	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	1	0	0	0
H_bar	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0
I_spi	1	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
I_ang	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	1	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0
M_cry	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
M_rug	0	0	1	0	1	0	0	0	1	0	0	0	0	0	1	1	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	1	0
M_pel	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1
M_sol	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0
M_mic	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
M_lan	0	0	1	0	0	0	0	0	0	0	0	0	1	1	0	0	0	1	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0
M_nod	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0
M_min	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	1	1	0	0	0	0	0	0	1	1	0	0	0	0
N_mel	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0
P_gra	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	0	0	0	0	0	0	0	0
P_mar	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0
P_mas	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
P_not	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
P_sem	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
P_per	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	0	0	0	0	0	0	0	0	1	0	0	0
P_car	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0
P_aur	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0
P_mbi	0	0	0	0	1	0	0	0	0	0	1	1	0	0	0	0	0	0	0	1	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	1
S_lan	1	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	1	1	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0

APPENDIX VI

DNA-barcode sequences, in this case the "Folmer region" at the 5' end of the cytochrome c oxidase subunit 1 mitochondrial region (COI), for the Brachyura species *Calappa pelii*, *Pseudomyra mbizi* and *Macropodia gilsoni*.

Calappa pelii:

CATAAAGATATTGGTACATTATATTTTATTTTTGGAGCTTGATCTGGGATAGTGGGGACT
TCTTTAAGTCTTATTATTCGTGCTGAACTAGGTCAGCCTGGAACATTGATTGGTAATGAT
CAGATTTATAACGTTGTCGTTACCGCCCATGCCTTCGTTATAATTTTCTTTATAGTTATA
CCTATTATAATTGGAGGATTCGGAAATTGACTTGTTCCCCTTATATTAGGAGCACCTGAT
ATAGCATTCCCTCGTATGAACAACATAAGATTCTGACTTTTACCTCCCTCTCTCACTTTA
CTACTTATAAGAGGGATAGTAGAAAGAGGTGTTGGTACTGGATGGACCGTTTACCCACCT
CTAGCCGCAGCCATTGCCCATGCAGGAGCTTCCGTTGACATGGGAATTTTCTCACTCCAT
CTTGCTGGGGTGTCTTCAATTTTAGGAGCAGTTAATTTTATAACAACCGTTATCAATATA
CGATCTTACGGAATACTTATAGACCAAATACCTCTATTTGTATGAGCAGTATTTATTACT
GCTATCCTGCTGCTACTATCATTACCGGTCTTAGCAGGAGCTATTACTATGTTATTAACA
GATCGTAATTTAAACACCTCCTTTTTCGACCCTGCAGGAGGAGGAGACCCTATTCTCTAC
CAGCACTTATTCTGATTTTTTGGTCACC

Pseudomyra mbizi:

CATAAAGATATTGGAACTTTATATTTTATTTTAGGAGCATGAGCAGGTATAATTGGCACA
TCCTTAAGATTAATTATCCGGGCTGAGTTAGGCCAACCAGGAACATTAATTGGAAATGAC
CAAATTTACAATGTAGTAGTAACAGCTCATGCATTTGTTATAATTTTTTTTTATAGTTATA
CCAATTATAATTGGAGGATTTGGTAATTGATTAGTACCCCTAATATTAGGAGCTCCCGAT
ATAGCTTTTCCTCGTATAAATAATATAAGATTTTGATTATTACCTCCTTCCTTAACACTT
TTATTAATAAGAGGGATAGTTGAAAGAGGTATTGGAACTGGATGAACTGTTTACCCTCCT
TTAGCTAGAGCAATTGCTCACTCAGGAGCATCTGTAGATATAGGAATTTTTTCTTTACAT
TTAGCAGGTGTATCCTCTATTTTAGGAGCTATTAATTTTTTAACCACTGTAATTAATATA
CGCTCTTCTGGTATATCTTTAGATCAAATACCACTTTTTGTTTGAGCCGTATTTATTACA
GCTATTTTACTGCTTCTATCTTTACCAGTACTAGCAGGAGCTATTACTATACTCCTTACA
GATCGAAATTTAAACACTTCCTTTTTTGACCCAGTTGGAGGTGGAGATCCTATTCTTTAC
CAACATTTATTTTGATTTTTTGGTCACC

Macropodia gilsoni:

CATAAAGATATTGGCACTTTATATTTTATTTTTGGAAGATGATCAGGAATAGTAGGTACT
GCTTTAAGAATAATTATTCGGACCGAACTTGGTCAACCAGGTACATTTATTGGAAATGAC
CAAATTTATAACGTTATTGTTACAGCCCATGCTTTTGTAATAATTTTTTTTTATAGTAATA
CCAATTATAATTGGCGGATTTGGAAATTGATTAGTCCCTCTTATATTAGGAGCCCCTGAT
ATAGCTTTCCCTCGAATAAATAACATAAGATTTTGATTACTCCCCCCAGCTTTAACCTTA
TTACTTATAAGAAGAATAGTAGAAAGAGGAGTAGGAACTGGTTGAACAGTTTATCCCCCT
TTATCAAGATCTATTGCTCATGCAGGAGCTTCAGTTGATATAGGTATTTTCTCTCTTCAC
TTAGCTGGTGTTTCTTCAATTTTAGGAGCTATTAATTTTATTACTACAGTAATTAACATA
CGATCATATGGAATAAATTTAGATCAAATACCTTTATTTGTATGATCAGTATTTATTACT
GCTATTTTACTTCTTTTATCACTTCCAGTTCTTGCAGGAGCAATTACAATATTACTTACA
GATCGAAATTTAAATACTTCATTCTTTGATCCAAGAGGAGGAGGCGATCCAATTCTTTAT
CAACATCTATTCTGATTTTTTGGTCACC

20.04.2006

GCLME

Sampling protocol - benthic invertebrates.

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Sampling of benthic invertebrates in the Gulf of Guinea region

Benthic invertebrates were included in the GCLME program in 2005 as a subproject, and a total of 255 grab hauls from 64 different stations were sampled. In addition, epifauna samples were obtained from 46 demersal trawls. This is an update of the sampling protocol used for the 2005 cruise. The main goal is to ensure that the material collected from the Gulf of Guinea region will be useful for taxonomical and ecological work, including new techniques such as DNA sequencing.

Grab

Grab will be the main sampling gear for collecting benthic invertebrates from soft-bottom substratum. The number of stations will depend on time available, and it will be up to the cruise leader to decide where and when to sample for bentic invertebrates. Generally, as many stations as possible will be sampled, both from shallow water on the continental shelf and from deeper parts near shelf break. Experience from 2005 showed that at least two grab stations each day, one in shallow water and one deeper than 100 m was a good trade-of between time available and coverage. As in the 2005 cruise, grabbing will

mainly be carried out using a regular van Veen grab with a surface area of 0.20 m^2. A full grab contains 48 l of sediment. A modified van Veen grab (with long arms) is also available, and will be used in localities with harder substrate (sand and shell-sand etc.). From each station, 4 replicates will be sampled (marked: A-D). Sample (A) will be sorted in Ghana and the rest (B-D) in Norway. The fullness of the grab will be noted for each grab replicate. Sample A and C will be sieved through a 0,5 mm (mesh size) sieve and sample B and D through a 1 mm sieve. The residue of the sieved sediment will be transferred to plastic containers and preserved. Sample A, B and C will be preserved in 10 % borax pre-buffered formaldehyde (1 part sediment: 2 parts formalin) and sample D in 96 % ethanol (1 part sediment: 3 parts 96 % ethanol). The sample preserved in ethanol will be decanted and refilled with fresh (96%) ethanol after 12-24 hours, to avoid sample deterioration. All containers must be turned upside down at least a couple of times during the first 24 hours, this to ensure that all the material is well preserved. The containers are labelled according to the country, station number, replicate number, date, mesh size used, and the type of preservation used (e.g. N07A, 12/06/05, 0.5mm, Formaldehyde; C03D, 22/06/05, 1.0 mm, Ethanol). From the first replicate (A) of each station additional samples (approximately 1 dl) will be taken for sediment analyses from the top of the grab (representing the top 5 cm layer of the sediment), and placed into plastic bags. These samples will be kept in a freezer during the cruise, and sent to the Nigerian Institute of Oceanography and Marine Research, Lagos for granulometric and chemical analyses immediately after the cruise.

Rectangular dredge

A rectangular dredge will be available on the 2006 cruise and onwards. This sampling gear will be used on hard substratum and shell-sand, when sampling with grab is impossible/difficult. The material will be sorted on deck and preserved in 10% borax pre-buffered formaldehyde or 96% ethanol. Sieving of material will be done when necessary. The containers are labelled according to country, station number, gear, date, organism group and the type of preservation used.

Trawl

Epifauna samples will also be collected from demersal trawls. Specimens are picked from the trawl catch and transferred to plastic containers and preserved in 10% borax pre-buffered formaldehyde or in 96% ethanol. The samples will be labelled according to the trawl station numbering, organism group, date and type of preservation used. In the 2006 cruise there will be a special focus on the deeper trawling stations (>200 m depth).

Station list

A station list (excel), containing all environmental data available (position, depth etc.), will be updated after each sampling station.