A review of Woodside's Draft Environmental Impact Statement of the Chinguetti Offshore Oil Development Project in Mauritania

A background paper to serve as an independent guide for stakeholders who wish to submit comments on Woodside's draft environmental impact statement

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About the authors

Sandra Kloff is a marine biologist and worked for two years for the IUCN (World Conservation Union) in Mauritania on coastal wetlands conservation projects from 1998 to 2000. Later she became involved in reviewing oil development off the Spanish coast for the environmental organisation, Ecologistas en Acción. Out of personal and professional interest she followed up on oil development in Mauritania and established contact with local stakeholders on this subject from her home base in Spain. Because the first oil company active in Mauritania is an Australian energy company (Woodside Energy) she also made contact with Australian environmental organisations; Australian MP's interested in oil and gas issues and with several shareholders of Woodside to inform them on the development in Mauritania. After extensive e-mail exchanges with these different interest groups it became clear that they did not have the necessary information which would enable them to make a proper evaluation of the draft Environmental Impact Statement recently released by Woodside on their oil development project in Mauritania.

Tom van Spanje is an ornithologist and worked from 1984 to 1994 as a co-ordinator for Dutch research institutions in the framework of marine and coastal research projects in Mauritania. He was involved in several years of field research in the Banc d'Arguin National Park in the north of Mauritania and the coastal wetlands near the Senegal River Delta in the south. He identified the need and managed to raise funds for the construction of a ship wharf for the repair and construction of traditional sailing boats for the Imraguen community in the Banc d'Arguin National Park. Monitoring studies of water birds and waders in the Banc d'Arguin Park formed the largest part of his work in Mauritania.

The review presented in this paper is intended to enable stakeholders to make a proper evaluation of Woodside's draft EIS. The technical details on offshore oil were checked for accuracy by oil experts in the United States of America and Australia.

Introduction

Woodside Mauritania Pty Ltd (Woodside) and its Joint Venture Partners (AGIP Mauritania B.V., Hardman Petroleum (Mauritania) Pty Ltd, Fusion Oil & Gas Nl, and Roc Oil Company Ltd), are planning to develop the Chinguetti oilfield off the coast of the Islamic Republic of Mauritania, North West Africa. The field was discovered in 2001 and is operated under a Production Sharing Contract with the Mauritanian Government. Woodside is an Australian based energy company and is operator of the Production Sharing Contract covering the Chinguetti field and is also operator of the project, on behalf of the Joint Venture Partners. The field is located in approximately 800 meters of water, 80 kilometres due west of the Mauritanian coastline and situated on roughly the same latitude as the capital Nouakchott. The Chinguetti field is the first oilfield planned for development in Mauritania.

On the 2nd of December 2003 Woodside made the draft Environmental Impact Statement – EIS – available to the public. Stakeholders who will be affected directly by this project and organisations and individuals from Mauritania and abroad, who are concerned by oil development, have been invited to submit comments on the draft EIS. Woodside has stated that it will acknowledge and record the comments. Woodside has also stated that it will quote the submissions in full or in part in the final EIS that will be prepared following the completion of the stakeholder review period. The deadline for submissions is the 2nd of February 2004.

In Mauritania most stakeholders are not well informed about the environmental impacts of offshore oil development and are virtually unaware of what constitutes best practice in the industry. Interested parties from Woodside's home country Australia have an extensive experience of offshore oil development, thanks to the Enfield oil project off NW Australia, but they lack information on the Mauritanian situation and the local ecosystem (e-mail exchanges). This review is intended to enable stakeholders to make a proper evaluation of Woodside's draft EIS and to make them more aware of the environmental and economic impacts of offshore oil on the marine environment. It examines what constitutes best practice and draws for the Australian stakeholders a better picture of the Mauritanian situation. A comparison will be made between the Enfield project off NW Australia, also implemented by Woodside, and the Chinguetti project in Mauritania, in order to illustrate the differences and to propose ways by which the project in Mauritania may be upgraded to Australian standards. Dr. Pattin's book "Environmental impact of the offshore oil and gas industry", recent publications on the impact of seismic surveys on fish catches and the impact of produced water on fish fertility will be used as independent scientific sources to comment on some of the issues raised by Woodside in the draft EIS.

Owing to the limited time available, the review presented in this paper is not as extensive or in-depth as the authors would have wished. Only the most significant differences between the draft EIS of the Chinguetti project and the Enfield offshore project will be outlined. Likewise, only a rough sketch of the marine ecosystem in Mauritania will be presented drawing on the author's experience in Mauritania relevant to offshore oil development. Some technical background information on seismic surveys and the exploitation phase will be given with some insight on best practices implemented by countries adjoining the North Sea. This will be preceded by background information on the offshore oil development approval process of several other countries. The social implications of oil development for Mauritania and the impact of fossil fuels in general on global warming will not be treated as this is beyond the scope of the draft EIS submitted by Woodside.

Offshore oil development approval process from elsewhere

Offshore oil exploration and exploitation has evolved over the past years. Impacts on the marine environment have decreased thanks to the development of new techniques and the oil industry's increasing consideration for the needs and wishes of other users of the sea, such as fishermen, tourists or marine conservationists. However there is no reasoning behind the optimism expressed by the industry regarding the ecological safety of offshore oil exploitation and the lack of harmful effects on fisheries. There is unfortunately no such thing as benign drilling. Disturbance of the marine ecosystem is inevitable and the intensity of these disturbances can certainly vary considerably depending on a combination of many natural and anthropogenic factors. Countries must decide for themselves whether these disturbances are an acceptable load for the marine ecosystem to carry and whether these negative impacts on, for example fisheries and tourism, are not too high. In a number of cases countries decided not to go ahead with oil exploitation in spite of the presence of important offshore oil reserves and in spite of improved exploitation techniques. By placing oil exploitation in a wider economic and ecological context, to go ahead with exploitation is sometimes assessed as an unwise decision. Some examples:

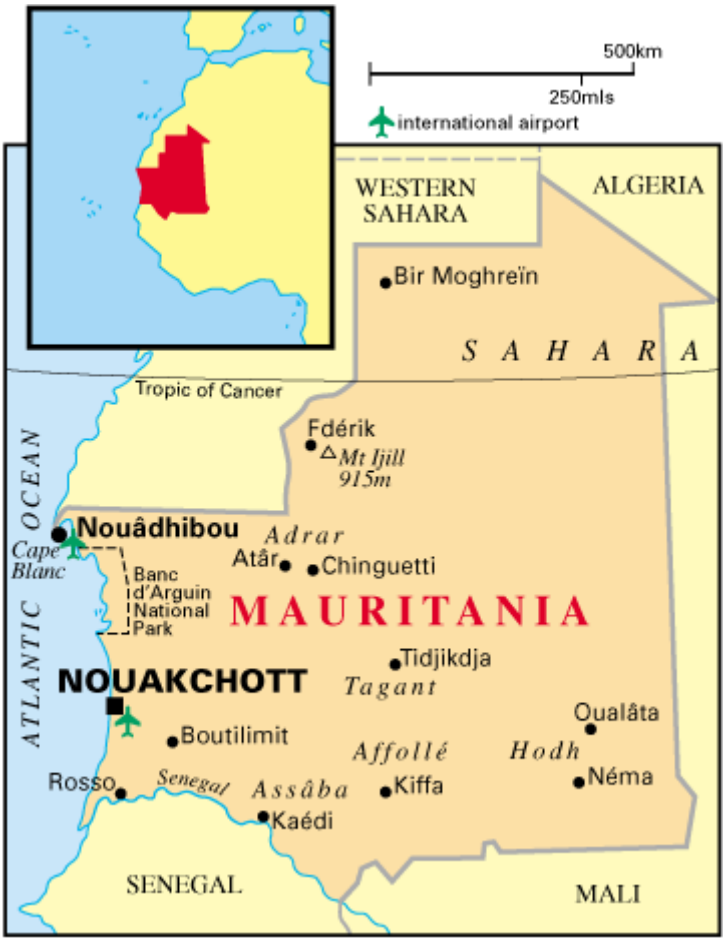
USA: Virtually all states on the west and east coast of the United States of America have a moratorium on offshore oil exploitation. Negative impacts on fisheries and tourism were evaluated to be too big by these states and governors successfully negotiated moratoria with the federal government (personal communication with the Californian Coastal Commission). A surprising fact is that President George W. Bush made a considerable personal investment in securing a moratorium on offshore oil exploration blocks off the Florida coast. Oil exploitation is very unpopular in Florida and this moratorium resulted in a significant boost to the President brother's election campaign. He went on to win the elections and became governor of the state.
Canada: In Nova Scotia the fisheries industry demonstrated through a study about the economic impact of offshore oil & gas development on fisheries that the development in the vicinity of a large and shallow area, George Bank, would be unwise on purely economic grounds (Gadus consultants, 1997).
Costa Rica: Poorer countries have sometimes also decided not to drill for oil. A forum comprising the local tourist industry, fisheries and indigenous peoples organisations on the Caribbean coast managed to place a moratorium, via a Supreme Court decision, on oil exploration blocks. These blocks were previously handed out by central government to the Texas based oil company Harken Energy, formerly owned by George W. Bush (Cajiao, 2002). The forum concluded that oil exploration would not to be compatible with tourism, fisheries and the livelihoods of indigenous people living in the coastal area. International pressure and media attention finally made the oil exploration business a major theme during the national elections. In 2002 the newly elected president, Dr. Abel Pacheco de la Espriella eventually declared Costa Rica an oil production free country.

Countries adjoining the North Sea, on the other hand, have decided to go ahead with oil exploitation. Best available techniques are generally applied and oil companies must comply with strict regulations that are put in place to minimise the risks and disturbances on the marine ecosystem. But disturbances do occur and the fishery sector in particular suffers the negative affects. In their appeal to government, British fishermen estimated the areas actually lost for fishing at 800 to 5,200 km2 of sea on the UK continental shelf. The resulting annual losses of catch range from 580,000 to 3,000,000 pounds sterling (870,000 to 4,500,000 euros) (Buchan, Allan, 1992). It should also be noted that the offshore oil and gas industry's

activities not only affect fisheries through fishing exclusion zones but also by causing physical interference, accidents, and losses or damage of fishing vessels and gear. Such incidents have become an everyday event in the North Sea. In Norway the compensation annually paid by the oil and gas operators to claims by fishermen is estimated at 3.3 million pounds sterling or almost 5 million euros (Pattin, 1999). Mauritanian waters will become an offshore oil development zone with a high density of fishing activity and will therefore be a high risk area for physical interference between fishing vessels and oil development related infrastructures (personal communication with Woodside). Acute impacts on fisheries caused by routine pollution of the offshore industry are more difficult to assess and making a precise economic evaluation of chronic pollution on fish resources is practically impossible.

In summary, offshore oil development can lead to economic profit but it is never without economic costs inflicted on other users of the sea. In some cases these costs were estimated to be more important than the benefits. Apart from the impacts on the marine ecosystem, fisheries and for example tourism caused by routine operations of offshore oil exploitation, countries usually evaluate the economic and ecological damages a major accidental oil spill might cause. Sometimes the oil reserves are relatively small and it is decided that it is not worth it exposing the marine ecosystem to the risks that are involved with exploitation. It is difficult to assign a monetary value to the damage caused by the oil industry to the marine ecosystem as a whole, which includes non-commercial species, and to the aesthetic value of the coastline and seascape views.

Mauritania



Mauritania is situated in the Sahara desert bordering the Atlantic Ocean, between Senegal and the Western Sahara. To the north east the country shares borders with Algeria and in the east and south east with Mali (see map). The country is slightly larger than three times the size of France with a population size of approximately 2.7 million. Mauritania has very low human development – ranking 149th of the 174 countries on the human development index. About half its people are in poverty, with 40% of children malnourished and almost 60% of adults illiterate (UNDP, 2000).

A series of droughts in the 1970s and 1980s triggered a shift from a nomadic population (app. 80 % of the population) heavily dependant on livestock production to a more sedentary population and by 1993, the nomadic population represented

only 8 percent of the country's population (World Bank, 1994). The majority of people live today on the coastal zone in the capital Nouakchott and in the economic centre Nouadhibou. The floodplains of the Senegal River in the south of the country form another area that is relatively densely populated. During the same period of the droughts export oriented fishing started to develop rapidly. Nonetheless, Mauritania remains a poor country with a per capita income of US$ 410, just below the sub-Saharan African average (World Bank, 1998).

Each year, from approximately October until June, high primary production (phytoplankton growth and growth of other marine plants) takes place in Mauritanian waters. The trade winds push nutrient poor surface water out to the sea which is replaced by nutrient-rich bottom water welling to the surface, a phenomena also known as upwelling. The subsequent explosion of primary production forms the basis of marine life and is the reason why Mauritanian waters are so extremely rich in fish resources (Wolff, et al., 1993). The country is today heavily dependant on fish resources which represent more than half of the total income derived from exports (World Bank, 1998). The specific composition of the fish population is strongly influenced by oceanographic conditions. Especially by the alternating of the cold Canary current (December to April) and the warm Guinea current (July to November). Marine life concentrates mainly in the upwelling zone from Cap Blanc to south of Cap Timiris just north of Nouakchott. At the seafloor rich benthos communities are found. At the surface many marine mammals such as whales (for ex. fin whales, humpbacked, Orcas), dolphins, sharks and sea-turtles can be seen. Northern-hemisphere migratory seabirds (for ex. shearwaters, storm petrels, gannets, auks, gulls, skuas and terns) are present in winter and juveniles presumably also year round in a wide variety of species (Wolff, et al., 1993). The sea mammal and seabird presence, distribution and ecology are poorly studied.

The fishery sector can be divided into a coastal zone sector and a deep water sector. The deep water sector is mainly exploited by large foreign fishing vessels that pay the Mauritanian state for the rights to fish. European vessels fish in the framework of agreements the EU signs with the Mauritanian government. The coastal zone is mainly exploited by Mauritanians with small to medium sized trawlers. The Mauritanian fishery sector consists for a large part of cold-storage pack house companies and practically all fish are destined for export. These companies usually work with fishermen from Senegal and Guinea Bissau. The fishermen come to Mauritania during specific fishing seasons with small motorized wooden boats "pirogues" and stay in temporary camps on the coast. The Mauritanian coastal zone fishery sector developed fairly late in the 1980s, with the exception of the Imraguen fishermen who have fished for centuries in an area that is now called the Banc d'Arguin National Park.

The Banc d'Arguin Park comprises about 30 % of the coastline and is made up of sand dunes, coastal swamps, small islands and shallow coastal waters covered with extensive sea grass beds. The Park was added to UNESCO World Heritage list in 1989. The aridity of the desert and the rich biodiversity of the marine zone result in a land and seascape of exceptional contrasting beauty and natural value. Millions of migratory birds, including 15 species of waders, mainly from arctic and Northern-hemisphere origin, contribute to the health of this rich and complex ecosystem. On the islands numerous large breeding colonies of cormorants, pelicans, herons, spoonbills, flamingo, gulls and terns are settled. Monk seal, a nearly extinct species, several species of sea turtle (4 species), shark (for ex. dogfish, hammerhead, sawfish, manta- and guitarray), whales (for ex. Orca) and dolphin (for ex. Hump-backed and Bottle-nosed) can also be found in the area. The shallow waters and sea grass beds play an important role as a nursery for many commercial and non-commercial marine species. Fishing with motorised vessels within the limits of the park is forbidden. The Imraguen fishing community

use traditional sailing boats and apply ancient fishing techniques. The Banc d'Arguin became famous for the Imraguen fishing for yellow mullet in collaboration with wild dolphins that chase dense mullet schools into their nets. In return the dolphins get to pick out some of the individual mullet that jump out of the nets (UNESCO world heritage website).

Mullet is also an important species for the coastal zone fishery industry that is active outside the park's borders. The export of mullet caviar (the eggs) to southern Europe used to be a multi-million dollar business. This caviar, otherwise known as Poutargue or Boutargue, is a delicacy, notably in France and Italy and is especially popular with the Jewish population. Every year mullet are caught during their migration from the Banc d'Arguin Park to the Senegal River Delta. The income from mullet has decreased over recent years as a result of overexploitation and due to the ecological disturbance resulting from the construction of a large salt-wedge dam (completed in 1989) in the mullet's spawning grounds at the mouth of the Senegal River. The decline in mullet and its economic value were an incentive for fishermen, government, research institutions, National Parks and conservation organisations to work together towards a solution. A stakeholder consultation initiative was set up by the IUCN in 1999 with the aim to achieve sustainable use of mullet. Thanks to these discussions, precautionary measures were taken by the private sector by reducing their fishing effort. The Diawling Park in the Senegal River Delta, the second National Park in Mauritania, plays an important role in ecosystem restoration of the Senegal River Delta, the mullet's spawning grounds (author's personal experience in Mauritania). Today mullet is exposed to yet another stress factor, oil exploration, and in particular seismic surveys constitute a real threat.

Oil exploration, Seismic surveys

Oil exploration usually starts with seismic surveys. A seismic survey is based on generating seismic waves and recording their reflection off the seafloor and subseafloor strata. The seismic profiles provide a detailed image of the structure of the subsurface rock layers and the oil and gas potential of the area. Woodside does not make any mention of the exploration phase and the impacts of seismic surveys on the marine ecosystem in chapter 5.2 (Identification of Environmental Hazards) in the draft EIS. This does not however imply that seismic surveys are harmless. Even the most modern methods of generating seismic waves pose a certain threat to marine biota, including commercial species. These impulses can create sound pressure of up to 150 atmospheres. The number of seismic impulses executed during exploration of an area of 100 km2 is never less than 5-8 million (Matishov, 1991, McCauley, 2003).

Experts working for environment and fisheries in a number of countries (for example in Great Britain, Norway, USA, and Canada) consider geophysical shelf exploration a serious threat to marine organisms, especially during periods of spawning, migration and growth. Results of research conducted by Norwegian scientists indicate that school pelagic fish change their behaviour in response to a seismic signal at a distance up to 100 km from the signal source (Dalen et al., 1996). Another study showed that intensive seismic exploration caused a decline in fish populations and resulted in a 70% decline of commercial catch near the Norwegian shore (Patin, 1999). Engas *et al.* showed in 1996 that seismic surveys in deep water ecosystems can cause a temporary decline in commercial fish catches of more than 40 %.

This is why some countries strictly regulate seismic surveys and require a fishing representative to be aboard the survey ships. In the North Sea, seismic surveys are not allowed

from July through September in areas where herring are spawning (Davis, Kingston, 1992). In the Norwegian economic zone, in order to limit the areas and periods of seismic surveys, special studies of the region were conducted. As a result, the region was mapped with allocation of areas where seismic surveys would pose an increased environmental threat. These included the places of spawning, migration, and development of eggs, larvae, and fry of commercial fish (Bjoerke et al., 1991). In general oil companies consult with marine biologists, fishermen and fisheries departments at an early stage in project development in order to establish a timetable for seismic surveys. Factors like fish migration, reproduction, fishing activity and the presence of cetaceans are taken into account to determine times when seismic surveys can have a minimal impact on marine life.

Such consultations have not yet taken place in Mauritania. Seismic surveys were carried out while oil companies had limited knowledge of the marine ecosystem. They did not know whether they were firing their air guns into migrating or spawning schools of fish. Dana Petroleum, for example, surveyed the inshore waters in an exploration block just north of the Senegal River Delta in the fourth quarter of 2002, that is at exactly the same time the mullet was migrating to their spawning grounds (Dana petroleum website). This may have had a negative impact on mullet reproduction. Scientific studies show that migrating species may loose track of their migratory route as a result of nearby seismic surveys (Dalen et al., 1996). As shown earlier mullet is a highly vulnerable species and considerable efforts was expended and compromises made by other users of the sea in Mauritania to safeguard its survival.

No information could be obtained from Woodside regarding their seismic survey calendar. When Woodside was asked, during an informal discussion with the authors of this paper, on what basis they established their calendar for seismic surveying, they responded that they did engage in a small-scale stakeholder consultation process with fishermen for this purpose. They added however that they would like to improve this process. Woodside explained that they informed fishermen in temporary fishing camps by handing out brochures on exploration activities. No information was actively obtained from fishermen, cold storage company owners or national research institutions regarding fishery activities and fish migrations. Woodside was not aware of the mullet's migration pattern or the species vulnerability. Woodside did not know of the mullet consultation initiative and later acknowledged that it could have been a perfect platform for them to get in touch with and exchange information with all stakeholders of the local fishery sector. It should be noted however that Woodside promised to get in touch with this group and that they would improve their stakeholder consultation engagement process before planning anymore seismic surveys in the future.

Oil exploitation

The most intense and diverse environmental impacts are usually seen during the development and production stages of oil exploitation. The draft EIS of the Chinguetti project gives an idea of how Woodside would like to develop the exploitation phase. Before going into the details of the draft EIS, first some background information on environmental impacts of oil exploitation in general.

The development stage, construction, assembling, drilling, and other activities in the sea and on the land are accompanied by intense support-vessel traffic. Besides accidental and routine oil pollution, the tanker fleet can be responsible for the appearance of non indigenous organisms. Their rapid development under new conditions can lead to ecological catastrophes.

One such uninvited guest, the ctenophore *Mnemiopsis leidyi* (American comb jelly), brought in with tanker ballast water in the Sea of Asov, the Black Sea, and the Mediterranean Sea, caused radical changes in the trophic structure of large areas. In the Black Sea, it undermined the feeding base of commercial fish and thus the fishing potential of the area (Patin, 1999). A strict regulation for ballast water in Mauritania is strongly advisable.

Drilling activities start during geological and geophysical survey. After locating the most promising pockets of hydrocarbons using seismic surveys, the exploratory drilling activities start to determine whether the area contains commercial quantities of gas and oil. Regardless of the type of drilling unit used, all drilling methods are similar. Pipe sections and rotating bits are used that gradually decreases in diameter while the well gets deeper. As drilling progresses, special drilling fluids (muds) are continuously pumped down the drill pipe for lubrification purposes and then pumped back to the surface with well cuttings. If exploratory drilling results confirm the existence of exploitable oil reserves, the well is plugged and bordered with the help of special armature (Patin, 1999).

Drill cuttings in best practice projects are injected into the geological formations of the seafloor or shipped to shore for further treatment and proper disposal. These projects generally use slim holed pipe sections in order to reduce the amount of drill cuttings. Other oil companies discharge cuttings to the surface waters of the sea from the production platform or vessel. Prior to discharge these cuttings are usually cleansed. Electrothermal treatment is evaluated as one of the best methods for detoxification. Disposing of drilling cuttings near the seafloor instead of dumping them on the water surface can limit the spread of polluted suspense and thus decrease the scale of its harmful impact. Drilling cuttings covered by oil and often toxic drilling fluids were the main source of oil pollution during drilling operations in the 80s (Patin, 1999).

The hydrocarbons are extracted from the well in a complex mixture of water, oil and gas. They are separated and treated on the oil platform or production vessel. Gas is either removed from the site by pipelines or is re-injected into the reservoir for maintaining pressure. The water in modern and best practice projects is likewise re-injected into the reservoir. In more out-dated projects or in areas without strict regulations, this water is cleansed to a maximum oil content of 40 mg/l, and then discharged into sea. Other dissolved components are not treated and thus remain in this water. In addition to oil this water contains components such as heavy metals, alkylphenols, aromatic hydrocarbons (including PAH) and sometimes radioactive materials (Meier et al., 2002). Recent large scale laboratory experiments with cod (*Gadus morphua*) have shown that alkylphenols in produced water have hormone disrupting effects. These substances affected the size of the gonads, made male fish more feminine and delayed the spawning time with several weeks, even at extreme low concentrations. If these results are transferred to natural conditions, produced water discharges may have considerable chronic effects on stocks of cod and possibly other marine species (Meier et al., 2002). This information has led to much stricter regulations for produced water in several countries adjoining the North Sea. On some platforms, the volumes of discharged produced waters can reach up to 20,000 m3 a day (Sakhlin-1, 1994).

Enfield project compared to the Chinguetti project

Woodside promised Mauritanian and foreign stakeholders that it would work according to best practices and Australian standards. A comparison is made here between Woodside's Enfield project in Australia and the Chinguetti project in Mauritania. The Enfield project is in a more advanced stage than the Chinguetti project and is seen by a large variety of stakeholders as an example of best practice. The main differences in the stakeholder engagement process and the technical implementation phase of both projects will be highlighted.

Stakeholder engagement process

Consultation with stakeholders is seen by Woodside to improve decision-making, and, build trust and understanding. Consultation is seen as a two-way process between Woodside and its stakeholders, including formal and informal discussions and formal responses and reporting by the company to meet stakeholder's information needs. Stakeholders of both projects were given the chance to send written comments on the draft Environmental Impact Statement.

Main differences:

Enfield: during the preparatory phase of the Enfield project an independent liaison officer and oil expert was appointed to inform all stakeholders on Woodside's activities and the impact of offshore oil on the marine environment in general. The work of the liaison officer is funded by Woodside but she was appointed by a third party and chosen and approved of by all main Stakeholders (personal communication with Australian stakeholders).
Chinguetti: Woodside directly appointed a liaison officer. Stakeholders had no say in the selection procedure (personal communication with liaison officer).

Enfield: Stakeholders (NGO's, Government Institutions and private sector) were informed and consulted on the progress of the preparatory phase of the project. Woodside had formal and informal discussions with all stakeholders during workshops and face to face meetings. A toll free information number was installed to inform stakeholders with questions on the project. Stakeholders received monthly written updates on base line studies of the marine environment and the progress of Woodside's activities. Information events were organised. By the time Woodside published the draft Environmental Impact Statement most stakeholders had the feeling that they had sufficient, non-biased information on the oil industry to independently review the draft Environmental Impact Statement (e-mail exchanges with the President of an Australian conservation organisation).
Chinguetti: Woodside had formal and informal discussions with all stakeholders during workshops and face to face meetings. Apart from (Inter) Governmental Organisations, Diplomatic Representatives and NGO's in Europe and Mauritania, Woodside did not consult with the private sector. Representatives of foreign and local fishery companies were not directly included in the consultation process. By the time Woodside published the draft environmental Impact Statement, the general opinion of the main stakeholders was that they did not have the knowledge that would enable them to review the sometimes quite technical details, in the draft EIS (e-mail exchanges with main stakeholders). Woodside planned to organise a capacity building mission for the Mauritanian stakeholders next spring. This will thus take place after the deadline for submissions on the draft EIS (e-mail exchange with Woodside).

Floating, Production, Storage and Offloading vessels
The preferred development choice of the Chinguetti and Enfield projects is a Floating, Production, Storage and Offloading vessel (FPSO). A number of sub sea wells will be drilled for production and water and gas injection. Sub sea well heads flowlines and moorings will be installed. The FPSO vessels will be installed and commissioned prior to production. The FPSO vessels will receive oil, water and gas from the reservoirs and process and store oil in cargo tanks before transfer to trading tankers (Woodside, 2003; Enfield website).

Main differences:

Enfield: under normal operation conditions, produced water (app. 90%) and surplus gas will be re-injected into the oil reservoir (Enfield website).
Chinguetti: under normal operations surplus gas will be re-injected. Oil content in produced water will be lowered to International standards and discharged into the ocean (Woodside, 2003). The hormone disrupting alkylphenols will remain in this water together with heavy metals, aromatic hydrocarbons, (including PAH's) and possibly radioactive substances. The oil reservoir will be injected with sea water to maintain the pressure.

Enfield: the FPSO vessel will be a newly build double hulled vessel constructed according to Suez Max standards (Enfield website).
Chinguetti: the FPSO vessel is likely to be a second hand and converted large crude oil carrier with a single hull configuration (Woodside, 2003).

Enfield: the FPSO will have a maximum storage capacity of 150,000 m3 (Enfield website).
Chinguetti: The FPSO will have a storage capacity of approximately 318,000 m3 (Woodside, 2003).

Many more differences between the Enfield and the Chinguetti project may be found. The above stated differences were the main ones that captured our immediate attention.

Conclusion

At present, no standardized or commonly accepted methodology exists for the integrated quantitative assessment of the environmental impacts of the offshore oil and gas exploitation. Different countries use different procedures and methods for this purpose. These include textual descriptions, expert's grading, and applications of hazard and risk theory. Sometimes the oil reserves are too small and it is decided that it is not worth exposing the marine ecosystem to the risks involved in exploitation. In some cases political reasons are the most important factor that determine a country's decision not to drill for oil, simply because offshore oil exploitation is unpopular. From a Mauritanian standpoint it is understandable that the country has a strong wish to develop offshore oil exploitation. The country is poor with a strong dependence on fisheries. But this makes offshore oil development at the same time a risky business and sensitive issue. Oil reserves are finite and their exploitation will therefore only be possible for a limited time period. – The expected lifetime of the Chinguetti field is in the order of 8-15 years. – Mauritania needs to rely on its fishery resources as an important source of income during the oil exploitation period, and when the oil companies have left the country. It is strongly recommended that the negative impacts of offshore oil development on

the marine ecosystem be kept to a minimum in order to safeguard the sustainability of fisheries in Mauritanian waters. For this reason Mauritania will need to impose strict environmental regulations on the offshore oil industry which should be at least as strict as those applied in the Australian situation.

List of comments to draft EIS

The Chinguetti field is the first oilfield to be developed in Mauritania. It is important that this offshore oil project will be carried out according to the highest standards. In this way the Chinguetti project would set an example for all other oil companies prospecting Mauritanian waters. At the same time this could be an incentive for the Mauritanian government to formulate legislation for sound offshore oil development based on best practices of the Chinguetti field.

The following points could be used by stakeholders when they elaborate a list of comments on the draft EIS:

- A large number of stakeholders in Mauritania expressed the need to be informed by unbiased experts on the technical details of the offshore oil industry, its impacts on the marine environment and best practice. They consider themselves at this stage inadequately informed to comment on the draft EIS of the Chinguetti project. It would be wise to postpone the deadline for submissions on the draft EIS until after the capacity building mission planned for next spring. In this way local stakeholders could provide Woodside with meaningful feedback.
- The foreign and national fishery sector should be actively engaged in the consultation process.
- The appointment of an independent liaison officer with a large experience on offshore oil issues, respected and approved of by all stakeholders is recommended. The same selection procedure and structure of appointment could be used as during the Enfield preparation phase.
- Regarding the high risk of physical interference of the fishing fleet with the FPSO vessel and trading tankers, it would be wise if the FPSO vessel and all trading tankers have a double hulled construction.
- The FPSO vessel for the Chinguetti project should, like its counterpart in the Enfield project, be a newly build vessel constructed according to Suez Max standards.
- The Mauritanian FPSO should have the same maximum storage capacity as the FPSO of the Enfield project which is 150,000 m3. This would lower the impact in the event of an accident occurring.
- It is highly recommended that the produced water is re-injected into the reservoir, according to the same techniques by which this water is re-injected in the Enfield oil reservoir. Alkylphenols and aromatic hydrocarbons that remain in this water also after treatment, may have a chronic negative effect on the fertility of fish stocks and should therefore not be discharged into the sea.
- Slim holed pipe sections should be used for drilling activities.
- It is recommended to inject drill cutting into the geological formation or to ship them to shore for proper disposal. If this option is not economically viable all drill cuttings should be detoxified according to state of the art technologies. Electrothermal treatment is the preferred method. All drill cuttings should be disposed off near the seafloor and instead of being dumped into the sea from the FPSO at the surface.

- The chronic effects of all discharges (drill cuttings, slurry, accidentally discharged produced water) on the marine ecosystem and fisheries should be monitored by independent scientific institutions.
- Woodside and other companies should fund base line studies to fill the gaps in knowledge of the coastal and deep water ecosystems prior to developing oil exploitation. Scientific knowledge of the Mauritanian marine ecosystem is at its current state insufficient. A better insight of the marine environment is crucial for proper monitoring of the impacts of offshore oil development.
- It would be recommendable if Woodside and other oil companies comply in Mauritania with special regulations for trading tankers to exchange ballast water. The Australian Quarantine Inspection Service requirements could serve as temporary legal framework while waiting for national legislation.
- A compensation fund for fishermen to cover physical damage to vessels and gear should be installed by Woodside and other oil companies.
- Mauritanian government institutions should develop special regulations to control the impact of seismic surveys on fish migration and spawning. As a sign of best practice, oil companies should respect the following rules while waiting for official legislation:
    - a fisheries representative should be aboard the survey ship as well as an independent cetacean watcher. Seismic surveying should be stopped immediately when cetaceans are located near the survey ship
    - Oil companies should establish a calendar for seismic surveying in close collaboration with the national fishery Institute, IMROP, and the fisheries sector.
    - Mapping of the coastal zone and allocation of areas where seismic surveys should be restricted (for example fish reproduction zones). Regarding the nursery function of the Banc d'Arguin, it can already be concluded that seismic surveying should be restricted in this area.

Literature

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Urbanization has a tremendous impact on the environment and urban areas are the primary source of carbon dioxide in the air due to augmented burning of fossil fuels for heating and cooling purposes and from industrial processes. The local effects of urbanization on the environment has been indicate that the construction of cities with the numerous processes involved including the building of roads, buildings and other infrastructure development processes profoundly impact and alter the exchanges of energy, water and flow of air.Â Assessment of the effects of global climate changes on agriculture might help to properly anticipate and adapt farming to maximize agricultural production. Deforestation. Science Technical Review of the draft Environmental Impact Statement (EIS) for Baffinlandâ€™s Mary River Project. Research (PDF Available) Â· March 2017 with 264 Reads. How we measure 'reads'.Â The intensive use of offshore areas seen in the telemetry data, where 76% of the locations were more than 15 km from mainland Quebec, was not evident in the TEK data, where only 17% of the records indicated offshore locations. Morisita's index of similarity indicated that TEK and telemetry data distributions varied with season, with the highest similarity in winter (0.74).Â An ecological research and management program has been drafted as a part of the barrage project. Refs. Read more. Environmental impact statements (EIS) are reviewed by government and its advisors, and are also made available to local environmental NGOs.Â Whites Point Quarry and Marine Terminal Project Joint Review Panel issues final Environmental Impact Statement Guidelines HALIFAX, March 31, 2005 â€“ The Joint Panel reviewing the Whites Point Quarry and Marine Terminal project in Digby County, today released the final Guidelines for the preparation of the Environmental Impact Statement (EIS). Giga-fren. The Environmental Impact Statement and technical review documents underwent public review. Giga-fren.