Oil or Development?

Results from a Field study on the environmental and social impacts of oil exploration along the northern coast

JUSTIÇA AMBIENTAL

by Daniel Ribeiro and Joshua Dimon

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Oil or Development? Results from a field study on the environmental and social impacts of oil exploration along the northern Coast

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BY:
Daniel Ribeiro and Joshua Dimon

FIELD TEAM:
Daniel Ribeiro (Msc Ecology), Joshua Dimon (PhD Candidate, Dep. Environmental Science, Policy & Management, University of California at Berkeley), José Domingos Bacar (Association of artisan fisherman), Mauro Pinto (Photographer) e Muhammad Tacuane (SHEIKH M.T.S.)

COVER IMAGE:
Daniel Ribeiro

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Jano Paixão

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TABLE OF CONTENTS

FOREWORD 03

ACKNOWLEDGEMENTS 04

EXECUTIVE SUMMARY 05

MAJOR FINDINGS 05

MAJOR RECOMMENDATIONS 06

1 - BACKGROUND/INTRODUCTION/OIL AND GAS CONTEXT FOR MOZAMBIQUE AND REGION 08

1.1 - REASSESSING OIL AND DEVELOPMENT 08

1.2 - EMERGING POLICY AND REGULATORY ISSUES – PERVERSE INCENTIVES AND CONFLICTS OF INTEREST 09

2- RESEARCH PROGRAM ON SOCIAL AND ENVIRONMENTAL IMPACTS OF EXPLORATION 11

2.1 - SHALLOW WATER SEISMIC PROGRAM DESCRIPTION 12

2.2 - IMPACTS 13

FISH DEATHS AND CATCH REDUCTIONS 13

IMPACTS ON OTHER MARINE ORGANISMS 14

HEALTH IMPACTS 15

LACK OF ACCESS TO COMPENSATION 16

LACK OF INFORMATION, CONSULTATION, PARTICIPATION 19

LACK OF INDEPENDENT MONITORING 19

3 - CONCLUSION 21

3.1 - RECOMMENDATIONS 21

REFERENCES 22

FOREWORD

WHEN THE EARTH BLEEDS

I hear that oil
makes things move
In reality check
oil makes life stop
because

The oil only flows
When the earth bleeds

A thousand explosions
in the belly of the earth
bleeding rigs,bursting
pipes
this oil flows
from the earth's sickbed
because

The oil only flows
When the earth bleeds

The oil only flows
When the earth bleeds

In conference halls
we talk in gardens of
stones
the ocean waves bathe
our eyes
but in Ogoniland we
can't even breathe
because

The oil only flows
When the earth bleeds

What shall we do?
What must we do?
Do we just sit?
Wail and mope?
Arise people,arise
Let's unite
with our fists
let's bandage the earth
because

The oil only flows
When the earth bleeds.

By:
Nnimmo Bassey (Nigerian poet) architect
and environmental activist, from the book
"We thought it was oil but it was blood"

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A very big thank-you to all the visited communities and all those who made themselves available to respond to our numerous questions which they did with such good dispositions, and for all that we were able to absorb and learn

Photo by: Daniel Ribeiro

EXECUTIVE SUMMARY

This report presents the results from field-based research on the environmental and social impacts of a shallow water marine seismic program which took place in April and May of 2009 along the northern coast of Mozambique.

The team conducted interviews with fishermen, community leaders and tour operators working and living within the area covered by the shallow water seismic operation to assess the impacts of the seismic program on coastal livelihoods and the coastal marine ecosystem. This information was triangulated where possible with interviews with tour operators, marine biologists familiar with the region, and what scientific literature was available for the region.

As this report was being finalized, the Government of Mozambique announced the discovery of the presence of gas offshore northern Mozambique, in at least four of the deep-water wells completed in 2010-11, with oil encountered in one other well. While the commercial viability of this find is yet to be determined, the probability of gas production in the near term makes the findings of this report all the more urgent. Fossil fuel development is a risky business in general, for livelihoods and the environment local to sites of production and for the national economy.

Mozambique is in a position to provide energy for its people in a manner that ensures both security of livelihoods and environments. Mozambique has viable renewable energy sources that hold the potential to provide sufficient electricity for all Mozambicans . Unfortunately, these difficult decisions about the future of energy sovereignty in Mozambique are being clouded by perverse incentives, a lack of information or incorrect information, and a failure of communication.

Hopefully, this report will shed some needed light on the potential implications of these developments to better inform policy for this sector. Given the huge oil blowout in the Gulf of Mexico, involving similar work to and some of the same investors now exploring offshore Mozambique, it is imperative that this report also serve to fuel more comprehensive and continuing investigations into the very possible environmental and social impacts that any oil development would have along the coast of Mozambique

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MAJOR FINDINGS

The starkest results of this study were not merely the impacts that were reported by coastal communities during and after the shallow water seismic program in May 2009, but also the fact that any necessarily detailed ecological and socioeconomic study of potential impacts before the program should have predicted them.

Issues Reported:

- Shallow water bottom feeding sea-grass fish died en mass

- If this reduction in fish was caused by the seismic program, this would imply that the assumption in the EIA that fish would return within two days of hearing seismic explosions from sea-floor cables (Shallow Water Seismic Compensation Plan) is incorrect.

- The EIA habitat sensitivity mapping acknowledged the potential sensitivity of motile epifaunal invertebrates, plankton and larval fishes, and juvenile fishes in the sea grass beds (Rovuma Area 1 shallow water seismic EIA specialist studies, volume III, Environmental Sensitivity Analysis of Selected Marine Habitats to Shallow Water Seismic Survey and Exploratory Drilling Operations within the Rovuma Offshore Area 1, Mozambique, pg 28 (pg215/250 of volume III), but did not include any specific buffers for sea grass beds in the final assessment of seismic lines.

- Possible red tide triggered

- Eight of the communities interviewed reported several signs of a 'red tide': light in the water at night (caused by photoluminescent dynoflagelates or phytoplankton), red, brown and murky water, high turbidity, and rashes on people who spent time in the water.

- Shellfish deaths

- Three species of mollusk were found dead on the beaches of one community starting the second day of the program.

- Turtle deaths

- Six turtles were found dead by communities during the seismic program

- Hearing Impacts

- Several harpoon fishermen from communities within the seismic program area suffered hearing injuries from the seismic guns firing when they went fishing during the program, having not heard or not understood the warnings about fishing underwater close to the seismic vessels

- Dietary impacts

- Many fishermen did not fish at all for extended periods of time during the seismic program due to miscommunication and misunderstandings about communities' rights to fish during the program

- Unrealistic and highly impractical compensation process for local fishermen

- While fishermen were told to stay out of the areas where the seismic vessels were operating, and a vast majority did, none of these fishermen were entitled to compensation even though they provided right-of-way to the seismic vessels and made their job easier by staying out of the water. Very few fishermen reported successfully fishing in an "alternative" area during the program, and thus staying out of their primary area during the program constituted a complete halt to fishing for them.

- As it turned out, not a single metical was paid in compensation for the entire shallow water seismic program despite the fact that a vast majority of the fishermen interviewed by our team noted either they did not fish at all during the program, or they could not effectively fish in their "alternative" areas.

- Perhaps what is most alarming about this compensation plan is the ease at which large tourism operators were able to gain compensation for lost days of dive tours, without having to provide proof that they were in the process of providing a tour when encountered on the sea by the chase vessels, while fishermen were required to provide direct proof they were interrupted in the process of fishing by the seismic vessel.

- When asked what information the teams from the oil company and consultant company had provided to the community, only two communities reported being told about the compensation plan. This means that only two communities reported even knowing that there was a way to claim compensation if their fishing was interrupted by the seismic vessels.

MAJOR RECOMMENDATIONS

Based on these findings, this report recommends:

1. Shift towards the **precautionary approach** to these programs, treating

2. **Independent** research to develop a complete and scientifically rigorous **baseline** of the marine ecosystems of this region for each season.

3. **Real-time** monitoring of actual environmental and social impacts from exploration and production programs by an independent entity. This entity should not be the same consultant company hired to conduct the EIA and EMP for the program.

4. **Ex-Post** evaluation of environmental and social impacts from exploration and production programs as an integral part of the environmental management plan

5. The creation of a **permanent standing commission** made up of interested parties to receive and appraise on a regular basis the results of points 2, 3 and 4 above, with all reports published in an open and transparent manner.

6. Separation of the investment-promotion and regulatory functions of INP to reduce conflicts of interest.

7. Strengthening and financing of MICOA to allow it to more effectively monitor and enforce environmental regulations pertaining to these projects, and **IDPPE** in order to improve quantity and consistency of fish catch data.

8. Alter EIA process to have **investing companies** for Category A and B projects **pay EIA fees to MICOA**, who would then select consultants to conduct the **EIAs based on open bidding processes**, MICOA retaining a percentage of the fees for their own increased costs in evaluating and monitoring these investments, potentially fee-sharing with IDPPE for fisheries areas potentially impacted.

9. Moratorium on oil and gas developments until these pre-conditions for adequate environmental and social protections are met

Photo by: Daniel Ribeiro

1 - BACKGROUND/INTRODUCTION/OIL AND GAS CONTEXT FOR MOZAMBIQUE AND REGION

REASSESSING OIL AND DEVELOPMENT

The coastal ecosystem of northern Mozambique and the Mozambican channel more generally represent incredibly environmentally sensitive marine ecosystems. 80% of the population living within these coastal areas depends upon their fisheries for their sustenance. The vast majority of these fishermen practice small-scale artisanal fishing, generally for daily protein and a little extra to sell. Given the sensitivity of both these ecosystems, and the livelihoods dependent upon them, potential oil and gas development must be considered with extra caution.

Nearly a year since the Gulf of Mexico oil spill was capped, the shrimp harvest that started in May 2011 has been dismal. The toll on coastal fishing in Mozambique given a spill of equal size would be unimaginable. The deep-water offshore drilling in northern Mozambique involves some of the same investors, similar habitat sensitivity mapping, and similar blowout prevention equipment as involved in the Gulf of Mexico Deepwater Horizon Well (EIA volume II, Section 2.3.5, pg 2-17 and New York Times Documents on Oil Spill

--**http://documents.nytimes.com/documents-on-the-oil-spill?ref=us#document/p1**; -- **http://www.nytimes.com/2010/06/21/us/21blowout.html?pagewanted=all**

The Gulf of Mexico deep-water spill demonstrates serious problems with over-generalized EIAs, and the perverse incentives operating for the oil and gas industry. For the well in question, no specific EIA was conducted, as the U.S. Mineral Mining Service granted "categorical exclusions" for exploration programs and sites deemed "substantially similar" to those with existing EIAs. As was the case with this particular site, complications arose, cost-cutting technologic decisions were made, and there were no EIA specific re-evaluation or enforcement requirements regarding these ad-hoc decisions, eventually resulting in the current blowout. The political result of this, to date, has been a moratorium on the granting of "categorical exclusions" and a review by the U.S. Justice Department of the entire policy, in addition to a lawsuits filed by the U.S. Federal Government against all of the companies invested in the particular well that blew out.

More specific lessons to take from the Gulf of Mexico experience are that while independent habitat sensitivity mapping and a Mozambique-coast-wide Strategic Environmental Assessment (SEA) are extremely important for mapping where there are areas far too sensitive to allow exploration, these do not substitute for the need for independent and rigorous individual EIAs for each project after specific seismic line locations and well sites have been chosen.

What this means for Mozambique is that investors need to be treated as competitors at the negotiating table, not partners. While they may offer to fund social programs as promoted by Mozambican law, they are not non-profit agencies, but for-profit agencies, and thus are concerned primarily with maximizing the return on their investment. Thus Mozambique must make demands on investors to safeguard coastal environments and livelihoods. This means that the primary role of the government in these cases is as a strict and stringent regulator, not a marketer or lobbyer for investment. It is geology, not investment incentives that has been attracting investors to the natural resource sector of Mozambique. This can be used as leverage to make greater environmental and social demands, but government institutions responsible for regulating these investors need to recognize this.

EMERGING POLICY AND REGULATORY ISSUES – PERVERSE INCENTIVES AND CONFLICTS OF INTEREST

With the drastic increase in the price of oil over the last decade, Mozambique has seen a renewed interest in its oil and gas geology that had been on hiatus for over a decade in some regions. Unfortunately, increasing interest in oil and gas exploration in Mozambique is not being met with an equally increasing capacity to effectively and independently regulate these operations.

The 2001 Petroleum law split the commercial and regulatory functions of ENH into ENH (Commercial) and INP (Regulatory), but it did not separate the investment marketing and investment regulating functions within INP, which is where another major conflict of interest lies. This has led to a lack of serious commitment to environmental and social regulation of recent exploratory programs.

Additionally, the time-frame and contractual process for new exploration agreements creates a contradiction for effective environmental evaluation. MICOA is assigned the duty of evaluating EIAs, and EIAs are mandatory for the industry, but the EIA process is only conducted after the EPC contracts are formally signed, which include often stringent investment timelines. This means that if a particular project is determined to have too serious a potential impact on the coastal environment or livelihoods to go forward, or at the very least requiring extreme caution and re-evaluation of exploration programs, the only way the government can effectively enforce this is to break a formal legal contract that could require they pay fines and damages to the oil company. In fact, the environmental management plan for Anadarko's Shallow Water Seismic Program in Block 1a states clearly: "The "No Action" alternative represents a failure to meet the requirements of the EPC between AMA1 and the Government of Mozambique." (Final EIA for Shallow Water Seismic Program in Rovuma Area 1, Part II, Chapter 3, section 1.1, pg 3-1, 2008).

Conducting a nation-wide strategic environmental assessment to determine which zones to pre-emptively exclude entirely from consideration of oil and gas exploration, would be a valuable first step. This has been proposed several times but has never progressed. It would only function if it were done in an independent and scientifically sound manner. This would alleviate some of the contradictions of the contract model, but the core principle of independent environmental impact assessment of individual projects is that they are conducted scientifically and without bias, meaning there will still be the potential for findings that certain projects cannot be conducted or require substantial re-formulation in order to avoid unacceptable environmental and social impacts. The inherent contradiction in contract law would still exist. An ideal situation would be to separate the marketing and regulating functions of the INP in order to assure greater independence of the regulatory branch.

However, even if MICOA had the ability to halt a project without breaking contract terms, the companies conducting the EIAs are hired directly by the project investors. This creates a direct conflict of interest in purely financial terms between the investor choosing the EIA consultants and the EIA consultants potentially halting a project on environmental terms. Many countries face a similar conflict of interest, but this could be improved by having MICOA select the

consultant companies from qualified bids, much like INP selects investors from a qualified set of bids. The project investors could pay into a MICOA fund that would be used both to fund the EIAs, and to support MICOA's oversight responsibilities for these projects, which at the moment is direly underfunded.

Under the current model, due to the contractual terms of the EPC contracts as signed by the government and the investor, EIAs are generally required to be completed within a month or two. Any longer would threaten the contractual time-frame previously agreed upon.

This means that in regions lacking multi-year and multi-season baseline studies and data, EIAs tend towards presenting a static snapshot of an ecosystem, rather than the fluctuating flows and relationships that define complete ecosystems more accurately. Unfortunately, as there have now been quite a few EIAs conducted for the Northern Mozambican coast, these previously limited snap-shots are being used as baseline data for current EIAs, thus compounding the problem.

Photo by: Daniel Ribeiro

2 - RESEARCH PROGRAM ON SOCIAL AND ENVIRONMENTAL IMPACTS OF EXPLORATION

Given the above noted problems emerging from the policy and regulatory side of oil exploration, Justica Ambiental decided to conduct a field research case study along the coast from Macomia to the border with Tanzania to assess the social and environmental impacts of a marine seismic program at the site of exploration. The research program conducted interviews predominantly with coastal fishermen in sixteen coastal communities in the Districts of Palma, Mocimboa da Praia and Macomia, extending most of the north-south length of the shallow water seismic program conducted in May and June of 2009 in Rovuma Area 1, two months prior to the field visit. Fishermen were interviewed primarily about changes in the sea they had witnessed during and after the shallow water seismic program and the conditions of the sea at the time of the interview, correcting for the normal seasonal changes from Kusi to Kaskasi winds. Fishermen were also asked about the consultations the EMP team held with the community before the program, the communication plan consultations during the program, and any post-program consultations. Finally, they were interviewed about their understanding of the program, and their rights and responsibilities during the program, including times they were informed to avoid their primary fishing areas and how compensation was to be requested.

Photo by: Daniel Ribeiro

The significance of the environmental changes recorded by the study and their temporal correlation with the shallow water 3D seismic program and deep water 2D seismic program demand a shift towards the precautionary approach to these programs, and further, fully funded, independent research to develop a complete and scientifically rigorous baseline of the marine ecosystems of this region for each season.

2.1 - SHALLOW WATER SEISMIC PROGRAM DESCRIPTION OF EXPLORATION

This field investigation was conducted roughly a month and a half after a shallow water 2D seismic operation in Area 1 of the Rovuma Basin in Northern Mozambique. While the environmental impact assessment for the project included an assessment of impacts for at least three wells in addition to the seismic program, this field investigation only considered the impacts of the seismic program, as drilling had not commenced at the time of the investigation.

The seismic program conducted from May 8th to May 29th 2009 was a 2D shallow water survey. The survey progressed in two phases, one for waters deeper than 50 meters, and another for the shallower waters. For waters less than 50 meters, a combination of sea-floor cables and ocean surface cables were used depending upon how shallow the water was. For the shallowest waters, sea floor cables were used as the surface cables could be damaged. As this phase of the seismic exploration was entirely 2D, the boats that did use streamers only used a single line.

Marine seismic exploration involves firing high decibel air guns under water and recording the sound waves as they bounce off the sea floor and sub-sea-floor geologic strata. This data is then used to determine the geology beneath the sea floor, and the likelihood of hydrocarbons and the formations that trap them. These air guns fire at about 200 decibels ever 7 to 15 seconds, 24 hours a day, for several months at a time. This particular seismic program included about 5,000km of seismic "lines", meaning the boat traveled for 5,000km in lines back and forth across the shallow water areas of Area 1 in the Rovuma Basin offshore area.

Figure 1: Hatched area represents rough location of the shallow water seismic program (source: Impacto ltd. Final EIA-Non-technical summary for Shallow Water Exploration Seismic Survey and Exploration Drilling, Rovuma Area 1)

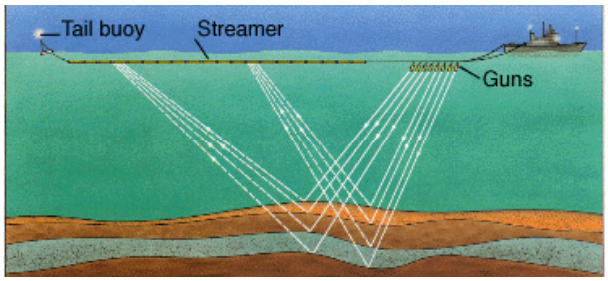

Figure 2: 2D seismic using streamers.

Figure 3: "minimum water depth 5.5 M" (the final seismic line vessel reportS-Source: **www.farallones.org.com**

2.2 - IMPACTS

FISH DEATHS AND CATCH REDUCTIONS

The most commonly reported change in environmental factors along the coastal waters during and after the program were reductions in fish catches. Nearly 60% of the communities interviewed reported reductions in fish catches during the program (when they heard announcements on radio to fish in alternative areas), while nearly 80% reported reductions in fish catches after the program. Of the communities reporting fish catch reductions during and after the program, the average catch was only 15% of normal for the season. For the communities with alternative fishing areas, only two reported these being viable during the program. Significantly, all the fishermen that reported fish catch reductions said catches had not returned to normal by the time of the interview (August 2009), over two months after the program. This implies that fish either died or permanently fled to new locations. As much of what fishermen catch along the coast are not large pelagics and do not migrate long distances, and given the consistency of reports along the entire stretch of coastline from Quionga to Quiterajo, the stronger likelihood is that many reef fish and bottom-feeders died. If this reduction in fish was caused by the seismic program, this would imply that the assumption in the EIA that fish would return within two days of hearing seismic explosions from sea-floor cables (Shallow Water Seismic Compensation Plan) is incorrect.

A mass bottom-feeding fish die-off appeared on the beach in one community. The community in Maganja reported that the entire beach was covered in dead "Peixe-Sapato' Bacalhao, Linguade," starting the second day of the shallow water exploration program. The dead fish covered several kilometers of beach. While other communities did not report similar scales of die-offs, six other communities reported fish deaths during the shallow water seismic program. This is likely because of the sea-grass beds offshore Maganja that provide a home for the particular bottom-feeding species of fish that died. This would seem to imply that sea-grass fish do not flee sound sourced beyond the limits of the sea grass beds, as these locations supposedly included soft-starts.

The EIA habitat sensitivity mapping acknowledges the potential sensitivity of motile epifaunal invertebrates, plankton and larval fishes, and juvenile fishes in the sea grass beds (Rovuma Area 1 shallow water seismic EIA specialist studies, volume III, Environmental Sensitivity Analysis of Selected Marine Habitats to Shallow Water Seismic Survey and Exploratory Drilling Operations within the Rovuma Offshore Area 1, Mozambique, pg 28 (pg215/250 of volume III), but did not include any specific buffers for sea grass beds in the final assessment of seismic lines.

Olumbe, the community just south of Maganja, reported the death of some juvenile fishes during the program. Fishermen in Ulo, a community further south, reported finding several fish dead per day on the coast of Ilha Tambuzi during the program. Interestingly, the communities further south in the concession reported deaths of larger fish. Several dead sharks and rays were found in the southern reaches as well.

Reductions in fish catches during and after the shallow water seismic program as reported by fishermen presented substantial socioeconomic difficulties for coastal communities (and likely interior communities also relying on fish-based protein). Two of the communities with fish reductions during and after the program reported fish disappearing almost entirely during the program. Maganja, the community close to the beach where large amounts of dead fish and

shellfish washed up, reported not only fish, but shellfish disappearing from coastal waters during the seismic program.

These catch reductions have serious implications for coastal livelihoods beyond the direct dietary implications noted above. The socioeconomic system of the coastal areas is in large part driven by the artisanal fishing sector. When fish stop arriving on the beach, it is not only immediate consumption that is hurt, but household economics and internal dynamics, community economics, and the broader dried-fish trade networks extending into the interior. During the time when fishermen were prohibited from fishing in their primary areas, fishermen in four communities reported relying predominantly on credit from local merchants, while three communities reported relying on manioc from household farms as the sole food source during the program, several others reported selling coconuts in Mocimboa da Praia, and a few reported ignoring prohibitions against fishing in their areas and going out when they did not see the boats. For most who did not have alternative fishing areas, income largely disappeared during the time of the seismic study, and for others, for a while afterwards as fishermen had to pay back the credit they borrowed for consumption purposes during the seismic program.

In one village, fishermen noted some fishermen borrowed up to MTN2,000 during the month they believed they were prohibited from fishing. This adds up to about MTN70 per day, which corresponds to about 3kg of fish per day in catch, on the lower end of catches. This amount would take quite a while for the average fisherman to repay.

Yet, despite the information provided by fishermen during our field visit, the closing report for the EIA for the shallow water seismic program noted *"[n]enhum impacto social foi registado e não houve reclamações relacionadas a actividade do navio sísmico."* (EIA closing report) It is unclear what the source of this claim is besides the few visits the communication team made to the communities, but as only one community reported the team returning after the end of the program, and then only to announce the end of the program, there did not seem to be any ex-post interviewing to determine whether there were any complaints about the program from the communities.

The complaints registered by our visit certainly warrant independent, systematic ex-post interviews in every community to determine comprehensively the extent of the complaints. Returning to the notion of conflict of interest, if the company doing the evaluation is the same company that designed the communication plan and environmental management plan and carried them out, there is little incentive to register complaints about those plans when the program is over.

IMPACTS ON OTHER MARINE ORGANISMS

Turtle and Marine Mammal Deaths: In addition to sea-grass and reef fish, turtle and dolphin deaths were also reported, although exclusively in the southern communities. Of the six turtles found dead, Nabadye and Quiterajo reported several of the turtles having tags, likely from one of the current Southern African studies. Only one community reported dolphin deaths, although a tour operator in the region did note that since a past seismic study in 2008 a particular pod of dolphins that they had been tracking disappeared, appearing only sporadically now.

Mollusk Deaths: Finally, there were reports of mollusk deaths, also in the sea grass beds near Maganja. Three species, in particular, were cited by fishermen as those that appeared in abundance on the beaches of Maganja, as seen in Figure 1. There are few studies internationally on the impacts of seismic sound sources on Mollusks, but given the proximity of the sound sources to the sea floor during the shallow water seismic program (5m depth), it is possible their greater abundance in the sea grass beds likewise led to their higher death rate on the beaches of Maganja.

Photo by: Daniel Ribeiro (Mollusk species found dead on Maganja beach on second day of shallow water seismic program).

Possible Red Tide Triggered: Perhaps the most alarming impact on marine organisms during the seismic study was the occurrence of a photoluminescent phytoplankton bloom, perhaps a 'red tide'. Eight of the communities interviewed reported several signs of a 'red tide': light in the water at night (caused by photoluminescent dynoflagelites or phytoplankton), red, brown and murky water, high turbidity, and rashes on people who spent time in the water.

While the causes of 'red tides' are not known well, Prof. Wolfgang Burger, a geologist and former Interim Director of the Scripps Institute of Oceanography in San Diego, notes that 'red tides' can be triggered by a shallow water "mixing event," such as a storm or seismic program, if followed by sufficient sunshine. Marasovic (1989) argues for similar causes of red tides. While not all 'red tides' are toxic, they often are. Additionally, while 'red tides' do occur naturally in this region, marine biologists familiar with the region note that they are occurring more often recently. Given the disruptive nature of even the non-toxic red tides, any increase in occurrence of these tides would be problematic for the marine ecosystem.

Regardless of the particular nature of the phytoplankton bloom, four communities reported high levels of turbidity, three of which also reported bioluminescent phytoplankton. While this agrees with the above cited causes of blooms, even without a bloom, excessive turbidity can be disruptive to marine ecosystems. This excessive mixing of the waters in shallower areas blocks sunlight and can cause serious disruptions to sea-grass, algae and coral ecosystems, all dependent upon photosynthesis as the basis of the food chain. This could have been another reason, independent of any 'red tide,' for the reductions in fish catches during the seismic program. Again, while storms can cause turbidity in these systems each year, adding additional periods of time in which these systems must compensate with lower levels of photosynthetic energy and oxygen levels can be disruptive. Red tides are not uncommon in the region, but due to increasing intensity, have been cited as a major contributor to the coral deaths after the El Nino year in 1998.

HEALTH IMPACTS

Hearing Impacts for Diving Fishermen: Several fishermen from three communities in the central to southern reach of the seismic program reported hearing problems after diving during the seismic program which had not improved two months later. 80% of the communities interviewed reported hearing the seismic guns firing above water, either on the coast or in boats, and 60% of communities interviewed had fishermen who reported hearing the sounds below water. This likely reflects not only the few fishermen who went diving regardless of the presence of the seismic vessels, but also those bathing or collecting fish close to the beach. Regardless, the presence of fishermen reporting hearing problems during and after a seismic program is concerning and cause for further investigation by the authorities.

Rashes from Possible Triggered 'Red Tide': Fishermen reported rashes caused by the photoluminescent phytoplankton bloom, likely a 'red tide', as noted

above, which began within a few days of the beginning of the seismic program and continued for a few weeks afterwards. The bloom lasted quite a while even after it peaked, however, as this team witnessed elevated levels of photoluminescence in the waters north of Pangaan in the middle of August, over two months after the end of the seismic study. The intensity of the rashes was not reported to be severe, but noticeable for fishermen quite accustomed to the normal levels of photoluminescent phytoplankton that occurs in the region. Another possibility is that the triggered bloom in photoluminescent phytoplankton, or the seismic air gun disturbance of coastal waters itself led to the release of jellyfish larvae which can sting even at the early phase of growth. Jellyfish larvae are known to detach from rocks with increases in phytoplankton or other disturbances.

Decrease in Available Dietary Protein: An additional indirect health impact noted by fishermen was the obvious lack of protein caused by the lack of fishing by a majority of the community during the time of the study, and for some communities, for a time afterward due to misunderstandings or miscommunication. Many relied more heavily on cassava and lanhas during this time period, but there was little protein substitute during the period. This can present significant health difficulties for those already suffering from other health and nutritional problems. For those families that went for longer than several weeks without a sufficient protein source, this presented a serious stress. This team did not include questions regarding indirect health impacts from diet, so we do not have data on any health problems that may have occurred due to dietary changes.

LACK OF ACCESS TO COMPENSATION

Seven communities were restricted from fishing in their primary fishing area, two of whom had no alternative fishing area, and the rest of whom could not catch sufficient fish in their alternative areas to warrant the trips. One community even reported the seismic vessels had occupied their alternative area as well as their primary area. Again, the closing report for the EMP for the shallow water seismic program reports that fishing continued as if there were no seismic program, and thus there was no change to fishing habits. It is unclear why they made this assertion given the reports from fishermen that our team collected.

Given these lost days of fishing for many of the communities interviewed, it seems astonishing that not a single person in any of the communities registered a formal request for compensation. However, the design of the compensation plan, and a lack of information about this plan provided to fishermen may have been the cause of this gap. When asked what information the teams from the oil company and consultant company had provided to the community, only two communities reported being told about the compensation plan. This means that only two communities reported even knowing that there was a way to claim compensation if their fishing was interrupted by the seismic vessels.

Photo : from FLO Closing report for EMP for Anadarko Shallow Water Seismic Program in Area 1).

However, even if they had known the process for registering a request for compensation, the restrictions the company placed on requests for compensation would have greatly limited the likelihood of a successful claim. As stated in the compensation plan attached to the final EIA for the Shallow Water Seismic Program, only those fishermen interrupted from

actively fishing (i.e. actually in the act of fishing at the time of contact) by the seismic chase vessels would be eligible for compensation, contingent upon the chase vessels actually registering the name of the boat captain, equipment, and other relevant information, and the fishermen following up this contact with a formal request to neighborhood secretaries, heads of administrative posts, or district administrators. Anadarko's compensation plan for the program indicated that upon contact with a chase vessel, the fishermen would be given a contact so that they could then file for individual compensation with the company, if the fisherman was literally in the act of fishing when encountered by the boat. While fishermen in five communities reported encountering chase vessels during the seismic, not a single fisherman was given any contact information by the chase vessel for later registration for compensation. The FLO final report for the shallow water seismic 2d program mentions the seismic vessel encountering sail boats and canoes of locals every day, and warning them away due to the seismic operations. The report even mentions physically towing some sail boats away from the seismic operation due to low winds. Technically, as per the compensation plan, at least some of these fishermen (the ones in the act of fishing) should have been given contact information from the chase vessel and directions for how they could claim compensation for that day. It is extremely unlikely that given the number of fishermen encountered during the program, none of them were actually fishing at the time of the encounter. This seems to be in direct violation of Anadarko's own compensation plan.

This process raises several concerns. First of all, the report itself notes that there were chase vessel contacts with fishermen every day, yet none of these resulted in a claim for compensation despite fishermen in these communities actively believing they were owed compensation. Given our findings, this was likely a result of fishermen not knowing they could file a claim with their local neighborhood or village administrator. However, beyond the problems of communication, there are contradictions in the approach to the compensation plan. While fishermen were told to stay out of the areas where the seismic vessels were operating, and a vast majority did, none of these fishermen were entitled to compensation even though they provided right-of-way to the seismic vessels and made their job easier by staying out of the water. As noted above, few fishermen reported successfully fishing in an "alternative" area during the program, and thus staying out of their primary area during the program constituted a complete halt to fishing for them. Why only those fishermen who ignored the restrictions and went fishing anyway would be eligible for compensation granted rights to file for compensation is unclear. Additionally, why only those fishermen who were interrupted in the act of fishing, as opposed to heading towards their fishing site, would be eligible for compensation seems unfair. The predominant fishing areas of different communities were documented, but a procedure allowing for standard compensation during the times when these areas, or access to these areas, were restricted was not implemented.

As it turned out, not a single metical was paid in compensation for the entire shallow water seismic program despite the fact that a vast majority of the fishermen interviewed by our team noted either they did not fish at all during the program, or they could not effectively fish in their "alternative" areas. The only communities that noted functional alternative areas were Pangaan, where they could fish the other side of the peninsula, and Quionga and Quirindi, where fishermen reported either the seismic operations were far away from their primary fishing areas or they had functional secondary fishing areas. This was likely due to several factors, some of which were discussed above. Obviously, not all fishermen knew the correct process for registering a complaint, and many we interviewed did not even know of a compensation plan. Secondly, as the communication team and the radio announcements specifically stated that fishermen should stay out of the water when the seismic vessel was in their area, many listened and stayed out of the water on those days, with no recourse to

compensation. Thirdly, those that did not listen to the radio announcements and communication team were often going fishing against the will of their neighborhood secretaries, administrative post directors, and district administrators, given these members of local government had agreed to keep fishermen in their communities out of the water when instructed. As these were the same people to whom the fishermen were supposed to file requests for compensation on those days they did not obey the requests to stay out of the water, the fear of retribution likely had a significant impact on those few fishermen who knew of the compensation process.

However, an additional concern arises when reading through the Fisheries Liaison Officer (FLO) report for the Shallow Water 2D Seismic. This reports lists contact with numerous fishing vessels, both sailing and canoe, during the program, but does not provide any details whatsoever on the individual contacts. Thus it is impossible to determine from this report whether there were any incidents which met the criteria for compensation as per the EIA compensation plan. It is unclear whether the detail was intentionally left out of the report or not recorded properly as per the compensation plan requirements noted above.

Perhaps what is most alarming about this compensation plan is the ease at which large tourism operators were able to gain compensation for lost days of dive tours, without having to provide proof that they were in the process of providing a tour when encountered on the sea by the chase vessels. This is a clear double standard, and one that makes little sense given the quite low amounts of compensation that would have been paid to artisanal fishermen for lost days of fishing. The logic used in the compensation plan is flawed, arguing that because the majority of fishermen have alternative fishing areas or alternative sources of revenue from trade, the impacts of the seismic program on their household economies would be slight, and thus, by implication, not important to consider more than superficially. While the basic premise of this argument is flawed (artisanal fishermen cannot consistently rely on "alternative" sources of revenue because these themselves are "back up plans" and limited in the time and extent to which they are accessible), the argument itself is not equally applied to large tourism operators, who also have "alternative" sources of revenue to dive tours.

Photo by: Daniel Ribeiro

The argument presented in the shallow water seismic compensation plan that because there is insufficient baseline fish catch data over long periods of time, it is impossible to confirm seismic impacts on individual fish catches is also flawed. While long term fish catch data is spotty in Mozambique because IDPPE does not have sufficient resources to carry out its responsibilities, this does not mean that sufficient pre-program and real-time monitoring of fish catches could not have generated approximate data on at least short-term impacts of the seismic program.

However, given the potential benefits the oil company will get from this exploration, it would be reasonable to request funding from the company to augment the resources and training for IDPPE to begin collecting scientifically accurate and complete fish catch data for each of its field stations. This would at the very least provide a general picture from which to evaluate sudden changes in fish catches during or after seismic programs, for instance.

LACK OF INFORMATION, CONSULTATION, PARTICIPATION

While the communication plan developed by the Impacto team for the Shallow water seismic program was a welcome response to miscommunication difficulties that arose from prior seismic programs along the northern coast, fishermen in communities interviewed in August of 2009 did not report as extensive a communication process as was reported by the communication team. All the communities reported being visited by at least one team from the EMP contractor, but the scale of communication reported varied widely. Two communities reported four visits by teams, before and after the program, but only four communities questioned said they had been visited more than once before, during and after the program. When questioned on the content of the communications from the teams, all of them reported the primary message of the teams was that they could not fish in their primary areas during certain times, and if they did they would be seriously injured or die.

Perhaps the most problematic, was that only one community questioned said the communication team returned after the program, and then only to say the program had ended. Thus no communities interviewed reported a post-program assessment done with fishermen to see whether there were any complaints of problems that had arisen during the program. If this had been done, many if not all of the problems found by our research team would have been caught and the company would have been given the chance to address these. As it stands now, many fishermen in the area of these studies are frustrated with what they see as a lack of consideration of their lives and needs.

While the closing report of the EMP notes that the local government noted no complaints or problems from the program, they only held their closing evaluations in the district headquarters, and thus in the presence of the District Administrators, who are seen as enforcers of central government regulations rather than representatives of the communities. It is unlikely that the local government officials at those meetings would have felt entirely free to report any problems or complaints. If the company is genuinely interested in evaluating the impacts of their program on fishermen, they are going to have to go directly to the source, the fishermen themselves, as authority in rural areas is not always conducive to sharing potentially damaging information.

Lastly, the EIA was conducted before the final locations of either the seismic lines or the drill sites were known. It was argued by the consultants and primary concession holder that this was in part to allow the results of the sensitivity mapping to be incorporated into the siting determination, but it is unclear whether this actually happened, as the follow up reports were never made available to JA. This lack of clear knowledge of where the actual activities occurred make it especially hard to monitor and evaluate potential impacts from the program. If this is an attempt to mimic the "categorical exemptions" provided by the United States Mineral Mining Service to oil companies in the Gulf of Mexico, it is obvious now this should not be allowed.

LACK OF INDEPENDENT MONITORING

The research on which this current report is written was conducted in August 2009, the earliest date at which a team and equipment could be organized after the shallow water seismic program. While we uncovered strong evidence of environmental problems occurring during and after the shallow water seismic program, this is no substitute for an independent,

real-time evaluation of impacts during the actual seismic program. The current situation, with the project sponsor selecting and paying for the EIA and EMP teams directly, housing them in their corporate field offices, and limiting the teams to monitoring resources selected by the company does not create the necessary conditions for independent evaluation. The key concern that seems to be lacking in much of the licensing system for EIAs in Mozambique is avoiding conflict of interest.

The results of this less-than-ideal monitoring are evidenced in the Marine Mammal Observation Report for the Shallow Water Seismic program. First of all, the passive acoustic monitoring software (PAMguard) used to filter the data from the passive acoustic monitors has industry funding, being a project of the International Association of Oil and Gas Producers (an industry coalition) E&P (Exploration and Production) Sound and Marine Life Joint Industry Program. Their website notes that the objective of the program is to "obtain scientifically valid data on the effects of the sounds produced by the E&P industry on marine life" (**http://www.soundandmarinelife.org/**, **accessed 9-24-09**). Given the direct incentive for the industry to underestimate impacts of seismic exploration on marine mammals, industry-sponsored monitoring software does not inspire confidence.

Secondly, the MMO concept is flawed to begin with. In the MMO report for the deepwater seismic work, they reported the sea in "good [viewing] conditions" for 52% of the survey time, meaning that for 48% of the time the sea was not in "good condition" and thus the MMO would have been less effective (MMO report for Anadarko Shallow Water). Additionally, MMOs and/or PAM detected marine mammals or turtles on 26 occasions (11 PAM and 15 visual) during the entire month-long shallow water study, despite noting that the seismic guns did not seem to scare away the mammals. This is contrary to the assumptions made by the consultants and company in the EIA, and in fact the entire reason for the "soft starts". The deep water sightings were not much higher.

During the entire program, the PAM only detected four creatures, all dolphins, unidentified (MMO report for Anadarko deep water seismic), while the MMO detected 33 animals, 47% of which were dolphins, but did detect two whales. In fact, the average distance of the marine mammals detected during the deep water seismic was closer when the air guns were firing than when they were not (MMO report Anadarko deep seismic). Given the low number of detections, this seems to be further proof that the detection methodology is flawed. 26 sightings during a month study is less than an animal per day, extremely low for the region given the 24 hour nature of the seismic study. Additionally, as the MMO effectively detected 17 marine mammals, and the PAM only detected four, it seems the detection rate for the PAM is quite low.

With the evidence of a large bottom-feeding seagrass fish die off during the shallow water program, the lack of real-time monitoring seems all the more problematic. The only real-time monitoring that occurred during the program was for marine mammals and turtles. Given the spatially localized concern for the particular coral and sea-grass marine ecosystems along the northern coast of Mozambique, it is unclear why there was no real-time monitoring for impacts on non-migratory species of particular relevance to those systems.

Further, there was no ex-post monitoring of any marine organisms. Thus there were no reports of any problems with these organisms from the company or the consultants hired to conduct monitoring. Given the lack of independent, peer-reviewed scientific baseline studies of the marine ecology of the region, it is all the more problematic to not have ex-post evaluation of impacts. If there had been, many of the issues raised by our team's field study would have been noted and addressed by the company and consultant teams. As it now stands, it is hoped that this study is sufficient to raise the concern for these types of ex-post evaluations in the future.

3 - CONCLUSION

Given the reality of the "habitat sensitivity/SEA" environmental assessment model in the Gulf of Mexico, and the impacts reported from shallow water seismic work in northern Mozambique, it is clear that current approaches to the management of impacts from oil exploration pose serious threats to the unique marine ecosystem of northern Mozambique and coastal livelihoods dependent upon that system. Contrary to beliefs prevalent in EIAs conducted for oil exploration in Mozambique to date, while fishermen do have coping mechanisms for times of reduced fish catches, these are insufficient to maintain livelihoods for any extended period of time, and certainly not for the entire northern coast. When people are impoverished, even small disruptions are more deeply felt. If something were to seriously impact fish stocks along the entire northern coast, existing coping mechanisms would be stretched too thin to compensate.

This report makes it clear that Mozambique needs to undertake more careful analysis of the real costs and benefits of oil and gas exploration and production in Mozambique, given preliminary results of research already conducted, and the overwhelming majority of literature on extractive resource-dependent developing economies.

RECOMMENDATIONS

1. Conduct a nation-wide coastal strategic environmental assessment to determine zones restricting extractive industry development.

2. Conduct independent, scientific, peer-reviewed studies of the coastal marine ecosystems of northern Mozambique in order to establish a rigorous set of baseline information (although this will not technically be baseline as exploration has already commenced and the ecosystem has already been impacted). Relying on environmental consultant companies to deliver unbiased and scientifically rigorous baseline data is both illogical and unfeasible – illogical because these consultant companies' business depend upon continuing to deliver favorable results to the investing oil companies, and unfeasible because their contracts are designed to be completed in one to two months, and do not allow for long-term investigations into the seasonal patterns of marine ecosystems. This would include annual seasonal surveys of key indicator species for each marine ecosystem in order to allow diagnosis of background changes to ecosystems as well as changes directly correlated with seismic programs or drilling. This could be a collaboration between tour operators, the Quirimbas National Park, IDPPE, IIP, UEM and other institutions concerned with marine ecosystem health in the region.

3. Require independent real-time and ex-post monitoring of impacts from any Category A project. Having the same company that is hired by the oil investor also manage environmental monitoring is a clear conflict of interest.

4. Place selection of EIA companies within MICOA's responsibilities, to be based on and open bidding process. Project investors would pay into a MICOA fund that would cover costs of EIAs plus administrative overhead to cover MICOAs evaluation, monitoring and enforcement costs.

5. Improve consistency and quality of fish catch data for region and make available to pub**lic.** fish

catch surveys of various fishing centers, but lack the personnel and resources to make these scientifically rigorous and standardized across Mozambique. Given the potential benefits the oil company will get from this exploration, it would be reasonable to request funding from the company to augment the resources and training for IDPPE to begin collecting scientifically accurate and complete fish catch data for each of its field stations. This would at the very least provide a general picture from which to evaluate sudden changes in fish catches during or after seismic programs, for instance.

6. As the livelihoods of fishing communities depends directly upon the continued ability to fish, programs such as this should ensure that fishermen along the coast have a voice in the process itself. It is not clear that any of the habitat sensitivity mapping took into consideration dominant fishing areas beyond the often links between fishing areas and coral reefs. Considering reports from this field research, it is not clear that even these designated habitats were avoided. If the government of Mozambique wishes to put Mozambican communities' livelihoods on hold, potentially permanently disrupting them, then the affected communities should have an equal voice in the matter. This could involve setting up a community council in areas of future programs that would determine exclusion zones for fishing and collecting.

7. Shift to a strict precautionary approach for oil and gas developments. Where information is incomplete, time-lines too constrained to adequately complete assessments, or where there are strong conflicts of interest, programs should be put on hold until these factors can be remedied. The resources are not going anywhere yet.

Photo by: Daniel Ribeiro

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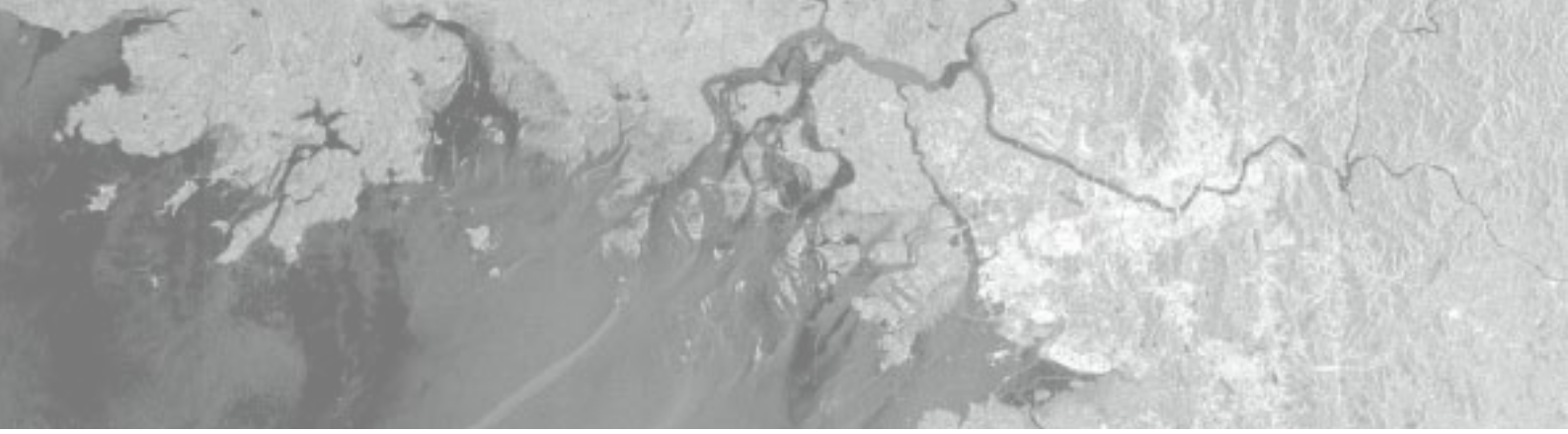

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