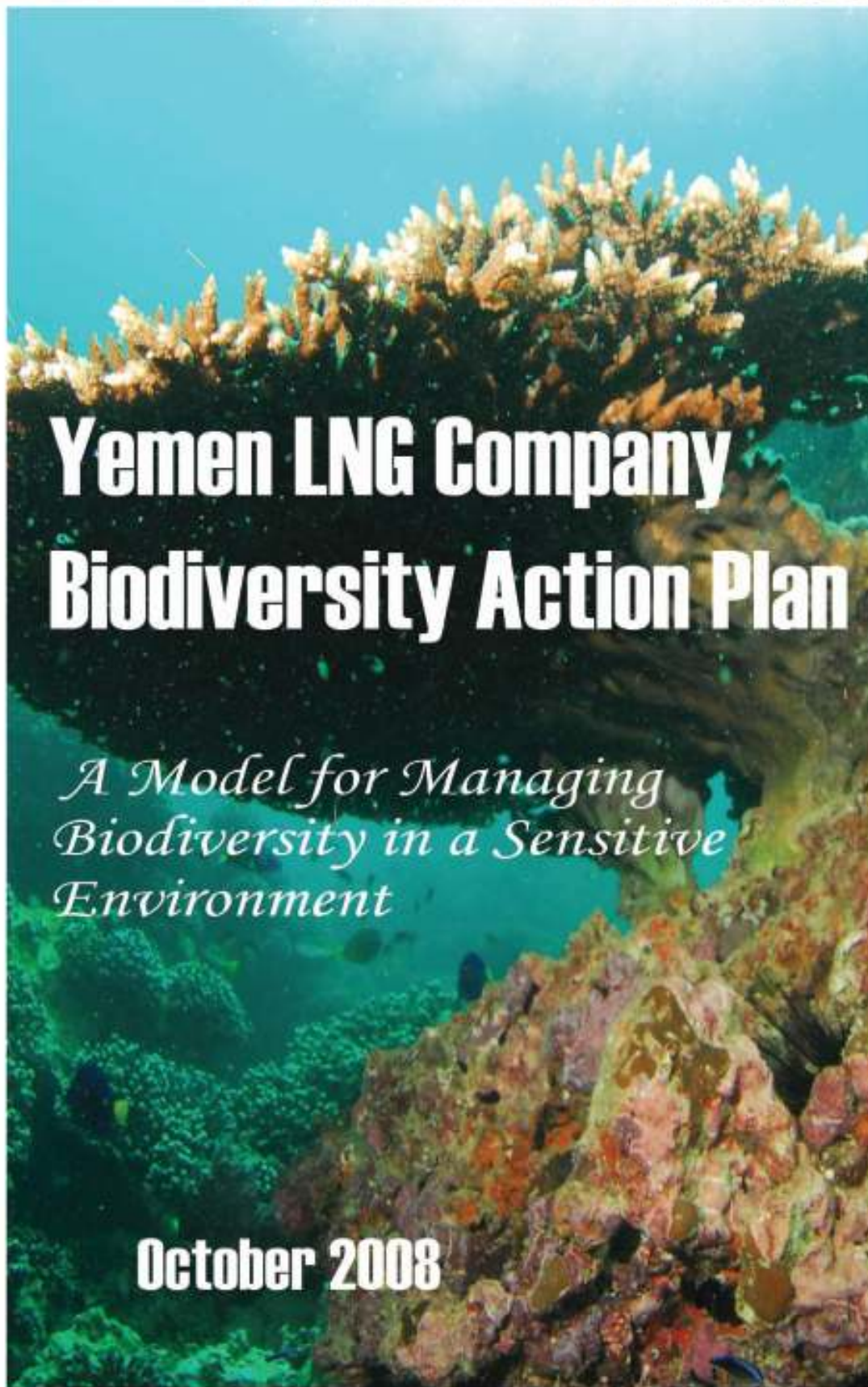




Yemen LNG Company











Yemen LNG Company Biodiversity Action Plan

*A Model for Managing
Biodiversity in a Sensitive
Environment*

October 2008

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ABBREVIATIONS

ALARP As Low as Reasonably Practicable

BAP Biodiversity Action Plan

BAT Best Available Techniques

BEP Best Environmental Practices

CBD International Convention on Biological Biodiversity

CBNRM Community Based Natural Resource Management

CCPs Contractor Control Plans

CEFAS Centre Français d'Archéologie et de Sciences Sociales de Sanaa

CEIP Community and Environment Investment Plan

CIPP Contractor Implementation Plans and Procedures

CLO Community Liaison Officer

CRC Community Relations Co-ordinator

COFACE Compagnie Française d'Assurance pour le Commerce Extérieur

CPU Central Processing Unit

CT Computer Tomography

CZMP Coastal Zone Management Plan

DAI Deutsches Archäologisches Institute

DFID (United Kingdom) Department for International Development

DO Dissolved Oxygen

EA Environmental Assessment

EBS Environmental Baseline Study

EIA Environmental Impact Assessment

EIS Environmental Impact Statement

EMMP Environmental Management and Monitoring Plan

EMP Environmental Management Plan

EPA Environmental Protection Authority (of Yemen)

EPC Engineering, Procurement and Construction Contractor

EPL Environmental Protection Law (of Yemen)

ESIA Environmental and Social Impact Assessment

ESMP Environmental and Social Management Plan

ESMS Environmental and Social Management System

FAD Fish Aggregation Device

GEF Global Environmental Fund (of the World Bank)

GIIP Good International Industry Practice

HSE Health, Safety & Environment

HSSE Health, Safety, Sustainable Development & Environment

HUST Hadrahmout University of Science & Technology

ICRS International Coral Reef Symposium
ICZMP Integrated Coastal Zone Management Plan
IFC International Finance Corporation
IMO International Maritime Organisation
IPIECA International Petroleum Industry Environmental Conservation Association
IR Independent Reviewer
ISRS International Society for Reef Studies
IUCN The International Union for the Conservation of Nature
K-EXIM Export-Import Bank of Korea
KPU Kamil Processing Unit
LIT Line Intercept Transect method
LNG Liquefied Natural Gas
LPG Liquefied Petroleum Gas
LTSDS Long Term Sustainable Development Strategy (for YLNG 2008 - 2012)
MAA Maritime Affairs Authority (of Yemen)
MARPOL International Convention for the Prevention of Marine Pollution
MBP Marine Biodiversity Protection
MEP MacAlister Elliott & Partners
MFW Ministry of Fish Wealth (of Yemen)
MOF Material Offloading Facilities
MOM Ministry of Oil and Minerals (of Yemen)
MPA Marine Protected Area
MWA Ministry of Water and Environment (of Yemen)
NBSAP The National Biodiversity Strategy & Action Plan (for Yemen)
NEAP National Environmental Action Plan
NGO Non Governmental Organisation
NIPASY National Integrated Protected Areas System in Yemen
NTU Nephelometric Turbidity Units
OECD Organization for economic co-operation and development
OGP The International Association of Oil & Gas Producers
OPIC Overseas Private Investment Corporation
PAC Project Approval Committee
PAP Project Affected People
PCDP Public Consultation & Disclosure Plan
PDYR People's Democratic Republic of Yemen
PERSGA Regional Organization for the Protection of the Environment of the Red Sea and Gulf of Aden
PIIP Project Indirectly Impacted People
RFP Request for proposal

ROW Right of Way
SD Sustainable Development
SDE Sustainable Development and Environment
SEPOC Safir Exploration & Production Operating Company
SME Small or Medium Sized Enterprise
SOGREAH SOciete GRenobloise d'Etudes et d'Application Hydrauliques
SOLAS International Convention on the Safety of Life at Sea
SPE Society of Petroleum Engineers
TDS Total Dissolved Solids (in water)
TSS Total Suspended Solids (in water)
UNCLOS United Nations Convention on the Law of the Sea
UNDP United Nations Development Programme
UNEP United Nations Environmental Programme
WCI Wood Clyde International
WCPA World Commission on Protected Areas
YAR Yemen Arab Republic
YGC Yemen Gas Corporation
YLNG Yemen Liquefied Natural Gas Company

GLOSSARY

Benthic: element found on the bottom of a lake, sea or other body of water

Biogenic: something produced by biological process

Demersal: found at or near the bottom of the sea or lake, often contrasted with pelagic

El Niño: term which designated a disturbed meteorological and hydrological situation in the Pacific and Indian oceans, which is characterized by the appearance of warm sea currents.

Micro-habitats: organisms occupying the same general habitat may actually be living under very different conditions. A small habitat with significantly different physical and ecological characteristics which distinguish it from its immediate surrounding area is termed a microhabitat (e.g. small caves or coral cracks).

Pelagic: refers to fish and animals that live in the open sea (water column), away from the sea bottom

Plankton: small, usually microscopic, plants (phytoplankton) and animals (zooplankton) that drift through the layers of the ocean and serve as food for many small aquatic species

Pink blotch disease:

Total suspended solid (TSS): small solid particles of and organic material that either float on the surface or are suspended in water or other liquids, and which are largely removable by laboratory filtering.

Turbidity: it corresponds to the reduction of the liquid transparency due to the presence of not dissolved materials. These particles consist of diverse organic and mineral matters (e.g. clays and silt) or vegetable and animal materials (e.g. the alive or dead plankton). The turbidity varies according to the state of the sea, the continental contributions (e.g. by rivers) and the planktonic production. It prevents the light deep extension and in this way decreases the thickness of the photosynthetic layer. The standard measure unit is the NTU (Nephelometric Turbidity Unit in reference to the measuring instrument, the nephelometer).

Upwelling: upward movement of cool and nutrient-rich sub-surface waters towards the surface, usually caused by winds.

PART 1 - A Biodiversity Overview

1. YLNG project description [1,2]

Yemen possesses an important reserve of natural gas in the Marib field. In order to realise this source of energy, the Yemeni government has granted Yemen LNG Company Ltd. exclusive rights to gas reserves in block 18 in the Safir oil and gas fields of the governorate of Marib (**Figure 1**) operated by Safir Exploration and Production Operating Company (SEPOC). Natural gas which is being produced in 2 processing units namely CPU and KPU as part of process to produce Oil and LPG is re injected to the oil wells to maintain pressure.

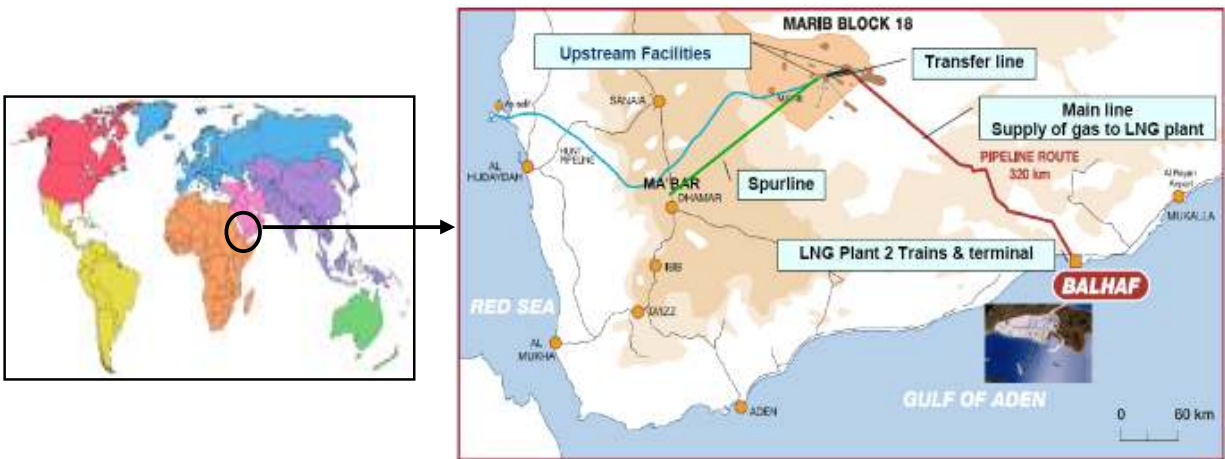


Figure 1 Location maps [1].

The Yemen LNG project involves upgrading onshore gas production facilities at Marib oil and gas fields and constructing a buried pipeline and a world-class, highly automated LNG Plant facility in Balhaf harbour area on the coast of Shabwah governorate, approximately 130 kilometres west of Mukalla and 400 kilometres east of Aden. The main project components are:

- a transfer pipeline to connect the two gas processing centres at Safir
- a main pipeline of 320-kilometer length and 38-inch diameter to deliver gas from the processing centre (KPU) to the planned liquefaction plant,
- a spur line to the city of Ma'bar to supply domestic consumption,
- an LNG plant located at Balhaf which will involve construction of the following marine facilities:
 - a jetty for LNG Carriers loading and shipping,
 - a Material Offloading Facility (MOF) for tug boat mooring,
 - a sea water intake pipe,
 - a water outfall pipe,
 - a shoreline protection

The Construction of the plant (**Figure 2**) commenced in September 2005 and production is expected to begin early 2009. It is the Yemen LNG Company goal to achieve internationally recognized environmental performance in biodiversity conservation during all phases of design, construction, operation and decommissioning of the plant.

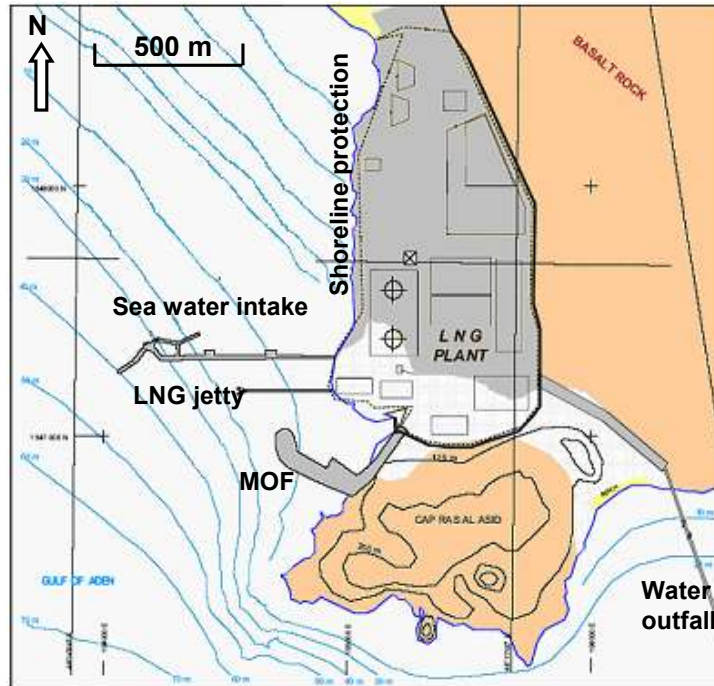


Figure 2 Balhaf LNG plant.

The area surrounding the Balhaf LNG Terminal site is remote and contains no existing industrial infrastructure, except for small scale artisanal fishing activities which used to take place in the bay of Balhaf (**Figure 3**).



Figure 3 Balhaf fishing area from east hill and aerial view prior to construction.

This area has a large natural biological marine abundance and plays a significant part in the regional fishing industry, which is the most important economic activity in the region [3]. In addition several archaeological sites including bronze age tombs and an old cemetery were found in the site and have been preserved. Also various more recent buildings and structures (c.1930's) including the North and South Towers (the latter of which will be restored and preserved), a Fort, a Customs House (**Figure 4**) and a dozen rudimentary shelters that were temporarily used by the fishermen during the summer when fishing activity in the Balhaf area was higher [4].



Figure 4 Pictures of the North Tower and the former custom building.

Yemen LNG have implemented a biodiversity conservation strategy which is the subject of this document and a socio-economic program for compensating the affected community for the loss of livelihood in addition to many economic legacy projects.

2. What is biodiversity?

Definition of biodiversity

In simple terms biological diversity, or biodiversity, is the variability among living organisms from all sources including terrestrial, marine and other aquatic ecosystems and the ecological complexes of which they are part; this includes diversity within species, between species, and of ecosystems (*UN Convention on Biological Diversity, Article 2*).

Biodiversity refers to all forms of life on earth and is generally considered at three interrelated levels:-

- Genes: Genetic variation among the members of the same species (intra-specific variation) is what makes every living being unique
- Species: All the different species of animals, plants. Fungi, micro-organisms
- Ecosystems: Each ecosystem is a dynamic complex composed of the non-living environment (the biotope) and the interacting living organisms (biocenosis) within that environment

Importance of biodiversity

Biodiversity has functions that are indispensable to all forms of life and provides essential goods and services: it is notably a source of raw materials and food, and regulates the quality of the water, air and soil. The variety and balance of biodiversity are sustained by the fragile interactions between the different species and the natural environments in which they live. Once these interactions are broken, the same functions cannot always be restored artificially and the cost of such efforts is often high. Therefore it is prudent to act before degradation sets in, using appropriate ways and means for the conservation and sound management of biodiversity.

Threats to biodiversity

The conservation of biodiversity is clearly important, both for the long-term and sustainable supply of raw materials and for the spiritual, cultural and recreational benefits that it brings. However, as the human population continues to grow, biodiversity is being lost at an increasing rate. Concern about this loss has prompted international, regional and national

legislation, including the United Nations Convention on Biological Diversity that engendered the target to reduce the rate of loss of biodiversity by 2010. The private sector, working with governments, NGOs, science and community partners, has a significant role to play in the conservation of biodiversity. Like many other sectors, the oil and gas industry faces the challenge of understanding what biodiversity conservation means in practical terms and how its day-to-day activities can be organized and managed to maximize the protection and enhancement of biodiversity (IPIECA BAP Guide 2005).

3. What is a Biodiversity Action Plan (BAP) and the rationale for Developing and Implementing a BAP for the Yemen LNG Project?

A Biodiversity Action Plan is a document for translating commitments to biodiversity conservation and sustainable use into practical actions. Generally the need for a Biodiversity Action Plan (BAP) depends on its regulatory, ecosystem sensitivity and business context. The IPIECA¹ has defined several criteria [5] which lead to the implementation of a BAP process (**Figure 5**). In some cases, a BAP is mandatory due to legal, regulatory, planning, permitting or third party requirements. In other cases, the presence of significant observed or predicted impacts will generally make the use of a systematic approach such as a BAP necessary (but not mandatory) for most efficient and effective biodiversity conservation. Even in the absence of legal requirements or significant observed or predicted impacts a BAP may still be recommended due to the business benefits that can accrue, e.g. for making a positive contribution to biodiversity conservation such as support to biodiversity related initiatives. If none of these conditions apply a company may still decide to proceed with a BAP on a purely discretionary basis or alternatively decide that a BAP is unnecessary.

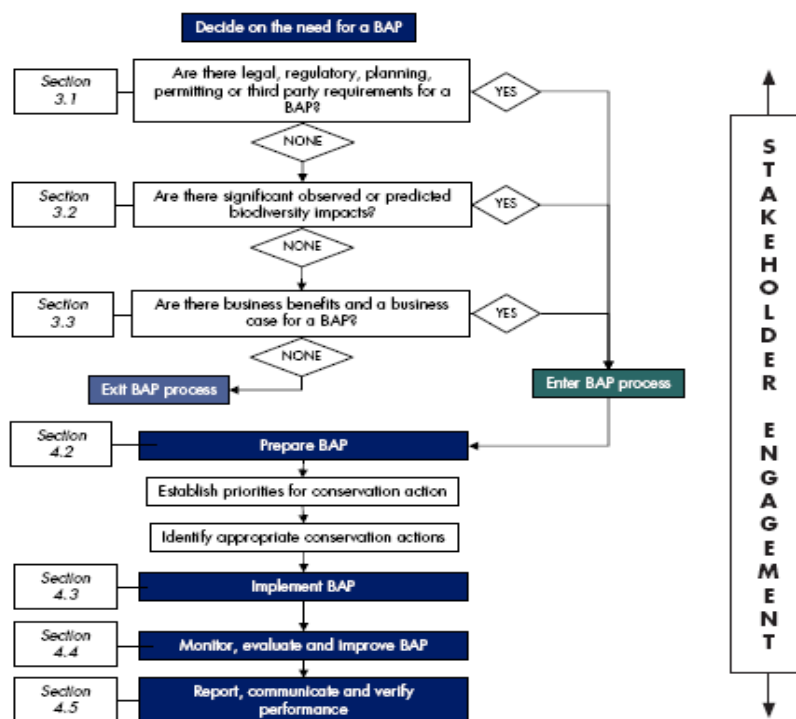


Figure 5 – IPIECA Model for producing and implementing a BAP

¹ IPIECA (International Petroleum Industry Environmental Conservation Association) aims to develop and promote scientifically-sound, cost-effective, practical, socially and economically acceptable solutions to global environmental and social issues pertaining to the oil and gas industry.

Legal Aspects

In the Republic of Yemen, there is no specific national law or requirement relating to biodiversity, species, habitat and ecosystem that mandate enterprises who want to establish themselves in Yemen to draw up a BAP. However, on February 21st, 1996 the Government of Yemen ratified the International Convention on Biological Diversity which was launched at the Earth Summit conference in 1992, in addition to other international biodiversity related conventions ratified recently. In doing so, the Yemeni Government is committed to significantly reduce the rate of biodiversity loss before 2010 and to prepare and implement a national biodiversity action strategy and plan (NBSAP). This involvement has been formalized in the draft NBSAP, published in January 2005 [6] (see next section). The draft plan identifies, on the basis of a detailed situation analysis of biodiversity in Yemen, “*strategic goals and priority objectives to preserve and use in a sustainable way the irreplaceable biodiversity and natural resources of Yemen*”.

Biodiversity Impact Assessment and Residual Impact significance

In preparation for the implementation of the YLNG project, an initial general coastal environment baseline survey (EBS) was carried out by internationally respected marine consultants in March 1997 [2]. This was performed in order to establish the ecological status of the Balhaf coastal area before any industrial activity commenced. It highlighted *inter alia* the presence of highly sensitive corals and a rich fishing area.



Figure 6 – Balhaf cape prior to commencement of construction work

In September 2005, prior to construction commencing (**Figure 6**) a second baseline survey was implemented, again by international marine experts (Creocean) with the participation of local expertise from the related Yemeni Authorities comprising the Environment Protection Authority (EPA), Maritime Affairs Authority (MAA) and Ministry of Oil and Minerals (MOM) in addition to experts from Hadramout Local Diving Centre for logistical support. This survey centred on the update of the 1997 baseline to confirm and to identify priority species, habitat and ecosystem and to evaluate the biological richness, diversity

and the ecological status of the coral and fish communities of the study area focusing on corals, fish and benthic fauna. It was concluded that the site constitutes an important ecological and economical resource for the local Balhaf area and for Yemen (**Figure 7**).



Figure 7 – Balhaf cape pre-construction showing coral reefs

The Environmental and Social Impact Assessment study (ESIA) [1] which has been discussed and consulted with various relevant stakeholders and prepared by international marine and terrestrial experts before it was publicly disclosed on the 10th February 2006 has therefore determined the potential impacts on intertidal and marine ecosystems of the YLNG project during the construction and operational phases. It also described the mitigation measures associated with these impacts which should be implemented by the Company. According to the ESIA assessment, the direct residual impact significance on intertidal and marine ecosystem during construction activities were re-evaluated based on the World Bank criteria as no higher than *moderate* during construction and as *negligible* during the operational phase (**Figure 8**).

B. Balhaf site

Environmental Impact and mitigations measures

| Identified issue | Planned mitigation | Residual Impact |
|---|---|------------------------|
| Groundwater depletion | Desalination plant to be built on site | negligible |
| Sensitive terrestrial flora/fauna | Flora: very limited; moved if encountered Fauna: scarce and mainly transitory; impacted only during construction | minor |
| Sensitive marine ecosystems in the direct vicinity will be impacted during construction | Best construction and dredging methods will be applied to avoid disturbance Appropriate design and construction of the wharf (ongoing studies) Regular monitoring | moderate |
| Potential impact of effluent discharges during operation on coral | 3D modelling studies (Sogreah) showed no impact if cooling and treated waters are discharged more than 650m from shore | negligible |
| Noise levels | Appropriate noise reduction equipment | negligible |



Figure 8 – Example of ESIA findings

The residual indirect socioeconomic impact significance on the local socio-economy was also assessed and evaluated in the vicinity of the pipeline, plant site and camps and was considered to be *minor/negligible*.

Therefore due to the sensitivity of the site, IPIECA (of which Total, the main shareholder and the leader of the Yemen LNG Project, is a member, recommends to implement a BAP.

As a result of the above legal and impact assessment aspects and in order to present its effort towards biodiversity conservation within the framework of the draft national strategy and biodiversity action plan, YLNG decided to implement this BAP to deal with biodiversity issues during both construction and operation phases.

Annex 1, provides more detail on the national and international legislation and policies followed by YLNG concerning marine environment and biodiversity management.

4. Biodiversity issues in Yemen and the first National Biodiversity Strategy and Action Plan (NBSAP)

The following section gives a brief executive summary of the main issues of the National Program concerning conservation of marine biological diversity, environmental protection and management of natural resources.

Status of Biodiversity in Yemen & Major threats

The coastline of Yemen is over 2500 km long and includes three different coastal regions, namely the Red Sea, Gulf of Aden and Arabian Sea. The Red Sea region represents about one third of this coastline, with the remainder bordering the Gulf of Aden region. The Red Sea and Gulf of Aden region of Yemen represents a complex and unique tropical marine ecosystem with extraordinary biological diversity and a remarkably high degree of endemism. It is also an important shipping lane linking the world's major oceans. For example, about 100 million tons of oil transits the Red Sea annually. The Eastern Gulf of Aden and Arabian Sea region is a highly productive fisheries region due to the tropical upwelling phenomenon, supporting a food web that ultimately sustains fish communities. Both the Red Sea and the Gulf of Aden are designated "special areas" under the international MARPOL convention.

Over 120 islands lie in the territorial waters of Yemen with distinct climatic and natural characteristics. More than 115 of these islands lie in the Red Sea region. Among those located in this region: Kamaran Island is the largest, and Mayoon Island, located in the Bab al Mandab Strait, has strategic importance. A large number of corals and coral habitats exist around the Yemeni islands, but with different diversity of communities and number. Socotra Island, the largest Yemeni island (nearly 3,625 km²), is located in the Arabian Sea region of Yemen and has a more exuberant and diverse flora and fauna than any other region in the Arabian Peninsula.

Coastal and marine resources Worldwide are typically threatened by over fishing, spear-fishing, aquarium fishing and dynamite fishing. These factors also represent major disturbances to the coral reefs of Yemen. Oil exploration and transport have historically resulted in several oil spills. Sewage discharge, agrochemicals flushed by floods, and sedimentation from urban development pose further threats to the Red Sea's coral reefs. Industrial and urban development, as well as extensive coastal development, land filling, and coastal engineering are dramatically altering certain coastal areas. Recreation and tourism also contribute to eutrophication and reef degradation. Coastal and marine biodiversity, including the Socotra Island, is threatened by the cutting of mangroves for wood and the use of mangroves for feeding animals, fuel-wood supply and new development projects.

Other threats to the coastal and marine environment of Yemen include the uncontrolled use of coastal zones, destruction of marine and coastal habitats and ecosystems, spatial conflicts among various users, unplanned coastal reclamation, the destruction of benthic habitats by bottom trawling and the destruction of endangered species due to non-selective gear [3].

The NBSAP Goals and Priority Objectives

The National Biodiversity Strategy development process has been funded by the Global Environment Facility of the World Bank, administered by United Nations Development Programme (UNDP Sana'a) and coordinated through the EPA with the technical assistance from the International Union for the Conservation of Nature (IUCN). IUCN has provided continuing support in facilitating the planning process through technical back-stopping, advice on the development of work plan, organizational structures, terms of reference for national and international technical working groups and assisting the editor of the strategy in editing and finalizing the draft NBSAP.

In the draft NBSAP, specific goals and objectives have been identified for the purpose of preserving and the sustainable use of biodiversity and natural resources. These are considered to be guiding principles because they represent the broad consensus of all the partners who developed the strategy. The principles include, first and foremost, striving to maintain the integrity of Yemen's land and marine resources and their biotic wealth. The basic principles also incorporate responsible public management based on accountability, transparency, participation in decision making and a full analysis of impacts. The strategy is illustrated according to its strategic goals; which are broken down into sub-goals, each targeted to a strategic area and complemented with a number of priority objectives requiring immediate, medium or long-term attention. Some highlights of part of the agenda relating to marine biodiversity issues for each goal are presented below:

Goal 1. Conservation of natural resources: through Conservation of Yemen's ecosystems by developing and maintaining a comprehensive and adequate network of protected areas, supported by an effective coordinating management mechanism, adequately funded management plans and improved information systems.

Goal 2. Sustainable use of natural resources : through conservation and sustainable use of marine and fisheries resources by the development and strict implementation of policy, legislation and management tools that ensure harvest level of biological resources are maintained within the biological limits and also monitoring and control of alien invasive species.

Goal 3. Integrating biodiversity in sectoral development plans: through reducing infrastructures and industrial adverse impacts on habitats and ecosystems by eco-tech introduction, EIA enforcement and effective regulatory policies.

Goal 4. Implementation of enabling mechanisms: through raising environmental awareness within Yemeni society by integrating environmental themes into university and school curricula, promoting green media, and supporting youth clubs and eco-industry. Also reviving traditional biological knowledge, innovations and techniques in conserving biological resources. Strengthening productive capacities and potential of individuals, agencies, and communities in the planning, implementation, monitoring and evaluating of biodiversity conservation programs. Establishing a nationwide inter-agency mechanism for monitoring the implementation and results of the NBSAP and other biodiversity related programs and maintaining and strengthening Yemen's relations and cooperation with international and regional partners in the field of biodiversity.

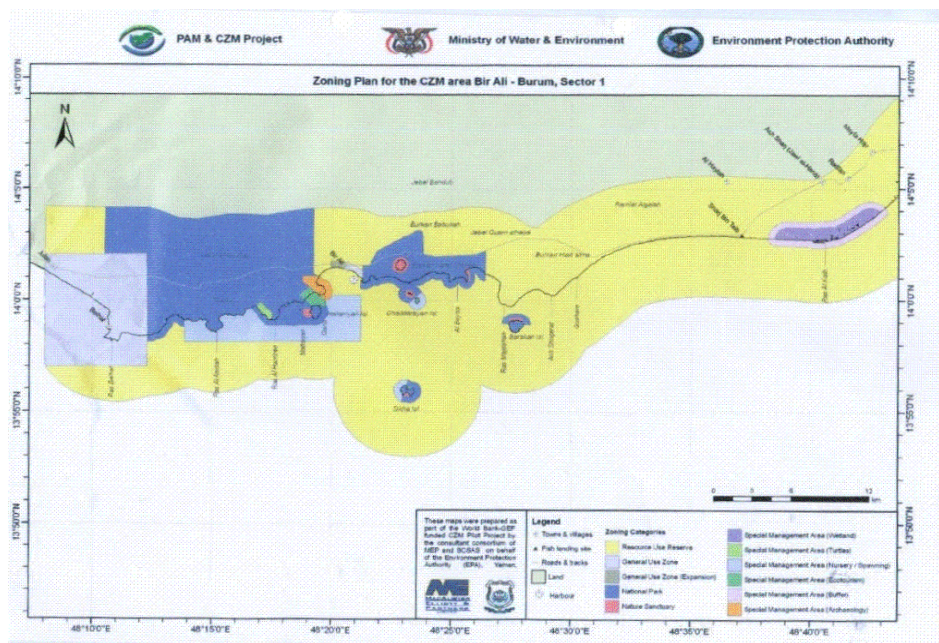
The NBSAP Priority Action List

In order to develop the action plan which translates the strategy, vision, goals and priority objectives into implementable actions, a long list of options composed of forty broad actions

were first identified and then they were short listed into seven priority initiatives (project concepts) based on the following priority criteria: (1) Geographic Impact, (2) Consistency with Convention Objectives, (3) Urgency, (4) Sequence (5) Country-driven, (6) Attainable and Resourceable, and (7) Multisectoral Implications to the objectives of this strategy. These priority project concepts form the basis for the action plan of this strategy. They are considered of immediate importance and require urgent action and attention to meet pressing biodiversity conservation needs. They are as follows:-

1. Establishment and Development of a Comprehensive National Integrated Protected Areas System in Yemen (NIPASY)

Figure 9 – Coastal Zone Implementation Plan around Balhaf



2. Development and Implementation of an Integrated Coastal Zone Management Plan (ICZMP) (see **Figure 9** above)
3. Development and Implementation of Specific Policies, Legislation and Regulations on Biodiversity Issues in Yemen
4. Essential Measures for the Conservation of Agro-biodiversity in Yemen
5. Reviving traditional and indigenous knowledge in Natural Resource Management Systems
6. National Biodiversity Education and Awareness Program
7. Regulations and Guidelines for Bio-safety.

The medium/long-term economic development of Yemen is dependent upon the appropriate management and sustainability of the limited resources in the country. The vision of the draft NBSAP is to achieve a better quality of life for all Yemeni people through the conservation and sustainable use of biological resources and stabilising resource consumption in harmony with the limits of the carrying capacity of nature and the integrity of creation. This vision is intended to be achieved by mobilizing the resourcefulness of the Yemeni people and applying international technical and financial support.

PART 2 - Yemen LNG 's commitment to Biodiversity

5. Biodiversity is an integral part of Yemen LNG's Business Ethos

In order to define its biodiversity activities, YLNG needed to know more about the biodiversity of the site where the LNG Plant was going to be constructed and to understand more about the potential impact of its activities on the biodiversity of the site. Additionally a framework to provide structure to these processes was also needed in order to integrate biodiversity conservation and management throughout all project stages ie construction, operation and site decommissioning.

Yemen LNG's **environmental and social philosophy** is based on the protection of biodiversity and livelihood. YLNG adopts nine fundamental environmental and social principles which are as follows:-

- ✚ Understanding the social, economic, institutional, political, cultural and environmental context of Yemen and in particular of the Project Regions, in order to integrate our operations effectively into the local environment.
- ✚ Identifying our stakeholders, engaging and maintaining dialogue with them to build relationships based on trust and mutual respect.
- ✚ Assessing and enhancing the positive impact of our activities, while preventing and mitigating their negative impact on populations, wildlife and the environment for the duration of our operations and beyond.
- ✚ Providing compensation commensurate with loss, where negative impact cannot be fully redressed, and to do so in a legal, transparent and ethical manner.
- ✚ Establishing a positive and enduring legacy for Yemeni society and preserving Yemen's natural environment for the benefit of future generations.
- ✚ Promoting human development in local communities to enable them to independently manage and sustain the community initiatives we support. To do this we will take every opportunity to work with local partners when designing and deploying societal and environmental initiatives.
- ✚ Maximising the employment of Yemenis, both for YLNG and for its contractors and providing training and development to improve their skills and capacity.
- ✚ Monitoring the progress of our environmental and social activities against the corresponding action plans, and regularly reporting on this progress to stakeholders.
- ✚ Following recognised regional and international standards in all of our environmental and social activities – as currently laid out in World Bank / IFC guidance.

In its **HSE Policy**, YLNG is committed to conducting its business in a manner, which makes health, safety and environmental consideration a priority in its planning and operating activities. This policy is as follows:-

- ✚ YLNG shall conduct its business in a manner, which makes health, safety and environmental consideration a priority in its planning and operating activities.
- ✚ Each employee of YLNG must be aware of his or her responsibility regarding health, personal and co-worker safety, and the environment.
- ✚ Criteria involving health, safety and environment shall be evaluated prior to decisions concerning development projects and the launching of all new activities.

- ✚ YLNG shall adopt an attitude of openness and constructive dialogue with public authorities and local communities. Beyond YLNG's global objective of protecting the environment, YLNG pledge not to jeopardize the health, safety and quality of life of those living or working in the vicinity of its facilities.
- ✚ Emergency procedures shall be tested, practiced and updated systematically so that YLNG can respond quickly and effectively to accident or pollution. In such situations, the rule shall be open information exchange with all parties involved.
- ✚ Contractors shall be required to have, and to comply with, an HSE policy and rules compatible with those of YLNG. Safety performance of all contractors shall be an important consideration in the selection process.
- ✚ The determination of YLNG to make progress in the field of health, safety and the environment shall manifest itself in training programs, consultation and through implementation of internal and external audits.
- ✚ Compliance with these principles of health, safety and the environment shall be an important element in the performance evaluation of each member of YLNG.

2. Planning for Success

Initial baseline environmental and biodiversity surveys were conducted at conceptual stages of the project followed by the development of impact assessment studies. In order to translate the commitments for environmental and biodiversity protection in these documents into firm actions, an Environmental and Social Management Plan (ESMP) has been developed for the construction phase and another specific management plan for the operation phase will be developed prior to the commencement of that phase. **Annex 2** describes the practical means by which this plan has been implemented on site.

The ESMP provides a framework through which Yemen LNG will develop and implement environmental, social, health and safety management systems and programs throughout the construction and operations phases of the Project. The ESMP and other relevant plans and programs have been developed in a manner which is consistent with the environmental and social standards and guidelines applicable to the development, construction, operation and management of the Project, including Agency policies and guidelines, other Senior Lender policies, Yemeni laws and the corporate objectives of Yemen LNG.

This ESMP aims to:

- Assist in translating Project environmental, social, health and safety commitments that were originally developed during the ESIA process and contracting processes into actions and commitments;
- Serve as a key tool by which Yemen LNG can follow up and check the **Management Plans, Contractor Control Plans ("CCPs")**, and **Contractor Implementation Plans and Procedures ("CIPPs")**, and specifically the procedures and method statements that specify how the activities described in the EPC Contracts will be carried out by the EPC Contractors to ensure compliance with Project commitments; and provide transparency and assurance to the Senior Lenders and stakeholders that commitments made through the ESIA process are being translated through to the ESMS, with identification of the party responsible for implementation.

YLNG has developed a **Community and Environment Investment Plan (CEIP)** which describes the approach that Yemen LNG is taking on participation in community and environmental developments with respect to meeting relevant commitments made in its

Environment and Social Impact Assessment (ESIA). This programme is the responsibility of the Yemen LNG Corporate HSSE Department. From the beginning of the program, the duties and responsibilities of stakeholders and of the communities in their development have been discussed and agreed in order for them to maximise local ownership. The CEIP contains the procedures for selecting, approving and developing projects, the purpose of which is to specify responsibilities, and provide guidance, on the procedure for processing and approving community and environmental development projects. The CEIP document is an active document and it has been reviewed throughout the community and environmental investment process to ensure that the lessons learnt and the future change to the environment (both natural and social) are taken on board and reflected across the program.

YLNG has also developed (**Annex 3**) the **Community and Environmental Development Strategy** describing priority themes in social related biodiversity issues for supporting the affected community. The strategy has been focussed on supporting communities in the areas near the pipeline and plant. The first priority was to support the coastal communities of Al 'Ein Bay with projects that could be developed and implemented in the short term. These have mainly been developed in consultation with local communities, often with newly established / elected village committees triggered by Yemen LNG's presence and desire for sustainable cooperation. The priority themes during this early phase were: sustainable fishing, water supply, electricity, sanitation and school renovation/extension. Many of these programmes have benefited from the technical input of external consultants with the appropriate technical / Yemen expertise. In the case of water programmes (down the pipeline route as well as in the coastal area) Yemen LNG has partnered with an international NGO.

The programme is working well across all the Project affected communities including benefitting the Project Affected People (PAP) and the Project Indirectly Impacted People (PIIP). It is also working in the areas of the Yemeni tribes and tribal groupings down the pipeline route. As projects are implemented and proven to be sustainable, effective and efficient, the investment activities may be extended to other outlying communities. In addition the community and environmental investment programme will also focus on areas adjacent to the Project area.

A further theme being developed is in the area of support for Yemeni biodiversity on the Shabwa coast ahead of and during the proposed government marine protected areas plan, shortly to go to Yemeni legislative approval. Looking ahead, as described in this Plan, Yemen LNG expects its project support to increasingly be in partnership with NGOs and for sustainability criteria to play a more emphasised role in project decision making.

Yemen LNG has identified the need to invest in **specific biodiversity** projects which aim to support the biodiversity of Yemen. Although some projects may be identified in the project affected areas, it is possible that biodiversity projects may be supported in other areas of Yemen. It may also be necessary to identify specific environmental investment projects as part of an environmental offset and mitigation process.

In the environmental investment process, the principal objectives will include:

1. The delivery of actions that are of benefit in the promotion and conservation of biodiversity;
2. To provide additional benefits ("additionality") that go further than mitigation of impacts;
3. To respond to ongoing initiatives, issues and suggestions that may be raised by stakeholders during the ongoing consultation process undertaken as part of the Yemen LNG Project;
4. To achieve maximum benefit by sharing financial inputs (e.g. through co-finance);

5. To maximise the opportunities for wider national and possibly international application of outcomes; and
6. The potential inclusion of international stakeholders in the development of the environmental investment projects.

3. Projects Approval Committee (PAC)

This committee has been established to evaluate and approve development and community investment projects. Yemen LNG Sustainable Development Manager is responsible for managing and overseeing the process under the guidance of the Yemen LNG Corporate HSSE Manager. In addition Yemen LNG considers all proposed projects to be implemented internally or in partnership with external parties and to coordinate activities with national strategies and plans. Current PAC members comprise:

- YEMEN LNG HSSE Manager (chairing the PAC);
- YEMEN LNG Deputy General Manager;
- YEMEN LNG SD Manager (Secretary of the PAC).
- YEMEN LNG SDE Senior Adviser
- YEMEN LNG Corporate Affairs Manager
- YEMEN LNG Procurement Manager (as required)
- YEMEN LNG Security Manager (as required)

Up until mid 2008, biodiversity projects have been evaluated and selected according to the CEIP evaluation procedure (**Annex 3**: procedure for approving Larger SDE Projects). Once the collaboration with the International Union for the Conservation of Nature (IUCN) has been established, it will be extended to include consultation with the scientific panel, within the context of Yemen LNG's Long Term Sustainable Development Strategy (LTSDS) which sets out a 5 year plan, part of which centres on biodiversity. This process will cover relevant stakeholders, including (eg); government officials, NGO representatives and academic members and officials from Universities and research centres, in addition to the scientific review panel. Such partnerships may be desirable if they will require government procedures to be implemented or if they need to be undertaken in conjunction with existing programmes to maximise synergies between the initiatives.

This current BAP document is linked to the Operations ESMP document which describes the management process by which environmental and social processes will be managed and monitored.

4. YLNG's BAP Approach

This action plan presents the YLNG strategy to conserve and enhance biological diversity at the Balhaf site where Yemen LNG is constructing its facility. Moreover as now biodiversity conservation is not only a biological issue but also an economic one of increasing importance, socioeconomic biodiversity related issues in places outside project area have also been considered during this stage of the project. This YLNG BAP describes the biodiversity status of the Balhaf and the surrounding affected area, setting targets for its conservation and outlining the mechanisms for achieving these targets and the degree of implementation. As it is in line with priorities of the draft national biodiversity strategy and action plan, this BAP is also contributing to the conservation of Yemeni biodiversity. Finally it uses the phased approach in implementing commitments in the action plan which means that some of the actions are being implemented or will be implemented during construction; whilst detailed development and implementation of other actions will take place during the operational phase.

The approach of the action plan for biodiversity conservation and sustainable use of the marine resources at the site of Yemen LNG is in line with the draft national biodiversity strategy and action plan and Yemen LNG's Environment and Social Management Plan (ESMP). Additionally this plan has been prepared based on the recommendation of Total's Biodiversity Practical Guide and the IPIECA Guide for Developing Biodiversity Action Plans for the Oil and Gas Sectors. Accordingly three themes have been developed :

- 🚧 Theme 1: Understanding of Marine Biodiversity
- 🚧 Theme 2: Protection of Marine Biodiversity
- 🚧 Theme 3: Going Further

Under these 3 themes, 4 priority goals have been established as follows:-

Goal 1: Acquiring up-to-date knowledge of the marine biodiversity at Balhaf bay where the LNG plant is being constructed (see **Figure 10**), in order to adequately anticipate the biodiversity risk in line with the objectives of the draft NBSAP to reduce infrastructure and industry adverse impacts on habitats and ecosystems through eco tech introduction and EIA enforcement.

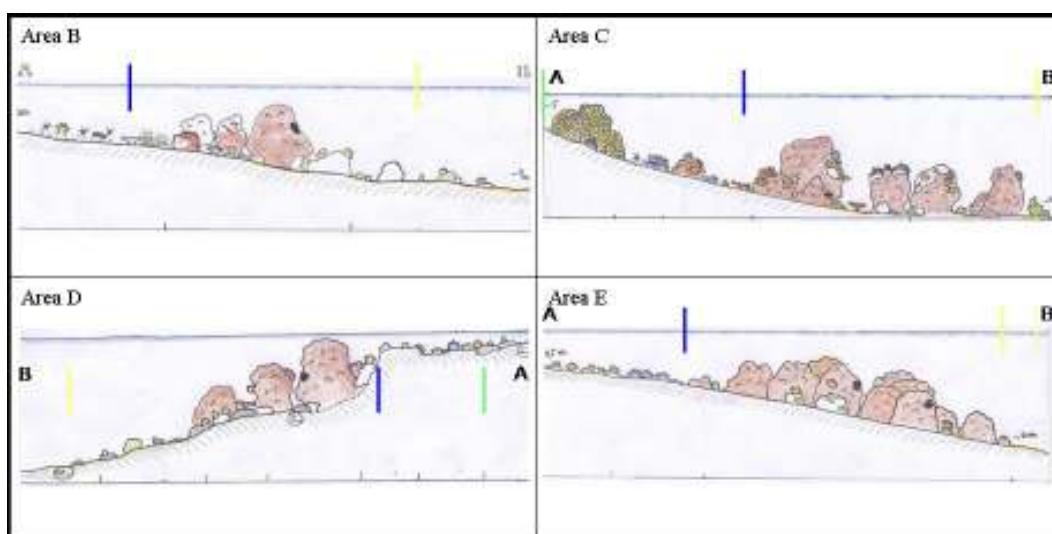


Figure 10 – Example of biodiversity drawings on transects in Balhaf Area

Goal 2 : Protection of the marine environment and the ecosystem in the YLNG site as part of the national efforts to preserve and use in a sustainable way the local natural resources and to integrate biodiversity protection in infrastructure in line with the strategic goals of the draft NBSAP.

Goal 3: Participating in & supporting biodiversity related initiatives outside project locus.

Goal 4: Maintaining a long term protection of the biodiversity and the ecosystem in the YLNG site as part of the national goals in the draft NBSAP to preserve and use in a sustainable way the local natural resources.

For each goal specific objectives have been defined with related action plans as will be described in the coming sections.

PART 3 - Biodiversity Consultation and Partnership Building Strategy

Yemen LNG BAP Biodiversity Goals and Priority Objectives

2. Theme 1: Understanding of Marine Biodiversity

Key issues

- Marine biodiversity baseline survey of the Plant site in the initial base line survey carried out in 1997 by WCI requires to be revalidated;
- EIA of 1997 by WCI needs to be updated so that biodiversity risk as a result of project construction is adequately anticipated.

Goal 1: acquiring up-to-date knowledge of the marine biodiversity at Balhaf bay where the LNG plant is going to be constructed, in order to adequately anticipate the biodiversity risk in line with the draft NBSAP objectives to reduce infrastructure and industry adverse impacts on habitats and ecosystems through eco tech introduction and EIA enforcement.

Priority objectives and actions (immediate during first year of construction)

In light of the draft NBSAP priority objective setting workshops and YLNG consultation with its stakeholders including marine experts, the following priority objectives are considered:

Knowing the biodiversity richness of Balhaf site

- Implementation of a detailed inventory marine baseline biodiversity survey at Balhaf and updating the 1997 baseline data with the new information (with the support of national and international expertise to identify, confirm species, habitat and ecosystem of the site and to identify their priority).

Anticipating the footprint of the construction on the Balhaf Biodiversity

- Reassessment of biodiversity risk and updating the ESIA (including direct and indirect impact) in participation with different stakeholders.

Performance Key Indicators

- The marine baseline biodiversity survey to be completed at the latest by end of September 2005 and prompt issuance of the report (Status – completed).
- ESIA is consulted and approved by EPA (Status – completed).
- ESIA is officially disclosed to the public on the Yemen LNG net by February 2006 (Status – completed).

2. Theme 2: Protection of Marine Biodiversity

Key issues

- Damage of the intertidal coral during the construction of shore protection berms in the west of Balhaf cape for the LNG plant and in the MOF area might lead to biodiversity loss (Status – completed).
- Increase in turbidity of sea water due to dredging activities associated with construction works of the MOF, Jetty and outfall pipelines could be deposited on corals leading to biodiversity loss (Status – completed).

- Potential contamination of sea water from a spill or diesel/fuel contamination in the MOF area or from construction camp waste water and discharge of tank hydrostatic test water for the LNG plant. This could lead to a loss of species diversity (Status – completed).
- Disappearance of coral will also represent a net loss in the sea production since the coral reef is known as a refuge and nursery for several fish species, thus a fish nursery detailed baseline survey and follow-up needs to be established (Status – completed).
- Presence of invasive species such as the red sponge needs to be studied and closely monitored (Status – completed).

Goal 2 : Protection of the marine environment and the ecosystem at the YLNG site as part of the national effort to preserve and use the local natural resources in a sustainable way and to integrate biodiversity protection in infrastructure in line with the strategic goals of the draft NBSAP.

Priority objectives and actions (1 to 3 years)

In light of the NBSAP priority objective setting workshops and YLNG consultation with its stakeholders, including marine experts, the following priority objectives are implemented:

1. Reducing significant impacts and conserving biodiversity

- Development and strict implementation of policies, plans and procedures to integrate biodiversity management within the framework of the company environment and social management system (ESMS) and for the lifecycle of the project (Status – completed);
 - HSE Policy
 - Environmental & Social Management Strategy
 - HSE Management plans
 - A site level contractor control plan and procedures
- Avoidance of biodiversity impact by redesigning of Project components (MOF relocation, outfall pipe configuration, shoreline layout) (Status – completed).
- Minimization of the unavoidable impacts to ALARP by using best available techniques (BAT) and best environmental practices (BEP) and keeping the impacts within acceptable limits as guided by the performance indicators (Status – completed).
- Implementation of an innovative coral transplantation strategy as an offset measure in case of predicted unavoidable or irreversible impact (Status – completed).

2. Monitoring biodiversity status and trends during construction

- Implementation of a multi level robust monitoring program with the involvement of various relevant stakeholders (Status – completed).

Performance Key Indicators

- Percentage decline of coral cover not greater than 10% when measured on transects compared to reference area including dimensioning of population density (Status – completed).

- Turbidity in sampling points close to area is less than 30 NTU (except during natural events such as the upwelling/monsoon periods); (Status – Achieved over 3 year period except for very occasional exceedances which were quickly corrected).
- Total Suspended Solid (TSS) concentration in sampling points close to coral area is less than 50 mg/l (except during upwelling/monsoon periods); (Status – Achieved over 3 year period except for very occasional exceedances which were quickly corrected).

3. Theme 3: Going Further

Key issues:

1. Livelihoods and local community socio-economic issues;
2. Lack of adequate and precise information on coral species and ecosystem in Yemen;
3. Requested by the Yemeni authorities to upgrade skills among members of the biodiversity monitoring entities for coral health evaluation and diving certification;
4. Lack of sufficient financial resources within EPA for implementing the Coastal Zone Management Plan;
5. The need to establish a scientific partner to Yemen LNG in biodiversity conservation issues and for independent monitoring of BAP performance;

Goal 3: Participating in and supporting biodiversity related initiatives inside and outside the project locus.

Priority objectives and actions (1 year to more than 3 years)

1. **Development and implementation of local biodiversity related sustainable development projects;**
 - Fishing infrastructure projects eg construction of a Breakwater, fish data monitoring, provision of equipment, the installation of Fish Aggregation Devices (FADs). (Status – completed).
2. **Setting up an independent scientific partnership by the establishment of a Biodiversity Observatory;**
 - Collaboration with IUCN (refer to next section).
3. **Improving scientific knowledge of the Yemeni coral ecosystem at Balhaf.**
 - Communicating biodiversity baseline and monitoring reports to the stakeholders as part of the company reporting system (refer to next section).
 - Publish monitoring results in scientific reviews (in particular concerning transplantation program, long-term impacts and mitigation measure effectiveness) (refer to next section)..
 - Funding a research and scientific publication of a Taxonomic guide of the corals of Balhaf (refer to next section)..
 - Implementation of an assessment study and a monitoring program for the Fish Aggregation Devices (FAD) Project (refer to next section).
 - Continue monitoring of transplanted corals including the use of techniques such as photoquadrats.
 - Continue monitoring and analysis of chronic diseases eg red sponges.

4. Building Capacity of the local conservation organizations

- development & implementation of a training program for members of the authority monitoring committee in diving & coral health evaluation methods (refer to next section).
- Developing a biodiversity awareness program internally/externally (school education program, posters, Intranet, Internet) (refer to next section).
- Organising periodic workshops for stakeholders (refer to next section).

5. Participation in the Protection of the Gulf of Aden Coastal Area

- Supporting the implementation of the protected area 1 Bir Ali – Burum as part of the CZMP Project sponsored by EPA (refer to next section).

Key Performance Indicators

- Projects completion on time
- Monitoring of results/benefits
- Community satisfaction

Goal 4: Maintaining a long term protection of the biodiversity and the ecosystem in the YLNG site as part of the national goals in the draft NBSAP to preserve and use in a sustainable way the local natural resources.

Key issues:

- Seawater temperature and salinity on the corals at both sides of the cooling water discharge in the eastern side of Balhaf bay.
- Turbidity regime due to the presence of the MOF and the Jetty in the western side of Balhaf bay.

Priority objectives and actions (more than 3 years)

6. Long term protection of the marine Biodiversity of Balhaf site

- adapt the construction coral health and sediment monitoring program to a long term program for the operational phase including monitoring of the transplanted corals.
- implement the discharge controls (cooling water, sanitary water, plant wastewater).
- Monitor the effectiveness of water treatment and the final discharges to sea
- Periodic qualitative/quantitative assessment of coral health by respected international consultants for selected areas
- Regular coral monitoring carried out by appropriately trained in-house people
- Water quality assessment in selected areas involving appropriately trained National resources
- Monitoring the long term effects of sedimentation.

Performance Key Indicators

- Monitoring periodicity
- Survival of transplanted corals
- Quality/composition of discharges

Part 4 - The Yemen LNG Biodiversity Action Plan (BAP)

Introduction

YLNG recognizes that ensuring the conservation of biodiversity and its sustainable use are considered in its Environmental and Social Management System as a key success factor when conducting its project activities, whilst at the same time maintaining the biodiversity of the sensitive environment of its work.

1. Biodiversity action plan components

The following is a list of **25 actions which comprise this plan**. These actions have been derived from the preceding analysis. The first 8 actions deal with biological biodiversity and related socio-economical aspects, which are designed specifically to be implemented during the construction period. The ensuing 9 actions (actions 9 to 17) deal with company involvement in scientific and research development and capacity building. These are designed for both construction and operational phases and the implementation of some of them have already commenced or are completed. The last 8 actions deal with the long term protection of the Balhaf LNG plant site during the operational phase. These will be developed prior to operations.

The BAP Actions are as follows (these are described in further detail in the subsequent text along with a statement of the status of their implementation as at 31st October 2008):-

(a) Construction Period

1. ***Biodiversity Action 1*** - Implementation of a detailed inventory marine baseline biodiversity survey at Balhaf and updating the 1997 baseline data with the new input. This is to be implemented with the support of national and international expertise to identify, confirm species, habitat and ecosystem of the site and to identify their priority.
2. ***Biodiversity Action 2*** - Reassessment of biodiversity risk and updating the ESIA accordingly (including construction and operational footprint, direct and indirect impact in participation with different stakeholders).
3. ***Biodiversity Action 3*** - Development and strict implementation of policies, plans and procedures to integrate biodiversity management within the framework of the company environmental and social management plan (ESMP) for the lifecycle of the project.
4. ***Biodiversity Action 4*** - Avoidance of biodiversity impact by the redesign of project components (MOF relocation, outfall, plant layout etc).
5. ***Biodiversity Action 5*** - Minimization of the unavoidable impact to As Low As Reasonably Practicable (ALARP) by using best available techniques (BAT) and best environmental practices (BEP) and keeping the impact within acceptable limits as guided by the performance indicators.
6. ***Biodiversity Action 6*** - Adaptation of coral transplantation strategy as an offset measures in case of unavoidable or irreversible impact.
7. ***Biodiversity Action 7*** - Implementation of a multi-level robust monitoring program with the involvement of various stakeholders.
8. ***Biodiversity Action 8*** - Development and implementation of local biodiversity related sustainable development projects.

(b) Construction and Operations Phases

9. *Biodiversity Action 9* - Setting up a scientific partnership by the establishment of a biodiversity observatory.
10. *Biodiversity Action 10* - Communicating biodiversity baseline and monitoring reports to the stakeholders as part of the company reporting system
11. *Biodiversity Action 11* - Publishing monitoring results in scientific reviews (in particular concerning transplantation program, long-term impacts and mitigation measure effectiveness).
12. *Biodiversity Action 12* - Funding a research and scientific publication of a taxonomic guide of the corals of Balhaf
13. *Biodiversity Action 13* - Implementation of an assessment study and a monitoring program for the Fish Aggregation Devices (FAD) Project.
14. *Biodiversity Action 14* - Development and implementation of a training program for the members of the authority monitoring committee in diving and coral health evaluation methods.
15. *Biodiversity Action 15* - Development of a biodiversity awareness program internally/externally (school education program, posters, Intranet, Internet).
16. *Biodiversity Action 16* - Organising periodic stakeholder workshops.
17. *Biodiversity Action 17* - Supporting implementation of the protected area 1 Bir Ali – Burum as part of the National CZMP Project sponsored by EPA.

(c) Operations Phase

18. *Biodiversity Action 18* - Adaptation of the construction coral health and sediment monitoring program to a long term program suitable for the operation phase including monitoring of the transplanted coral areas.
19. *Biodiversity Action 19* - Implementation of the effluent discharge control (cooling water, salinity water, plant wastewater).
20. *Biodiversity Action 20* - Implementation of a community solid waste cleaning pilot project particularly to clean the coastal area of the city of Bir Ali.
21. *Biodiversity Action 21* - Implementation of a study and a pilot project for coral recruitment and growth outside the project area under the goal of supporting biodiversity initiatives outside project area.
22. *Biodiversity Action 22* - Implementation of planned coastal reclamation for Balhaf.
23. *Biodiversity Action 23* - Implementation of a coastal expansion projects for the area between Bir Ali and Balhaf to encourage turtles nesting activities.
24. *Biodiversity Action 24* - Monitoring of the success of the corals transplanted during the construction phase under the objective of improving scientific knowledge of the Yemeni coral ecosystem.
25. *Biodiversity Action 25* - Monitoring and analysis of chronic diseases such as the red sponge in Balhaf and the surrounding area under above objective.

2. The 25 Biodiversity Action Plan components and their current status.

Biodiversity Action 1 - Implementation of a detailed inventory marine baseline biodiversity survey at Balhaf and updating the 1997 baseline data with the new input. This is to be implemented with the support of national and international expertise to

identify, confirm species, habitat and ecosystem of the site and to identify their priority.

Biodiversity Action 1 – Status; This action was completed in September 2005, a stakeholder workshop was held and a comprehensive report issued.

This has involved the carrying out of a detailed inventory marine baseline biodiversity survey at Balhaf with the support of national and international expertise to identify, confirm species, habitat and ecosystem of the site and to identify their priority and to updating the 1997 baseline data with the new input.

In 1997, YLNG carried out baseline survey (WCI 1997), along the pipeline route and at the Balhaf site. These studies comprised both onshore and coastal surveys, identifying soil and groundwater, fauna and flora and archaeology issues, socio-economic data and land uses in the Project area.

More recently in September 2005, YLNG has commissioned several studies including a marine survey of the Balhaf area by Creocan, a complementary 3D model on thermal distribution by SOGREAH; a field validation terrestrial survey of the pipeline route; a complementary archaeological survey conducted in October 2005 by the Centre Français d'Archéologie et de Sciences Sociales de Sanaa (CEFAS) and the Deutsches Archäologisches Institute (DAI) along the pipeline route and in the Balhaf area; complementary socio-economic baseline surveys; several water and sanitation surveys; an assessment of fisheries loss and potential compensation measures carried out by MacAlister Elliott and Partners (MEP).

The 2005 Creocan marine survey focused on corals and fish communities (richness, biodiversity and health condition). It described in detail the ecological characteristics of the Balhaf area including the physical environment, the diversity and state of health of coral communities, fish population and benthic fauna. A local description of the Balhaf coastal area was then carried out (**Figure 11**) based on 3 global areas the western, eastern and southern areas. Previous pollution rates in the area was also documented.

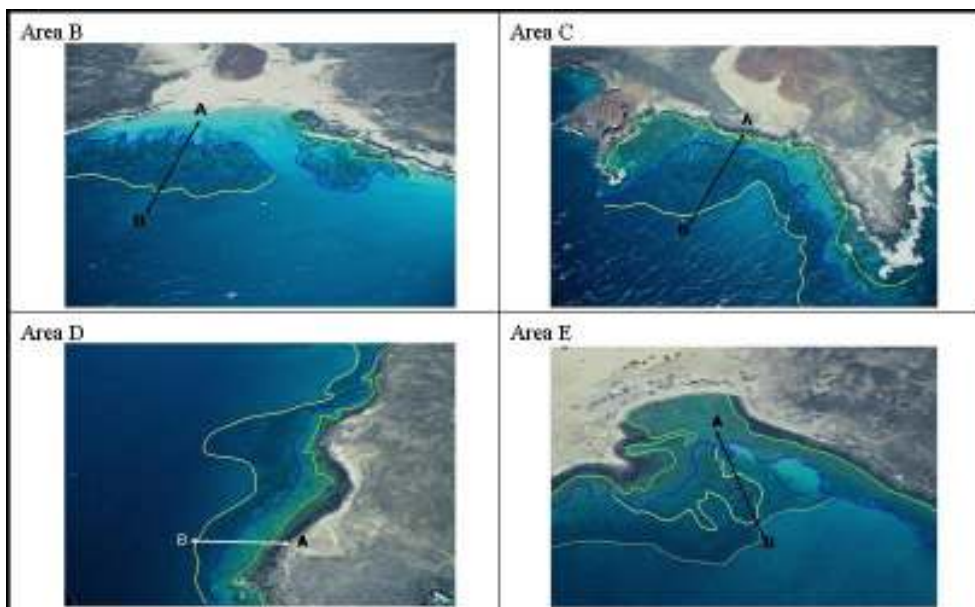


Figure 11 – Sensitivity mapping of corals around the Balhaf Headland

This work led to the development of the first sensitivity maps of the coral communities in the Balhaf bay. This map has recently been updated as a result of regular monitoring. The

result of this detailed inventory confirmed that the site represents an important ecological and economical resource for the local Balhaf area and for Yemen.

The survey was carried out by an internationally respected independent specialist marine scientific contractor. Logistical and diving support were provided by a local contractor specialist in diving who also provided safety divers. The environmental related authority's representatives from EPA, MMA and MOM attended this survey and they effectively added their input to this inventory. **Annex 4** presents a summary of the results of the baseline biodiversity survey carried out in September 2005.

Biodiversity Action 2 - Reassessment of biodiversity risk and updating the ESIA accordingly (including construction and operational footprint, direct and indirect impact, in participation with different stakeholders).

Biodiversity Action 2 – Status; This action was completed in December 2005, the ESIA was formally accepted by the Competent Yemeni Authority in December 2005 and the ESIA was updated and publicly disclosed on 10th February 2006.

Following the first baseline in 1997, YLNG conducted an EIA (WCI, 1997) for the pipeline and the LNG plant construction and operations.

In the years following this initial EIA, YLNG undertook several additional studies: a socio-economic baseline survey (June 2001) conducted by two team of scientists conducted by one French and one Yemeni scientist in Sana'a and several additional surveys and technical studies to further evaluate the baseline conditions and the proposed mitigation measures. In the meantime, YLNG adapted the design to new capacity requirements and to changes or trends in environmental protection, in order to build the YLNG project to comply with the best international environmental standards.

The present ESIA is an completely updated study of the 1997 EIA, taking into account the current environmental regulation of Yemen, the revised design of the project and additional data collected by YLNG during 2005, not to mention the inclusion of societal issues thus making the 2005 document a true ESIA.

The ESIA study has undergone several consultations including national and international NGOs, international lending agencies (working to World Bank and IFC regulations), Yemeni environmental authorities. It was approved by the Competent Yemeni authority MWA/EPA and was officially disclosed publicly on 10th February 2006.

Concerning the Balhaf marine port, the present ESIA defines the potential impacts and degree of significance of the YLNG project on intertidal and marine ecosystems during the construction and operation phases which are quantified to be (at worst) moderate and (more typically) negligible respectively. It also describes the mitigation measures adopted to minimise these impacts which are being implemented by the Company.

Annex 5 presents a summary of the potential impacts of the project on the biodiversity of the site during the construction and operation phases.

Biodiversity Action 3 - Development and strict implementation of policies, plans and procedures to integrate biodiversity management within the framework of the company environmental and social management plan (ESMP) for the lifecycle of the project.

Biodiversity Action 3 – Status; This action was completed in July 2007 with the issue of the Construction phase ESMP.

Yemen LNG operates a multi-level management system with management components operating across, or common throughout, the Project.

In order to effectively capture and implement during the construction phase the various issues and recommended mitigation measures identified in the ESIA, an Environmental and Social Management Plan (ESMP) has been developed. This has provided a consistent set of management tools to enable YLNG to systematically implement cost-effective measures to respond to, to monitor and to control environmental and social performance. This ESMP describes the Yemen LNG management system that has been, or will be, implemented by the Project and/or the EPC Contractors during the design and construction phases of the Project. A separate (but complementary) ESMP will be produced for the operational phase.

As highlighted above, the Project has completed a number of comprehensive environmental and social studies outlining commitments to eliminate or reduce identified environmental and social impacts (from the ESIA) to acceptable levels, and maximize identified benefits. This plan is based on the company's Sustainable Development and Environmental Strategy which consists of three distinct tiers of action (**Figure 12**).

- to minimise and mitigate any possible harm or damage, whether to populations, wildlife or the environment, ensuring the residual impact is negligible or moderate at most,
- to provide proper compensation (offset measures) to international standards where harm cannot be fully redressed,
- To establish a positive and enduring legacy in Yemen for the benefit of future generations.



Figure 12 – YLNG's three tier strategy for managing environmental and social impacts

This strategy was put in place prior to marine construction works commencement in January 2006 (**Annex 2**: Yemen LNG strategy on the protection of corals).

The ESMP includes the actions needed to implement these measures, verification monitoring and reporting requirements [2]. Such actions are listed in a series of Management Plans and Contractor Control Plans (CCPs). These management control

documents present the procedures and method statements that specify how the activities described in the contractor's contracts will have to be carried out by EPC contractors to ensure compliance with project commitments. Moreover, the plans allocate responsibilities and frequencies of implementation, as well as describing how these actions will be monitored and reviewed for compliance and performance review.

The CCPs are implemented by the EPC Contractors through a suite of policies, plans and procedures which are generically called Contractor Implementation Plan and Procedures (CIPPs). These documents demonstrate how the EPC Contractors intend to implement the requirements of the CCPs.

This hierarchical management system described above can be summarized in the figure on the following page which also shows the transition to the operations phase: (**Figure 13**).

Concerning biodiversity and marine ecosystem protection, the main CCP which refers to this issue is the Coral Habitat Protection CCP. It describes coral protection specific mitigation, offset and monitoring measures implemented during the construction phase by YLNG and EPC Contractors. This CCP should be read in conjunction with other related CCP:

- Pollution Prevention CCP,
- Environmental Restoration CCP,
- Waste Management CCP,
- Chemical Management CCP,
- Emergency Response CCP.

YLNG ESMP Structure - Rev 2 – Transition to Operations Phase

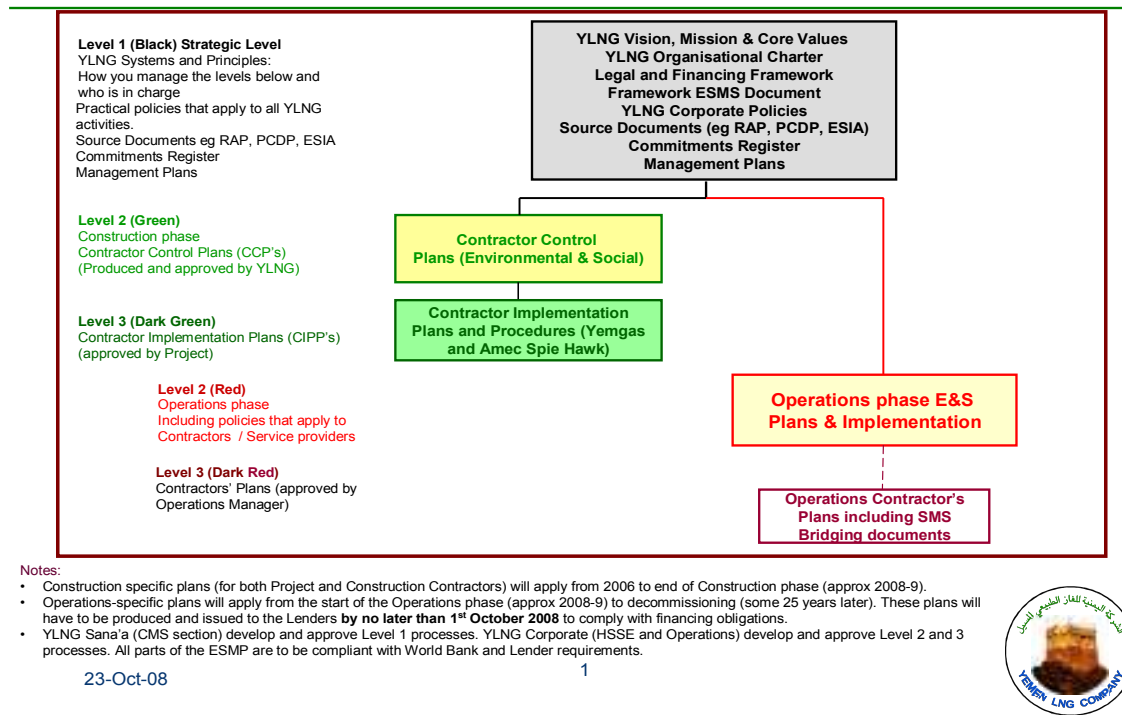


Figure 13 – ESMP structure including the transition to the Operations Phase

This Yemen LNG BAP document needs to be linked to appropriate documentation of the ESMS as stated earlier in part 2.

Biodiversity Action 4 - Avoidance of biodiversity impact by the redesign of project components (MOF relocation, outfall, plant layout etc).

Biodiversity Action 4 – Status: Action complete, design changes fully implemented.

Site Screening and Selection

The initial screening of the various site alternatives took place in 1995. The rationale was to select a combination of a LNG plant location and pipeline route to transport the gas, which would optimize the economics of the project while minimizing its environmental and social impacts. The Marib gas field location being fixed, various alternatives were reviewed, and these considered the available options for an access to the sea and a pipeline route through difficult geographical features such as mountains and narrow valleys in areas with a rapid population growth (***Annex 2***).

Detailed studies were conducted for three sites, Ghubb Diknah, Ras Imran and Balhaf. Based on several results, the comparison of the three selected sites resulted in the final site selection of Balhaf, which offers, with the revised layout, the best technical compromise with minimal dredging and the lowest capital investment. It also offers environmental and socio-economic conditions for both site and pipeline that were recognized acceptable by the Yemeni Government.

Nevertheless, whilst Balhaf was assessed to be the optimum site, the ESIA (formally accepted by the Yemeni Authorities in 1998 and reconfirmed in December 2005) recognises that the coastline is very rich in corals.

Avoiding localized impacts by modifying the plant design

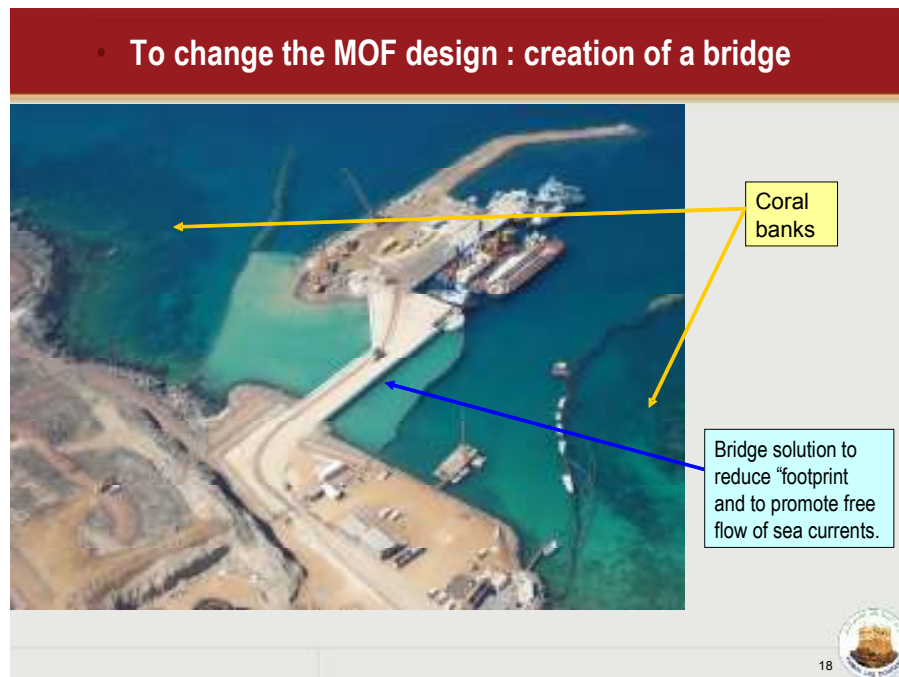
In order to limit to a minimum the extent of the impacted area and to ensure that there is a negligible impact on coral, the design of all marine facilities was optimised.

The present location of the **Material Offloading Facilities (MOF)** is the best technical and environmental option amongst the various alternatives.

Following the findings of the September 2005 baseline survey undertaken by CreOcean, and several oceanographic studies implemented by Sogreah, YLNG validated the current design option, which offers notable environmental advantages. Indeed, the MOF south bay location between two coral banks required a small volume of dredging in coarser material, thus less prone to turbidity. Moreover, this alternative presented a lower impact on corals of area D. At last, to reduce “footprint” and to encourage free flow of ocean currents, the MOF was redesigning and it was decided to open a bridge under the MOF (see over the page ***Figure 14***).

In addition, YLNG has also redesigned the shoreline works to the north of Balhaf cape (known as Area F) to eliminate works at the shoreline and move it back onto land, thus avoiding the potential for physical damage to corals. Furthermore, the location, length and design of the water outfall for cooling water and other waste water discharges were studied in detail and optimised. The water outfall was design to avoid coral area by burying the pipe in the sea bed in a gap between the corals in area B, thus avoiding the risk of coral morbidity or mortality due to any increase in seawater temperature. Moreover, the position of the jetty head and the jetty trestle has been studied to reduce impact on corals communities. Indeed, according to oceanographic studies, the location perpendicular to the coast in water depth greater than 15 m would be optimum to avoid any dredging works.

Figure 14 – Revised design of MOF to reduce environmental impacts



Biodiversity Action 5 - Minimization of the unavoidable impact to As Low As Reasonably Practicable (ALARP) by using best available techniques (BAT) and best environmental practices (BEP) and keeping the impact within acceptable limits as guided by the performance indicators.

Biodiversity Action 5 – Status: Completed (see also Action 4 above).

This has been implemented by using best available techniques (BAT) and best environmental practices (BEP) and keeping the impact within acceptable limits as guided by the performance indicators.

Eliminate/mitigate impact by precautionary construction methods

The EPC Contractor, under the supervision of YLNG, has been carefully selecting the methods of marine construction works to ensure that damage to coral is minimized. These methods have permitted the reduction of turbidity in the seawater and sediment deposits on corals as well as minimising direct and indirect impact on marine and intertidal ecosystems. Example of using best available techniques is the use of sucker dredger in dredging close to sensitive coral areas such as the MOF.

Additionally a set of precautionary and mitigation measures are used to mitigate potential marine impacts. These include:

- minimising dredging activities,
- offshore disposal of dredging and excavation material in an appropriate specific deep location (at least 1400 m off the coast in water depths not less than 150 m)
- onshore successive sedimentation basins for onshore disposal of dredging cuttings
- the construction of the MOF has taken place before the majority of dredging operations, in order to minimise the spread of turbid plumes during dredging activities,

- prohibition of blasting in water and the development of special procedure and mitigation measures concerning nearshore blasting in order to ensure that there would be no significant impacts to the marine ecosystem,
- use of silt barriers (see silt curtains below in **Figure 15**)

Figure 15 – Installation of Silt Curtains



- the use of floating crane and barge,
- delineation of the reef bank by floating buoys to identify the edge of the coral reef to prevent physical damage of corals by boats/vessels,
- Implementation of good environmental management practices in the management of vessels and barges used during the construction phase.

The Use of silt curtains technology

An important protective measure which Yemen LNG implemented at the commencement of marine construction works is the silt curtains. These are geotextile curtains which physically control the dispersion of turbid water in seawater produced by dredging and marine constructions. Silt curtains are impervious, vertical barriers that extend from the water surface to specified water depth (see above in **Figure 15**). The silt curtains function as filters to suspended solid approaching the coral area but they allow the natural flow of sea water into the coral area.

The sensitive areas D and E have been protected by the deployment of silt curtains around the work area (see **Figure 14** above) which act as a barrier “filter” between marine construction works which may generate suspended particles in water, and the corals which would be adversely affected by sediment deposited on them. This technology has also been used to protect sensitive coral species in other areas of the site such as the intake pipe area at commencement of dredging works in such areas.

The silt curtains are inspected by divers on a regular basis and any repairs identified as necessary to maintain curtain integrity are carried out immediately by EPC Contractor.

These sediment barriers have proven to be extremely successful protective measures which greatly reduce the risk of sedimentation on the corals.

During the shoreline protection works the need to silt barriers raised but due to shallow water depth it has not been possible to deploy silt curtains between work area and coral area, therefore another method was developed which involve installation and protection by gabions.

Biodiversity Action 6 - Adaptation of coral transplantation strategy as an offset measures in case of unavoidable or irreversible impact.

Biodiversity Action 6 – Status: Complete, transplantation program fully implemented and successful outcome.

Notwithstanding the above measures to reduce impacts at source by redesign, YLNG recognised that (as stated in the approved ESIA) some minor physical damages to corals would inevitably occur during the site construction works in 4 specific areas :

- construction phase for MOF,
- cooling water intake pipeline (excavations close to shoreline),
- cooling water outfall pipeline (excavations close to shoreline),
- construction phase for the jetty (piling and foundations).

An example of this is the “temporary dyke” which has been used to facilitate MOF construction. Whilst this dyke was constructed in an area of low coral sensitivity, some scattered corals were covered by this structure and have therefore been impacted.

In such cases, YLNG decided to provide measures to mitigate these potential impacts by implementing a coral transplantation program.

Coral transplantation program

Recognizing that there will be some localized loss of corals associated with the construction of the above mentioned project components, YLNG therefore have worked with international expertise in coral monitoring, coral transplantation and recognized biologists to first undertake an evaluation study and to plan for the program, then to undertake a major transplantation campaign managed by the Corporate HSSE Department with technical assistance provided by the principal shareholder Total and site construction and QHSE environment department. The program has been implemented in phases in line with the construction plan of the MOF, Intake, Jetty, outfall and shoreline protection works (see over page **Figure 16**). Consultation has been made prior to launching the project with the competent authority EPA.

The overall transplantation programme objective is to compensate for the plant construction impacts on coral communities, and to recreate areas where biodiversity had disappeared for a long time before any industrial activity. It is though expected that in these areas, corals will be healthier and more diverse after the project construction is completed. The scope of the work has been to remove the healthiest colonies of sensitive corals (with slow growth rate, the reef builders, the rare or uncommon species and the species with low capacity recruitment) from impacted areas and reinstate them without any damage onto new safe and suitable areas inside the project area.

The transplantation assessment was proposed in 2006, then followed by PAC approval Between January and September 2007, 3 major transplantation campaigns (January, April and September) have taken place to remove and transplant more than 1500 branching and massive sensitive coral colonies. Prior to each mission a dedicated assessment survey has been carried out.

Figure 16 – The transplantation areas



A total of 6 new transplanted sites have been formed of which 4 of them are located south of the MOF and other 2 close to the outfall pipeline east of Blahaf Bay. The locations of these sites have been selected carefully. They offer special features which allow corals to recover such as:

- protected from marine works,
- similar oceanographic conditions to the original areas,
- hard substrate to stick small coral colonies,
- protected from fishing activities.

The YLNG transplantation program is believed to be the largest attempt ever made to transplant small and massive corals. Indeed, Some huge *Porites* colonies of more than 1.5 tonnes and up to 4 tonnes (believed to be the largest coral ever transplanted), have been collected, transported and transplanted on new locations. Because of the speciality of this project, new technologies and original tools (e.g. tripods, big basket) were specifically developed for transport and were built on site using the building construction service. (**Annex 6**) presents the method used for transplantation.

It is the YLNG intention to extend this program in future to areas outside project in order to promote new population and new growth.

Monitoring the transplanted corals

In order to survey the health of the transplanted corals and to assess the potential impact of the monsoon on them, a specific monitoring program has been implemented by Creoccean. This biannual monitoring is based on photoquadrat pictures from previous survey and growth measurements on branching corals (*Acropora*) and massive colonies (*Porites*). Over one year has passed since we started monitoring these corals and so far results of monitoring are very promising as corals are in a good health and growing (Refer to paper attached at **Annex 6**).

The YLNG transplantation program is a new experience that could be used as an example for other worldwide projects.

Biodiversity Action 7 - Implementation of a multi-level robust monitoring program with the involvement of various stakeholders.

Biodiversity Action 7 – Status: Complete, biodiversity monitoring scheme fully in place and working effectively.

Overview

In order to validate the 3-tier Sustainable Development and Environmental Strategy, YLNG has employed a Yemeni consultancy and two respected international consultancies to monitor the marine environment during and after construction works. This approach is then overseen by the Yemeni Authorities.

The monitoring (which includes all aspects of marine biodiversity) is designed to measure the impacts of the construction works on marine and intertidal ecosystems and to confirm if the installed mitigation measures are effective (see summary of results over 24 months of monitoring in **Annex 7**). It involves successive observations of the coral health, the water quality and the fish population. This will allow the detection of any changes which may occur within the coral communities during construction phase, before either morbidity or mortality occurs. Moreover, it will allow appropriate adapted response to be executed. The monitoring consists of [8]:

Level 1 – Daily site monitoring by marine contractors (water quality, qualitative coral conditions, etc). Rapid feedback to project if problems are discovered.

Level 2 – Regular water quality sampling (Turbidity, TSS, TDS, water temperature, salinity etc) on weekly basis . Rapid feedback to project if problems are discovered.

Level 3 – in depth bi-monthly marine monitoring involving successive observation of the coral health by Creoclean (qualitative and quantitative assessment). This allows the detection of any changes which may occur within the coral communities during construction phase this is supported by Intermittent water quality analysis, cumulative sediment impact monitoring by Creoclean and a fish population study implemented by MacAlister Elliott & Partners. Repaid feedback to project if problems are discovered.

Level 4 – Regular monitoring missions by the Authorities Monitoring Team which comprises EPA, MOM, MAA. Rapid feedback to project and company if problems are discovered.

Specific Objectives

Balhaf coral resilience

In addition to the sea water quality monitoring performed in normal weather conditions, it was decided to implement sea water quality analysis during the monsoon time in order to validate the thresholds. The result of the study, which indicated a remarkable natural increase of TSS and Turbidity figures during the monsoon, confirmed that the Balhaf corals are naturally more resistant to suspended sediments than other corals in the world. For the monitoring protocols, see **Annex 8**.

Assessing the sediment cumulative impact

Following the discussion during the November 2006 Coral Monitoring Mission debriefing, a study aiming to clarify the nature and origin of the sediment deposits found on the living

corals around the MOF building area was proposed on January 2007 and started on February 2007. As part of this study, samples collected in sediment traps, on living coral colonies and at different sites around the MOF construction area were analyzed. The primary objectives of this study were then:

- A quantitative and qualitative monitoring study of the sediment deposited in sediment traps during dredging activities for the MOF construction and at control Areas.
- A qualitative study of the sediment collected on living coral colonies in close proximity of the MOF construction and dredging site and in control sites.

Annex 8 presents the detailed methodology of the study and **Annex 7** presents a summary of the results. This effective management strategy allows identifying problems and taking appropriate and immediate remedy actions. Additionally all monitoring reports are communicated to the relevant stakeholders including the Yemeni Authorities.

TABLE 1 - Summary of Environmental Thresholds and Performance Indicators:

| | Indicators | Thresholds | objectives |
|-------|--|------------|--|
| Coral | Relative abundance ⁽¹⁾ of living cover, non-living cover and sediments | | To detect a potential presence of coral mortality, bleaching or change of the bottom composition and to assess coral health |
| | Relative abundance ⁽¹⁾ of hard corals, other benthos, rock, biogenic rock and sediments | | |
| | Relative abundance ⁽¹⁾ of the nine main hard coral families | | To detect potential modification of the coral community composition |
| | Red sponge growth | | To estimate the red sponge growth rate and to know if the infestation is linked to the construction activities or is natural |
| | Sediment deposits | | To assess the efficiency of the mitigation measures and to evaluate the potential impact of the project |
| | Presence of coral disease, bleaching, mortality ⁽²⁾ | | To assess the coral community health |
| Water | Total Suspended Solid | 10 mg/l | To evaluate the water quality and to highlight potential impact of the construction activities |
| | Turbidity | 29 NTU) | |
| | Salinity | 37.5 g/l | |
| | Dissolved oxygen | 3 mg/L | |
| Fish | Diversity (number of species) | | To establish a fish nursery baseline |
| | Abundance (number of fish) | | |
| | Biomass | | |
| | Size class frequencies | | |

Biodiversity Action 8 - Development and implementation of local biodiversity related sustainable development projects.

Biodiversity Action 8 – Status: Complete for the construction phase and long term plan in place for the operations phase.

Early in the construction phase, and following a fisheries baseline study (**Annex 9**) YLNG recognised the need to implement sustainable development projects to support local fishing communities and to maintain fish biomass, taking into account the loss of Balhaf Bay as a fishing ground. YLNG's sustainable fishing strategy is shown overleaf in **Figure 17** and a description of the projects carried out between 2005 - 2008 is in **Annex 10**. Subsequent to this construction phase work, YLNG has initiated its "Long Term Sustainable Development Strategy" (LTSDS) and Aquaculture is a crucial component of this 5 year plan. **Annex 11** gives an overview of the LTSDS and the future Aquaculture projects which will support the maintenance and indeed improvement in biodiversity once the operations phase has commenced.

Biodiversity Action 9 - Setting up a scientific partnership by the establishment of a biodiversity observatory.

Biodiversity Action 9 – Status: Agreement reached with IUCN, Board approval obtained, contract being drafted, scientific work to commence in 2009.

Following a number of discussions in Yemen, France and Switzerland, the potential for an IUCN facilitated independent scientific review of the work of Yemen LNG emerged, resulting in a programme of activities to support the planning and implementation of the Yemen LNG Biodiversity Action Plan (BAP) strategy which is an integral component of the company's overall Sustainable Development and Environment (SDE) Strategy.

The Biodiversity Partnership consists of three key partners:

- Yemen LNG (representing the private sector);
- the Government of Yemen (representing the public sector); and
- IUCN (representing civil society and sustainability professionals).

The Partnership will work to ensure that the planning and implementation of the company's BAP Strategy is undertaken in a manner which is mutually acceptable to key stakeholders within the private sector, the public sector, and also the broader conservation community. Its programme of work will focus on an independent review of the design and implementation of the BAP strategy. See **Annex 12** for further details of this partnership, which will commence its work early in 2009.

Biodiversity Action 10 - Communicating biodiversity baseline and monitoring reports to the stakeholders as part of the company reporting system.

Biodiversity Action 10 – Status: Complete for the construction phase and long term plan in place for the operations phase.

Biodiversity reports are communicated regularly to the various relevant stakeholders including YLNG's shareholders, contractors and various Yemeni authorities including MOM, EPA, MAA and MFW.

This reporting will extend in future to include potential partners eg IUCN.

Figure 17 - YLNG Sustainable Fishing Strategy

Compensation Issues

Loss of fishing in Balhaf bay, additional boat travel (restricted zone / exclusion zone)

Loss of Balhaf auction, landing site and overnight shelter during monsoon

Potential loss of fish productivity from the Balhaf bay

Short term impacts on less adaptable parts of the local economy

Legacy Issues

Economics of small-scale fishing (price of product; operational costs)

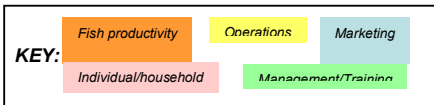
Sustainable fishing practices; reversing the current trend and securing a long-term future

Better understanding of opportunities and constraints through data collection and analysis

Local capacity building

YLNG's 10 Strategic Objectives

- To replace Balhaf landing site and auction
- To support alternative fishing locations away from the exclusion zone
- To support offshore pelagic fishing vs. over-fished inshore demersal fishing
- To support the monsoon operations of nomadic boats
- To encourage better quality and fresher fish, hence higher prices and export potential
- To enable lower operational costs (e.g. fuel/catch)
- To maintain the productivity of the Balhaf Bay fish nursery site
- To improve data collection, and enable advance warning of overfishing and price changes
- To address potential economic loss during construction period
- To provide training and education in sustainable fishing and community management



YLNG Key Programmes

and link to the 10 objectives

Italics = programmes under consideration

Jela'a Breakwater (1,2,3)

Boat handling onto the beaches (1,2,4)

Fish Aggregation Devices (2,3)

Nets (pelagic fish) for non-nomadic fishermen + training (2,3,10)

Tents for nomadic operations (2,3,4)

Improved auctions + access roads (5,6,10)

Bir Ali Electrification + Waste (5)

Improved boat / engine / fish handling e.g. superhours + loan fund (3,6,10)

Coral transplantation (7)

Artificial Reef Programme + rehabilitation of any lost habitat (7,9)

Fish baseline + monitoring (7,8,9)

Computerised recording of Bir Ali auction + beach recorders at Al 'Ein Bay landing sites (8,10)

Vulnerable household support (9)

Training and capacity building Local and Regional (10)

Coastal Zone Management Project support (Zone 1) (10)

Biodiversity Action 11 - Publishing monitoring results in scientific reviews (in particular concerning transplantation program, long-term impacts and mitigation measure effectiveness).

Biodiversity Action 11 – Status: Complete for the construction phase and long term plan in place for the operations phase.

This action has commenced during the construction phase with presentations at a number of important conferences and the publication of associated papers (eg a paper (SPE111475) at the Society of Petroleum Engineers Conference in April 2008, a paper at a major biodiversity conference in Paris in June 2008 (see **Annex 13**) and a paper at the International Coral Reef Symposium in Florida in July 2008 (see **Annex 6**). This process of awareness raising in the scientific community will continue into the operations phase.

Biodiversity Action 12 - Funding a research and scientific publication of a field guide of the corals of Balhaf.

Biodiversity Action 12 – Status: Publication due in November 2008.

YLNG has financed preparation of an illustrated book on the corals of Balhaf which is being prepared by international coral experts. This will be available at the end of November 2008.

Biodiversity Action 13 - Implementation of an assessment study and a monitoring program for the Fish Aggregation Devices (FAD) Project.

Biodiversity Action 13 – Status: Phase 1 trial completed for the construction phase and Phase 2 in preparation for the operations phase.

The FADs trial phase has been extremely successful and it will now be extended into Phase 2. **Annex 14** describes the FAD assessment study (undertaken by MacAlister Elliott and Partners), the results and the next steps.

Biodiversity Action 14 - Development and implementation of a training program for the members of the authority monitoring committee in diving and coral health evaluation methods.

Biodiversity Action 14 – Status: Complete for the construction phase and long term plan in place for the operations phase.

As part of the company efforts to raise the competency of the Yemeni Environmental conservation agencies, and based on a request from the members of the environment monitoring authority consisting of members from MOM, EPA and MAA, the company agreed to upgrade the diving ability for the divers and to conduct a training program in coral evaluation for the members of the committee. The coral recognition training has been completed successfully (see next page **Figure 18**). The diving training will be commenced during the last quarter of 2008.

Biodiversity Action 15 - Development of a biodiversity awareness program internally/externally (school education program, posters, Intranet, Internet).

Biodiversity Action 15 – Status: Complete for the construction phase and long term plan in place for the operations phase.

HSSE have conducted awareness programs across a range of stakeholders in relation to biodiversity. This is described in detail in the Public Consultation & Disclosure Plan (PCDP). A program of schools awareness and “open house” sessions is planned for November 2008. Media used include internet, intranet, posters (example shown on next page in **Figure 19**), leaflets etc in both English and Arabic.



Figure 18 – Yemeni Authorities with course tutors Dr Francesca Benzoni and Prof Michel Pichon

Coral Monitoring

Yemen LNG recognises the important role corals play along the Balhaf coastline. These corals shelter a very high number of species, enhance the productivity of the area and encourage fishing activities.

The Importance of Corals

The repeat baseline study carried out by marine scientists in Balhaf Bay in September 2006 identified:

- The sensitivity, richness & diversity of the area.
- The role played by this area on the local fisheries.
- The risk of the project construction works for the corals within Balhaf bay.

The contribution of coral monitoring to marine biodiversity

Yemen LNG has implemented a system able to detect negative effects of the construction on the corals at an early stage. Yemen LNG adopted this process to minimise impacts due to construction works. The heart of coral protection is the monitoring process.

Thanks to these operations, impacts on corals are limited, thereby meeting the challenge of maintaining a high level of biodiversity and meeting the expectations of stakeholders.

A Robust Coral Health Monitoring Programme

- To monitor the impacts of construction on coral health, Yemen LNG established a coral monitoring programme.
- Monitoring involves bi-monthly monitoring of coral health against the September 2006 baseline to check sea conditions and to identify any coral mortality or evidence of developing morbidity.
- Coral Health Monitoring started in September 2006 and will continue to end of 2008.
- Programme linked to site construction plan, mitigation measures (silt curtains) and to water quality monitoring (turbidity, total suspended solids, temperature, salinity, sedimentation monitored by the project marine contractor and also by a local contractor on a weekly basis).
- Project informed immediately of results and Authorities and other Stakeholders informed regularly.

Results of Coral Monitoring September 2007

The coral communities are healthy. Small disease (e.g. sponges) can be observed but the corals resist it. The situation is stable.

Figure 19 – Example of Awareness Poster

Additionally environmental and social issues have been presented to internal Yemen LNG staff and to external various stakeholders including governmental bodies, national and international NGOs in two public disclosure workshops held in 2006 and 2007 with a further series to be held in 4Q2008.

Biodiversity issues are communicated to all staff and shareholders through emails, intranet and posted on notice-boards on weekly and monthly basis.

The Yemen LNG web site (www.yemenlng.com) provides a good source for communicating our actions to external stakeholders. This program will extend in future in line with our BAP strategy.

Biodiversity Action 16 - Organising periodic stakeholder workshops.

Biodiversity Action 16 – Status: Complete for the construction phase and long term plan in place for the operations phase.

Stakeholder workshops are arranged regularly as part of the public consultation and disclosure process (see also Action 15 above). The first major workshop on the subject of biodiversity was held in September 2005 to feed back the outcomes of the 2nd baseline survey, and since then major participative workshops have been held in 2006, 2007 and the next one will be held in November 2008. This is also supported by awareness sessions in local schools around the site (see **Figure 20**) and pipeline works and different techniques are adopted to convey key messages to the schoolchildren.

Figure 20 – An awareness session at a Local School



Biodiversity Action 17 - Supporting implementation of the protected area 1 Bir Ali – Burum as part of the National CZMP Project sponsored by EPA.

Biodiversity Action 17 – Status: Awaiting ratification of the CZMP by Yemeni Government and appropriate co-funding arrangements to be in place.

The genesis of Coastal Zone Management on the Gulf of Aden can be traced back to the Jeddah Convention of 1982 when PERSGA (The Regional Organization for the Conservation of the Environment of the Red Sea and Gulf of Aden) was founded. Yemen is a signatory to this since Yemen ratified the Convention on Biological Diversity on February 21st 1996. A national environmental action plan (NEAP) was actioned in 1996 with the two key actions related to protection of the coastal marine environment being:

- To prepare and develop an Integrated Coastal Zone Management Plan.
- To develop and establish a system of marine protected areas (MPA) with effective management plans.

These actions are implemented through a project funded by the Global Environment Facility of the World Bank. The project seeks *“to conserve globally significant coastal and marine biodiversity in threatened pilot sizeable sections of the coastal zone along the Gulf of Aden by promoting effective and replicable integrated coastal zone management process including the establishment of coastal and marine protected areas based on a strong participation of all the coastal users. In doing so, the project will complement ongoing initiatives and is expected to develop an enabling framework for coastal and marine biodiversity conservation through CZM in Yemen which will pave the way for the development of a broader program”*.

The pilot sections of the coastal zone identified under the project are located in the Governorate of Hadramout. These are as follows:

- **Bir-Ali - Burum**, 75 km in length, west of Al Mukalla: a site characterized by its coral reefs (Pilot Area 1),
- **Sharma - Jethmun**, 50 km in length, east of Al Mukalla: a major sea turtle nesting site (Pilot Area 2).

These pilot areas were chosen because of their known biological diversity and because of the threats from uncontrolled commercial development and from artisanal fishing. Pilot Area 1 was later divided into two sectors. Balhaf lies on the western edge of Sector 1 (the most westerly survey sector) and it is therefore part of the proposed Zoning Plan under the CZMP.

The Zoning Plan is a key outcome from this GEF (World Bank, UNDP, UNEP) funded pilot project and it will determine the permissible developments along the coastline from Balhaf eastwards. There are a number of zoning definitions under the CZMP, but the one which affects Balhaf is *General Use Zone*. General Use Zones are defined as *“Areas where a significant level of habitat modification and/or resource exploitation has already occurred, or where development activities will be required to support the social and economic interests of the community. The General Use Zone is intended to concentrate development activities away from environmentally sensitive areas and to provide a focal area for essential infrastructure and utilities.”*

Until the mid 1990's, very little was known about the fish and coral populations along the Yemen coastline of the Gulf of Aden. The first real survey work was carried out by Jeremy Kemp and Francesca Benzoni (1998, 1999 and 2000) and this was followed by work by Kemp and Rebecca Klaus in 2002. Other (unpublished) works include YLNG commissioned baseline marine surveys in 1997 and 2005 at Balhaf.

The PERSGA survey of 2002 led by Kemp and Klaus, was the most intensive marine survey to date of the Balhaf – Burum region (Pilot Area 1). This was then followed and expanded by MacAllister Elliott and partners in 2005 (concentrating on Pilot Area 2) although the report from this survey is currently unpublished. Separately, YLNG commissioned an intensive marine survey of Balhaf in September 2005 (Dutrieux, Benzoni et al, Creoccean, 2005) followed by a series of intensive missions at 2 monthly intervals.

The GEF funding for the implementation of the Coastal Zone Management Plan has not been forthcoming, which means that, without an alternative source of funding, coastal zone

management in Pilot Areas 1 and 2 would merely remain as a recommendation and not become a reality. This would clearly be a significant lost opportunity and YLNG has recognised and acted on this.

Accordingly, on 22nd November 2005, YLNG agreed with the Environment Protection Authority of Yemen (EPA) to provide funding (either partial or complete) to implement the coastal zone management plan for Pilot Area 1. The precise level of funding will be determined once the management plan has been confirmed by EPA and the CZMP ratified by Council of Ministers Decree. This funding will be managed through an independent third party who are competent and experienced in such matters, in order to ensure appropriate and optimal use of the funds to improve the coastal resources in Pilot Area 1.

YLNG has therefore committed to assisting with the funding of the implementation of the national Coastal Zone Management Plan for Zone 1 (Balhaf to Burum). This will provide a lasting legacy in the coastal area both adjacent to, and some distance from, the LNG plant at Balhaf. YLNG is coordinating this issue with EPA as the main sponsor of this project.

Annex 15 shows the draft EPA Management Plan and initial costs.

Biodiversity Action 18 - Adaptation of the construction coral health and sediment monitoring program to a long term program suitable for the operation phase including monitoring of the transplanted coral areas.

Biodiversity Action 18 – Status: Plan to be in place for the operations phase.

The Balhaf LNG plant is situated close to a sensitive marine ecosystem, notably because of the presence of coral communities along the rocky shore. The baseline, carried out in 1997 and updated in 2005, highlighted an important coral diversity with the presence of coral species which can be considered as representative of the northwest Indian Ocean area. These species are to be considered of special value and sensitivity for the Balhaf area. Moreover, this coral ecosystem shelters an important marine biodiversity and supply favourable environment for fish reproduction, recruitment and growth.

Due to the fact that YLNG recognised the need for protecting the Balhaf marine biodiversity, the company will develop a specific environmental management plan for the operational phase. To control the efficiency of the measures and the impact of the project during this phase, an environmental monitoring protocol has to be developed to address the following issues:

- Seawater temperature and salinity on the corals at both side of the Cooling water discharge in the eastern side of Balhaf bay;
- Turbidity regime due to the presence of the MOF and the Jetty in the western side of Balhaf bay.

As part of the Operation ESMS, a detailed monitoring program will be developed.

Performance indicators:

Define long-term indicators in the monitoring plan which show that the implemented monitoring protocol is efficient and also to define frequencies of verifications and updates of the implemented protocol.

Biodiversity Action 19 - Implementation of the effluent discharge control (cooling water, salinity water, plant wastewater).

Biodiversity Action 19 – Status: Plan to be in place for the operations phase.

This issue is linked to the previous action. The proposed monitoring plan will ensure this control (see also Part 5).

Biodiversity Action 20 - Implementation of a community solid waste cleaning pilot project particularly to clean the coastal area of the city of Bir Ali.

Biodiversity Action 20 – Status: *Plan to be in place for implementation during the operations phase.*

Biodiversity Action 21 - Implementation of a study and a pilot project for coral recruitment and growth outside the project area under the goal of supporting biodiversity initiatives outside project area.

Biodiversity Action 21 – Status: *Plan to be in place for implementation during the operations phase.*

Biodiversity Action 22 - Implementation of planned coastal reclamation for Balhaf.

Biodiversity Action 22 – Status: *Plan to be in place for implementation during the operations phase.*

Biodiversity Action 23 - Implementation of a coastal expansion projects for the area between Bir Ali and Balhaf to encourage turtles nesting activities.

Biodiversity Action 23 – Status: *Plan to be in place for implementation during the operations phase.*

Biodiversity Action 24 - Monitoring of the success of the corals transplanted during the construction phase under the objective of improving scientific knowledge of the Yemeni coral ecosystem.

Biodiversity Action 24 – Status: *Plan to be in place for implementation during the operations phase.*

Biodiversity Action 25 - Monitoring and analysis of chronic diseases such as the red sponge in Balhaf and the surrounding area under above objective.

Biodiversity Action 25 – Status: *Plan to be in place for implementation during the operations phase.*

PART 5

MONITORING, EVALUATION AND IMPROVEMENT

The monitoring of the success of the management of biodiversity occurs at a number of levels as described below:-

Level 1 – Daily site monitoring by marine contractors (water quality, TSS, turbidity, qualitative coral conditions etc). Rapid feedback to project management if problems are discovered.

Level 2 – Regular water quality sampling by Hadrahmout University of Science & Technology (HUST) who have carried out over 20 missions since September 2005. This process has been quality checked by Creoccean who have carried out an additional 8 water quality missions between April 2006 and September 2007, measuring parameters such as TSS, turbidity, temperature, salinity, pH and sedimentation. Rapid feedback is given to project if problems are discovered. Monitoring continues on a regular basis using Yemanja but still quality checked by Creoccean.

Level 3 – In depth bi-monthly missions by Creoccean to check coral health and diversity against internationally accepted statistical criteria. Reports copied to the Yemeni Authorities. Currently a total of 20 missions have been undertaken by Creoccean between January 2006 and October 2008. Rapid feedback is given to project if problems are discovered.

This is supported by monitoring of fish populations by Macalister Elliot and Partners, against a baseline carried out in January 2006.

Level 4 – Regular monitoring missions by the Authorities Monitoring Team which comprises EPA, MOM, MAA and MFW. Approximately 30 missions held to date.

In addition to the above, the Financing Agencies monitor progress through regular verification visits which are described in **Annex 16**.

PART 6

REPORTING, COMMUNICATING AND VERIFICATION

The reporting, communicating and verification of the success of the management of biodiversity occurs at a number of levels, some of which are common and some of which are not, depending on the recipient's requirements. In broad terms, the recipients of the various reporting mechanisms are as follows:-

1. The Yemeni Authorities under the legislation variously described in **Annex 1**.
2. The Financing Agencies which require reporting to World Bank requirements and which are described further in **Annex 17**.
3. Shareholders in accordance with their own particular requirements.
4. The scientific panel formed under the aegis of IUCN (see **Annex 12**).
5. The International Association of Oil & Gas Producers (OGP) of which YLNG is a trade member.
6. The communities with an interest in the YLNG project by reason of their livelihood or location.
7. Other ad hoc reports as may be required by stakeholders.

Annex 1

National & International Legislation/Policies followed by YLNG concerning Marine Environment & Biodiversity Management

General Legal Environmental Framework of the Republic of Yemen

The Republic of Yemen was formed on 22 May 1990 through the unification of the Yemen Arab Republic (YAR) and the People's Democratic Republic of Yemen (PDRY). Its first constitution was passed in 1991, at which time the central government functions were transferred to the new capital city of Sana'a. Now, Yemen is divided into 19 governorates. Since the unification, legislated environmental protection in Yemen has been undergoing a rapid development process. The general environmental institution framework of the Republic of Yemen is as follows:

MINISTRY OF WATER AND ENVIRONMENT (MWE) : Overall responsibility for environmental management in Yemen.

ENVIRONMENTAL PROTECTION AUTHORITY (EPA): EPA is part of MWE , formerly called Environment Protection Council (EPC) is the central organization responsible for policy making on the protection of the environment and for activities of environmental protection and natural resources conservation

MINISTRY OF OIL AND MINERALS (MOM) Responsible for assessing the potential environmental impacts from oil and gas pipelines and other upstream and downstream facilities with the assistance of EPA

MINISTRY OF AGRICULTURE AND IRRIGATION

Responsible for the management of biological resources (protection and management of wildlife, agriculture, forestry and fisheries)

No legislative mandate for environmental protection

MARITIME AFFAIRS AUTHORITY (MAA): Responsible for taking measures to prevent the pollution of the sea

MINISTRY OF FISHERIES (MF): Concerned by marine resources

Applicable National Legislation

At this moment, there is no legislation or policies in force in Yemen, which specifically deals with biodiversity resources. However, there are a number of effective laws which are related to the protection, conservation and management of environment. The most important of these for marine environment and biodiversity conservation are:

The Environmental Protection Law (EPL) No. (26) of 1995 [3]

The EPL is the most comprehensive environmental legislation to date in the Republic of Yemen [1]. It includes general regulations for the protection of both the marine and terrestrial environments and outlines the basic objectives and roles of concerned authorities in the protection of air, water, and soil. It establishes controls on environmentally damaging activities, environmental monitoring and marine pollution. It is very general in nature, and does not provide specific compliance standards [2].

The EPL spells out the necessity of an Environmental Impact Assessment (EIA) as a pre-requisite for development projects licences, prior to implementation of any project or activity which might cause negative effects to the environment. Moreover, it establishes the basic definitions of EIA guidelines and standards and it requires environmental audit for existing activities.

Finally the Law provides for the establishment of natural protected areas, defined as land or water (both coastal and inland) that enjoys special protection to preserve its environment, archaeological features, or to protect fauna, flora, birds or marine species that are endangered or threatened with extinction. In particular, it is prohibited to construct establishments, buildings or roads, or to transport vehicles and equipment, or to perform any commercial or industrial activities unless permission has been obtained from the competent authority specified by the cabinet.

The Law for the Protection of the Marine Environment No. (11) of 1993

This law, amended by Law No.16 of 2004, aims at protection of the sea from pollution. It is mainly concerned with pollution by oil and the pollution from passing ships. The Law determines procedures for prosecuting, penalizing and requesting compensation from ships that violate the law. More particularly, it prohibits any industrial complexes or facilities which may cause pollution of the beaches of the Republic of Yemen, either done internationally or unintentionally, directly or indirectly.

The Maritime Affairs Authority (MAA) is responsible for taking measures to prevent the pollution of the sea. Under Law No.16 of 2004 regarding the Protection of Marine Environment from Pollution (PMEFP), the MAA has full power to intervene, investigate and regulate marine pollution. Such powers extend to the inspection and detention of vessels.

The Presidential Decree on Law No. (43) of 1997

It regulates fishing exploitation and protection of live aquatic resources [2].

The Law Regulating Fishing and Protection and Use of Living Marine Resources No.42 of 1991

This Law aims at the regulation of the exploitation, the fishing and the protection of aquatic life.

While the Republic of Yemen has developed laws and regulations dealing with various aspects of the environment including the field of the biodiversity, the country faces a number of obstacles to implement its legislation. The existing national legislation in the Republic of Yemen has evolved in a fragmented manner, leading to increase potential for overlapping jurisdictions associated with weak law enforcement. As a result there is no specific legislation for biodiversity resources, and there are only limited provisions in the EPL dealing with biological resources. Moreover, some legislation, which is in place, lacks complementary by-laws, guidelines and standards for effectively enacting them. At last, another principal obstacle to implementing measures to conserve biodiversity and biological resources sustainable use is the scarcity of financial resources. Although the legislation imposes severe penalties for violations of its provisions, it is not consistently enforced and offenders often are not prosecuted [1,2,3,4,5].

International Conventions ratified by Yemen

The Republic of Yemen has international environmental law obligations because it has ratified biodiversity-related international agreements. These are listed in the following table:

Global conventions protecting the marine environment and biodiversity (modified from [5]).

| Marine environment protection/biodiversity-related conventions ratified by the Republic of Yemen | Date of ratification |
|--|----------------------------------|
| The International Convention on Biological Biodiversity (CBD) Rio de Janeiro, 1982 | 21.02.1996 |
| The United Nations Convention on the Law of the Sea (UNCLOS) Montego Bay, 1982 | 10.12.1987 |
| Regional Convention for the Conservation of the Red Sea and Gulf of Aden Environment (PERSGA) Jeddah, 1982 | 20.08.1982 |
| Protocol Concerning Regional Co-Operation in Combating Pollution by Oil and Other Harmful Substances in Cases of Emergency Jeddah, 1982 | 20.08.1982 |
| The Convention on International Trade in Endangered Species of Wild Fauna and Flora Bonn, 1979 | 03/08/1997 (entry into force) |
| Convention concerning the Protection of World Cultural and Natural Heritage Paris, 1972 | 07.10.1980 |
| Convention for the Safety Life at Sea (SOLAS) London, 1960 | 06.03.1979 |
| Protocol on Interference on High Seas in case of Marine Pollution with Substances other than oil London, 1973 | 06.03.1979 |
| Convention on Intervention on High Seas in case of Catastrophes of Oil Pollution Brussels, 1969 | 06.03.1979 |
| Convention for the prevention of Pollution of the Sea by Oil London, 1954 | 06.03.1979 |
| Convention on the Conservation of Migratory Species of Wild Animals Bonn, 1979 | 01.12.06 (entry into force) |

The International Convention on Biological Biodiversity (CBD)

The Convention on Biological Diversity is an international treaty that was adopted at the Earth Summit in Rio de Janeiro in 1992. It recognizes for the first time in international law that the conservation of biological diversity is "a common concern of humankind" and is an integral part of the development process. The agreement covers all ecosystems, species, and genetic resources (without focussing only on protected species and habitats). The Convention has three main goals:

- conservation of biological diversity,
- sustainable use of its components,
- fair and equitable sharing of benefits arising from genetic resources.

The convention reminds decision-makers that natural resources are not infinite and sets out a philosophy of sustainable use. At last, the convention also offers decision-makers

guidance based on the precautionary principle that where there is a threat of significant reduction or loss of biological diversity. Importantly, the Convention is legally binding; countries that join it are obliged to implement its provisions.

As recommended in Article 6 of the Convention on Biodiversity [6], the Environment Protection Authority of Yemen, in cooperation with the UNDP², GEF³ and IUCN⁴, has published in 2005 a National Biodiversity Strategy and Action Plan (NBSAP). This plan represents a major step towards a national program aiming to conserve and wisely utilize in a sustainable way the limited but yet unique natural resources of Yemen. On the basis of a detailed situation analysis of biodiversity in this country (and the threats it faces), specific goals and objectives are identified to govern the thrust of the action plan outlined in this document [5] [6].

The United Nations Convention on the Law of the Sea (UNCLOS)

It provides the overall legal framework for ocean activities. The Convention sets out the rights and obligations of coastal states concerning the continental shelves, as well as regulations on how the area outside continental shelves should be managed for the benefit of humankind. The Convention also includes provisions on the protection of the marine environment from negative effects from various activities that might be undertaken. Countries should ensure that they have the necessary legal and institutional framework for managing mining activities. This calls for the establishment of a national authority in each country, with the mandate to issue authorization/licensing having fully considered the potential effects of the planned operation, be responsible for monitoring of compliance, develop the monitoring framework and enforce conditions as attached to the license [7].

International Convention for the Prevention of Pollution from Ships

All boats and LNG carriers involved in YLNG construction and operation will comply with MARPOL 73/78 Convention [8]. This convention is designed to minimise pollution of the seas, including dumping, oil and exhaust pollution. Its stated object is: to preserve the marine environment through the complete elimination of pollution by oil and other harmful substances and the minimization of accidental discharge of such substances. The MARPOL 73/78 Convention is a frame convention with six annexes containing detailed regulations regarding permissible discharges, equipment on board ships, etc. Apart from the detailed regulations, the convention also includes a number of regulations regarding inspection of ships, etc. aimed at facilitate for the authorities to control the ships' compliance with the requirements of the convention.

Convention on Migratory Species (CMS)

It is an intergovernmental treaty which aims to conserve terrestrial, marine and avian migratory species throughout their range. CMS Parties strive towards strictly protecting

2 UNDP (The United Nations Development Programme) is a large multilateral source of development assistance which provides expert advice, training, and grant support to developing countries, with increasing emphasis on assistance to the least developed countries.

3 GEF (the Global Environment Facility) is an independent financial organization that helps developing countries fund projects and programs that protect the global environment (biodiversity, land degradation...).

4 IUCN (World Conservation Union or International Union for the Conservation of Nature and Natural Resources) is an international organization with aims of influencing, encouraging and assisting societies throughout the world to conserve the integrity and diversity of nature and to ensure that any use of natural resources is equitable and ecologically sustainable.

these animals, conserving or restoring the places where they live, mitigating obstacles to migration and controlling other factors that might endanger them. Besides establishing obligations for each State joining the Convention, CMS promotes concerted action among the Range States of many of these species [9].

The Regional Convention for the Conservation of the Red Sea and Gulf of Aden Environment

The Jeddah Convention of 1982, formally titled "Regional Convention for the Conservation of the Red Sea and Gulf of Aden Environment," provides an important basis for environmental cooperation in the region [10]. Its objective is to ensure conservation of the environment of the Red Sea and Gulf of Aden by the promotion of environmental protection and natural resources management in the marine and coastal areas of the region, in order to guarantee rational human use of living and non-living marine and coastal resources [11].

The contracting parties have to prevent, abate and combat pollution from ships (art.4), pollution from land-based sources (art.5), pollution resulting from exploration and exploitation of the bed of the territorial sea, the continental shelf and the subsoil thereof (art.7) and pollution from other human activities (art.8).

Environmental Policies followed by YLNG [12,13] (Applicable Lender E&S standards)

The World Bank Pollution and Abatement Handbook

The General Environmental Guidelines (July 1998)

The General Environmental Guidelines are technical references with general and industry-specific examples of Good International Industry Practice (GIIP). Although this document doesn't especially deal with the field of the environment and biodiversity protection, it proposes guidelines and standards concerning water quality and conservation, waste management and noise. It summarizes management approaches for land contamination due to anthropogenic releases of hazardous materials, wastes, or oil, including naturally occurring substances.

The Oil and Gas Development (Onshore) Guidelines

The World Bank Safeguard Policies

The World Bank Group has developed safeguard policies for environmental and social issues which are used by credit agencies to grant project financing [14]. Concerning marine environment and biodiversity protection, there are two main safeguard policies:

The World Bank operational policy No.4.01 "Environmental assessment" (January 1999, revised August 2004) :

The Bank requires Environmental Assessment (EA) for all projects which requested for financing support, to help ensure that they are environmentally sound and sustainable, and thus to improve decision making. EA is used by Bank to identify, avoid and mitigate the potential negative environmental impacted associated with Bank lending operations.

The Operational Policy 4.01 describes the Bank's EA policy and recommended procedures (notably the content description of the EA which has to be executed by the borrowers) and outlines the content of the Environmental Action Plan [15].

The World Bank Operational Policy No.4.04 “Natural Habitats” (January 2001, revised August 2004)

The Bank upholds the protection, maintenance, and rehabilitation of natural habitats and their functions in its economic and sector work, project financing, and policy dialogue. The Bank supports, and expects borrowers to apply, a precautionary approach to natural resource management to ensure opportunities for environmentally sustainable development. This specific safeguard policy [16] seeks to ensure that World Bank-supported infrastructure and other development projects take into account the conservation of biodiversity, as well as the numerous environmental services and products which natural habitats provide to human society.

Specifically, the policy prohibits Bank support for projects which would lead to the significant loss or degradation of any Critical Natural Habitats, whose definition includes those natural habitats which are either:

- legally protected,
- officially proposed for protection,
- unprotected but of known high conservation value.

In other (non-critical) natural habitats, Bank supported projects which can cause significant loss or degradation only when there are no feasible alternatives to achieve the project's substantial overall net benefits and when acceptable mitigation measures, such as compensatory protected areas, are included within the project.

IFC⁵ Environmental and Social Standards

Based on the World Bank Group safeguard policies, IFC has developed Performance Standards on Social and Environmental Sustainability [17]. These standards define client's role and responsibilities for managing their projects and requirements for receiving and retaining IFC support. Indeed, IFC applies to all projects it finances these standards in order to minimize their impact on the environment and affected communities. Concerning marine environment and biodiversity protection, there are three main Performance Standards:

Performance Standard 1: Social and Environmental Assessment and Management Systems:

This guideline underscores the importance of managing social and environmental performance throughout the life of a project. It aims to

- identify and assess social and environment impacts, both adverse and beneficial, in the project's area of influence,
- avoid, or where avoidance is not possible, minimize, mitigate, or compensate for adverse impacts on workers, affected communities, and the environment,
- ensure that affected communities are appropriately engaged on issues that could potentially affect them,
- promote improved social and environment performance of companies through the effective use of management.

⁵ The IFC (International Finance Corporation) is the World Bank Group entity with a mandate to invest in private sector projects in developing countries as a way to reduce poverty and improve people's lives.

In this way, the client has to establish and maintain a Social and Environmental Management System appropriate to the nature and scale of the project and commensurate with the level of social and environmental risks and impacts. The Management System will incorporate the following elements: (i) Social and Environmental Assessment; (ii) management program; (iii) organizational capacity; (iv) training; (v) community engagement; (vi) monitoring; and (vii) reporting.

Performance Standard 3: Pollution Prevention and Abatement

This Performance Standard recognizes that increased industrial activity often generate increased levels of pollution to water and land that may threaten people and the environment at the local, regional, and global level. Its objectives are to:

- avoid or minimize adverse impacts on human health and the environment by avoiding or minimizing pollution from project activities,
- promote the reduction of emissions which contribute to climate change.

The client is required to apply pollution prevention and control technologies and practice techniques that are best suitable to avoid or, where avoidance is not feasible, minimize or reduce adverse impacts on human health and the environment. This document defines the client bonds in terms of pollution, as the pollution prevention, the resource conservation or the use and management of pesticides.

Performance standard 6: Biodiversity Conservation and Sustainable Natural Resource Management

This measure recognizes that protecting and conserving biodiversity and its ability to change and evolve is fundamental to sustainable development. The components of biodiversity, as defined in the Convention on Biological Diversity, include ecosystems and habitats, species and communities, and genes and genomes, all of which have social, economic, cultural and scientific importance. This Performance Standard reflects the objectives of the Convention on Biological Diversity which are:

- To protect and conserve biodiversity,
- To promote the sustainable management and use of natural resources through the adoption of practices which integrate conservation needs and development priorities.

This Performance Standard addresses how clients can avoid or mitigate threats to biodiversity arising from their operations as well as sustainable manage renewable natural resources. The client has to assess the significance of project impacts on all levels of biodiversity as an integral part of the Social and Environmental Assessment project. If it is necessary, client will have to retain qualified and experienced external experts to assist in conducting the Assessment. At last, this guideline describes the content of a standard Biodiversity Action Plan.

To help clients in their approaches, IFC has prepared a set of Guidance Notes, which provide guidance to client in meeting the standards.

COFACE⁶ Environmental Guidelines [18]

COFACE uses the environmental guidelines « Common Approaches on Environment and Officially Supported Export Credits », adopted in 2001 (and updated in 2003) by OCDE⁷ countries. The Recommendation defines the rules and procedures for assessing the environmental risk project undertaken, based on practises of international financial institutions such as the World Bank Group (EA, potential impacts, mitigation measures, monitoring and management plan). COFACE carry out a systematic environmental assessment of all major projects.

K-EXIM⁸ Environmental Policy and Environmental Procedures

Published guidelines by the Agency.

6 The COFACE (Compagnie Française d'Assurance pour le Commerce Extérieur) Group provides insurance products and services for companies, with the aim of facilitating trade throughout the world.

7 OCDE (Organization for economic co-operation and development) is an international organization of economic surveys whose Member States, mainly developed countries, have in common a democratic system of government and a market economy.

8 K-EXIM (Export-Import Bank of Korea) is an official credit agency providing comprehensive export credit and guarantee programs to support Korean enterprises in conducting overseas business.

Annex 2

THE RATIONALE FOR SITE SELECTION OF BALHAF AND THE YEMEN LNG STRATEGY ON THE PROTECTION OF CORALS

1. Background

This paper addresses the joint subjects of site location and the management and protection of marine biodiversity at the YLNG plant construction site at Balhaf in the South of Yemen.

The purpose of this paper is to explain why (from a social and environmental perspective) Balhaf was chosen as the site for the LNG terminal, and to further explain Yemen LNG Company's strategy in preserving marine biodiversity at Balhaf, recognising that, despite YLNG best efforts, some minor impacts to corals may have already occurred (as recognised in the ESIA report, which was approved by the designated Yemeni Government Competent Authority in December 2005) but that this is neither reason nor justification for any Authority claim against YLNG on the grounds of environmental damage, coral impacts or coastal pollution. Indeed this paper will clearly show that the overall programme of coral management has introduced a number of powerful and innovative solutions which are pushing the scientific frontiers of reef management forwards in a manner in which MOM, YLNG, and indeed The Republic of Yemen itself, can take pride.

2. Site Selection and the Balance between Social & Environmental Impacts

The initial screening of the various site alternatives took place in 1995. The rationale was to select a combination of a LNG plant location and a pipeline route to transport the gas which would optimize the economics of the project while minimizing its environmental and social impacts. As the Marib gas field location was fixed, various alternatives were reviewed, and these considered the available options for an access to the sea and a pipeline route through difficult geographical features such as mountains and narrow valleys in areas with a rapid population growth.

The process to analyse alternatives thus commenced with the selection of a LNG plant location on the coastline for production and export of liquefied gas. Options were then studied for the layout of the marine facilities within the selected site. Once the LNG plant site was selected, the most favourable pipeline corridor was chosen amongst the various route alternatives available for this LNG plant site. Then within the pipeline corridor selected, the detailed route was studied to further minimize the environmental and socio-economic impacts.

In June 1995, the Yemen Gas Corporation (YGC) and Total carried out a four-day survey of eight pre-selected sites, followed by preliminary comparative studies. The selection process comprised a weighting criteria appraisal. The main criteria that were considered can be grouped into the following categories:

- Marine natural conditions for a tanker terminal: marine accessibility and safety for LNG carrier (capacity of 125,000 to 135,000m³ needed); water depth (minimum required 14.5m); wave, current and wind conditions; need for breakwater; need for dredging;

- Onshore suitability for a LNG plant: available space (110 to 130 ha needed for the plant and 80 to 100 ha for camps); natural hazards (earthquake, flooding); site preparation requirements; geotechnical foundation conditions;
- Pipeline route associated with the LNG plant site (length and difficulties)
- Socio-economic and environmental aspects at each location.



Detailed studies were conducted for three sites, Ghubb Diknah, Ras Imran and Balhaf. Based on these additional surveys and studies, the comparison of the three selected sites resulted in the final site selection of Balhaf, which offers, with the revised layout, the best technical compromise with minimal dredging and the lowest capital investment. It also offers environmental and socio-economic conditions for both site and pipeline that were recognized acceptable by the Yemeni Government. The has been classified as a “General Use Zone” within the forthcoming implementation of the Coastal Zoning Management Plan for the Gulf of Aden.

Nevertheless, whilst Balhaf was assessed to be the optimum site, the ESIA (formally accepted by the Yemeni Authorities in 1998 and reconfirmed in December 2005) recognises that the coastline is very rich in corals.

3. *Why Protect Corals?*

There are a number of compelling reasons to protect corals. These can be summarised as follows:-

- It is the policy of the Company and its main shareholder (the Total Group) to preserve the environment and especially the marine biodiversity.
- Corals are a worldwide protected species (IUCN).
- Coral reefs shelter a very high number of species, their biodiversity is very high.

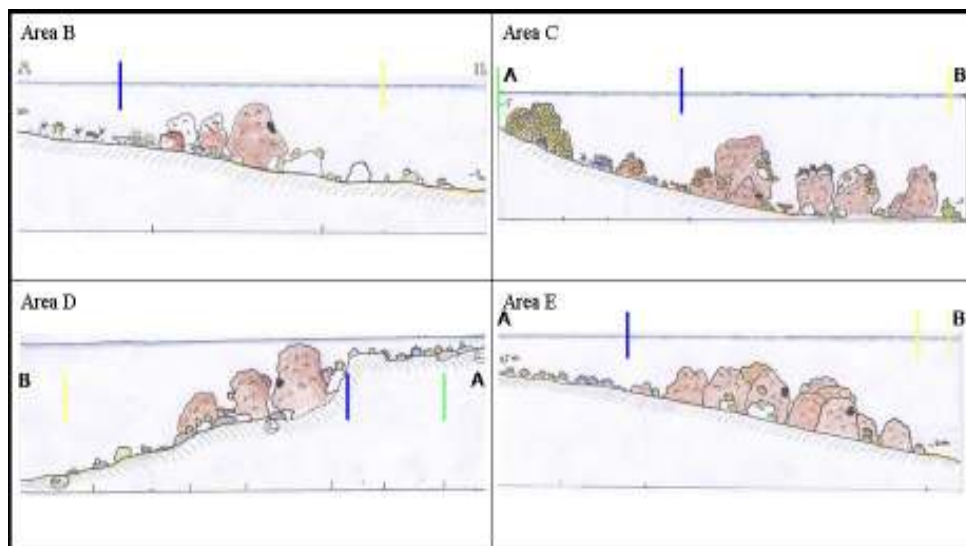
- Coral reefs enhance the productivity of an area and encourage fishing activities.



In addition, there is a compelling moral and reputational issue at stake.

4. ***Pre-Construction Baseline Survey***

In order to determine the “pre-construction” conditions at Balhaf, a “Baseline” survey was undertaken by marine scientists who worked with Creocan, an internationally recognised consultancy which specialises in marine environmental matters. The survey was undertaken in September 2005 (5 months before the commencement of marine works) and the scope included mapping of the benthic communities and a full description of the structural complexities of the habitats.



The Baseline Survey found that the area had some very sensitive and diverse corals, more so than had been previously realised by scientists, that the coral reefs were very important to the local fisheries, and that measures should be taken to protect these corals

during and after the site construction works. With this in mind, YLNG put in place a robust management strategy which is designed to encompass both environmental and social issues.

5. **YLNG Environmental & Social Management Strategy**

YLNG's approach to the control of social and environmental impacts is designed to follow a 3-tier management strategy :-

1. Eliminate or mitigate impacts by redesign.
2. If elimination or mitigation is not completely effective, provide offset for impacts.
3. Provide investment to promote sustainable improvement in social or environmental conditions.



This strategy was put in place prior to marine construction works commencing (January 2006) and it still holds good some 22 months later (October 2007). Furthermore, the effectiveness of this policy is proven by a programme of regular monitoring missions.

6. **The Management of Biodiversity**

Practical examples of how YLNG has implemented this robust strategy in managing the marine environment at Balhaf are as follows:-

6.1 **Eliminate or mitigate impacts by redesign:**

Following the findings of the September 2005 baseline survey YLNG completely redesigned the Materials Offloading Facility (MOF) to position it between two coral banks and to dramatically reduce the "footprint" on the seabed by moving from a rock-dumped solution to a piled bridge solution (see picture opposite and photograph over the page).





In addition, YLNG has also redesigned the shoreline works to the north of Balhaf cape (known as Area F) to eliminate works at the shoreline and move it back onto land, thus avoiding the potential for physical damage to corals. Furthermore, the cooling water outfall pipe has been redesigned to lie between two coral banks and also to eject the warm water at an increased distance from the corals, thus avoiding the risk of coral morbidity or mortality due to any increase in seawater temperature. The cost of these modifications runs to tens of millions of US dollars.

6.2 *The use of Silt Curtains*

A further protective measure which Yemen LNG implemented at the commencement of marine construction works was silt curtains. These are geotextile curtains which are deployed to protect the corals from water borne suspended sediments. Yemen LNG continues to use silt curtains in order to provide a barrier “filter” between marine construction works which may generate suspended particles in the water, and the corals which would be adversely affected by sediment deposited on them.





They have proven to be an extremely successful protective measure which greatly reduce the risk of sedimentation on the corals.



6.3 *If elimination or mitigation is not completely effective, compensate for impacts: Transplantation Programme.*

Notwithstanding the above, YLNG recognises that (as stated in the approved Environmental & Social Impact Assessment report) some minor physical damages to corals may occur during the site construction works.

There are 4 specific areas where this risk might be realised :-

-  Construction phase for Materials Offloading Facility (MOF)
-  Cooling water intake pipeline (excavations close to shoreline)
-  Cooling water outfall pipeline (excavations close to shoreline)
-  Construction phase for the Jetty (piling and foundations)

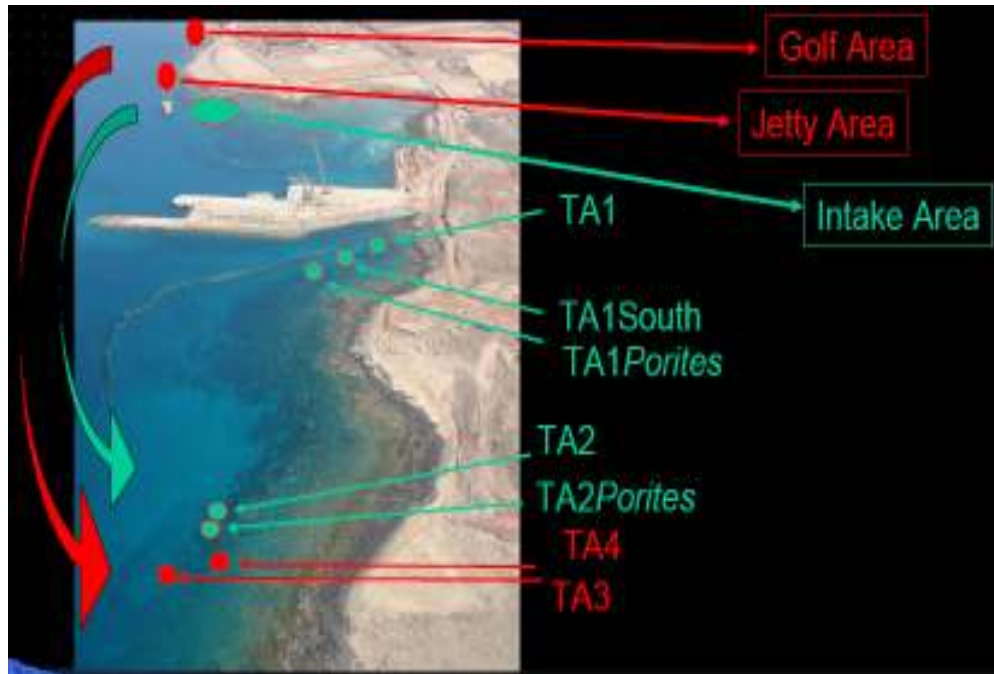
In each case, YLNG is working with the construction contractors to minimise the area of corals at risk. Furthermore, YLNG relies on the regular and thorough independent monitoring programme managed by Creoclean (refer to Section 7), to monitor each phase of the construction works and to identify where corrective measures might be needed, or where works would need to be reconsidered to reduce impacts.

Nevertheless it is recognised (indeed it has been since the project inception) that some limited amount of coral impact will inevitably occur during construction works. An example of this is the “temporary dyke” which has been used to facilitate MOF construction. Whilst this dyke was constructed in an area of low coral sensitivity, some scattered corals were covered by this structure and have therefore been impacted.

YLNG is of course committed to provide measures which offset these potential impacts. Yemen LNG therefore took a proactive approach to this problem and discussed several approaches with marine scientists with a view to maintaining the high level of biodiversity on site.

In this way, a unique and innovative approach was adopted by Yemen LNG in order to mitigate impacts to corals. Yemen LNG has been working with internationally recognised coral transplantation experts to transplant sensitive corals away from the areas of construction activities, to new areas nearby, to promote new populations and new growth on natural substrata. The scale of this exercise is larger than has ever been attempted and the corals which have been transplanted represent particularly sensitive and diverse species. The largest coral transplanted so far has been recorded at 4000kg, believed to be the largest coral ever transplanted successfully. It is believed that this is the largest and most successful exercise in coral transplantation ever attempted by an energy company and, to date, almost 1,500 corals have been successfully replanted.





The first phase of the transplantation programme at Balhaf involved a major mission in January 2007, to remove threatened corals, then to replant them immediately onto a location in which they are not threatened. Some 600 colonies were transplanted, the largest of which weighed around 2 tonnes. This was followed by a second transplantation mission in April 2007 which included an additional 400 corals including one weighing 3 tonnes. The diagram above shows the original locations of the transplanted corals and their new locations.



Since April 2007, 2 further transplantation missions have been carried out, the first to transplant corals from the “Golf” area (shoreline to the North of the MOF) and the 4th mission to transplant corals from the outfall area.

7. Monitoring Process

In order to validate the above 3-tier strategy, YLNG has put in place a robust and multi-level monitoring programme.

YLNG has employed a Yemeni consultancy and 2 respected international consultancies to monitor the marine environment both during and after construction works. This approach is then overseen by the Yemeni Authorities (MOM, MAA, EPA and MWE). The monitoring (which includes all aspects of marine biodiversity) is designed to measure the effects of construction works on fish and coral populations in order to identify the potential for impact before either morbidity or mortality occurs, and it consists of:-

Level 1 – Daily site monitoring by marine contractors (water quality, TSS, turbidity, qualitative coral conditions etc). Rapid feedback to project management if problems are discovered.

Level 2 – Regular water quality sampling by Hadrahmout University of Science & Technology (HUST) who have carried out over 20 missions since September 2005. This process has been quality checked by Creoccean who have carried out an additional 8 water quality missions between April 2006 and September 2007, measuring parameters such as TSS, turbidity, temperature, salinity, pH and sedimentation. Rapid feedback is given to project if problems are discovered. Monitoring continues on a regular basis using Yemanja but still quality checked by Creoccean.



Level 3 – In depth bi-monthly missions by Creoccean to check coral health and diversity against internationally accepted statistical criteria. Reports copied to the Yemeni Authorities. Currently a total of 20 missions have been undertaken by Creoccean between January 2006 and October 2008. Rapid feedback is given to project if problems are discovered.

This is supported by monitoring of fish populations by Macalister Elliot and Partners, against a baseline carried out in January 2006.





Level 4 – Regular monitoring missions by the Authorities Monitoring Team which comprises EPA, MOM, MAA. Approximately 30 missions held to date.

8. *Provide investment to promote sustainable improvement in social or environmental conditions:*



Finally, YLNG has committed to assisting with the funding of the implementation of the already mentioned Coastal Zone Management Plan for Zone 1 (Balhaf to Burum). This will provide a lasting legacy in the coastal area both adjacent to, and some distance from, the LNG plant at Balhaf.

9. *Conclusions*

In progressing the LNG project at Balhaf and along the pipeline route, Yemen LNG Company is acting with full commitment to environmental and social principles. This is on the basis of two fundamental principles:-

-  Respecting the provisions of a Government approved Environmental & Social Impact Assessment (ESIA) which encompasses all environmental and social parameters from corals, through flora, fauna, to persons and populations who are to be resettled or displaced (of which there are none with Balhaf as the selected site location);
-  Minimising the impact of all of the environmental and social parameters covered by the ESIA along the principles of ALARP (reduce the impacts to As Low As Reasonably Practicable).

YLNG has achieved this by doing the following:-

-  YLNG has developed a robust 3-tier coral management strategy.
-  YLNG has implemented a system able to detect negative effects of the construction on the corals at an early stage.

- ✚ YLNG can adapt its method statements in order to minimize any impacts due to construction works.
- ✚ The core of this system is the monitoring process, associated with a very fast management decision process.
- ✚ In addition, YLNG has implemented the largest ever coral transplantation and resettlement programme, to relocate healthy corals from areas at risk to new safe areas.
- ✚ Thanks to these operations, impacts on corals are limited, thus satisfying the challenge of maintaining a high level of biodiversity and thus meeting Stakeholder expectations

It is therefore YLNG belief that the approach which has guided us so far is both holistic and appropriate, not only in the selection of the location at Balhaf, but also in the Government approved ESIA which has, by definition, the intention to minimise the overall impact on the whole spectrum of environmental and social parameters. The Lenders and Shareholders of Yemen LNG Company have supported this approach and it is the belief of YLNG that this approach is valid now and will remain valid throughout the project life cycle and into the operational phase.



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Annex 3

PROCEDURE FOR APPROVING LARGE SDE PROJECTS

1. PROCEDURE

1.1 INTRODUCTION & BACKGROUND

YLNG has developed a comprehensive Community and Environmental Investment Strategy which principally aims :-

- To bring social and environmental benefits to all stakeholders of the YLNG Project;
- To display good corporate social and environmental responsibility;
- To promote support for the YLNG Project;
- To address stakeholder concerns;
- To comply with various World Bank and other IFC standards and best practices; and
- To honour YLNG's Environmental and Social Principles on human development and the protection of biodiversity.

1.2 Community Participation Objectives

YLNG is committed to bringing fair benefits – directly and through engagement with communities in a sustainable way - to Project Affected People and areas.

The Project will, however, also have a wide range of social and economic benefits for Yemen as a whole. These benefits include revenue creation, local access to employment, employment training and education programmes and opportunities for local procurement and small and medium-sized enterprise development.

YLNG's goal in contributing to community development is to create sustainable development for local populations – to generate employment opportunities and a steadily improving quality of life, both during the period of the gas development activities and also in the longer term.

Great care should be given in the affected communities to those who are the most affected since the project will not have an equal impact on people.

Benefits to communities should also be assessed in terms of conflict with those not benefiting from the project. Fair benefits are those which will not trigger such conflict.

Community investment projects shall therefore strive to:

- Provide positive and fair benefits in communities to all potentially affected by YLNG activities;
- Increase the benefits to the wider population and contribute to meeting community expectations of benefits from YLNG activities; and
- Deliver mutual gain for communities near the Project area and for YLNG.

Given operational requirements and the need to optimise funding, interventions under this CEIP will need to be prioritised. Priority will be given to projects that focus on the following:

1. Initial emergency assistance in the form of infrastructure support e.g. school renovation, providing energy, transportation, etc.;
2. Increased economic opportunities for income and employment creation through various instruments, such as micro-finance, rural credit in combination with vocational training, business services for micro-enterprises, and extension services for rural / artisanal fishing areas;
3. Capacity building and institutional strengthening to develop organised and strengthened communities who will be better able to meet their own needs through community mobilisation initiatives and community driven development approaches. There is also a need to ensure that communities are involved at all stages of the project selection, implementation and management;
4. Improved sanitation (and potentially health services) to produce greater impact and sustainability at community level. Activities that are identified should translate into locally run programmes that are able to sustain themselves through local financing and/or user fees or other cost recovery schemes while avoiding setting up parallel structures;
5. Improved economic and social infrastructure at local level through community organisation, with priority given to rehabilitation of existing facilities and structures..
6. Priority will be given to those projects which demonstrate multi-stakeholder partnership.

1.3 Environmental Investment

YLNG has identified the need to invest in projects which aim to support the biodiversity of Yemen. Although some projects may be identified in the project affected areas, it is possible that biodiversity projects may be supported in other areas of Yemen. It may also be necessary to identify specific environmental investment projects as part of an environmental offset and mitigation process.

In the environmental investment process, the principal objectives will include:

7. The delivery of actions that are of benefit in the promotion and conservation of biodiversity;
8. To provide additional benefits (“additionality”) that go further than mitigation of impacts;
9. To respond to ongoing initiatives, issues and suggestions that may be raised by stakeholders during the ongoing consultation process undertaken as part of the YLNG Project;
10. To achieve maximum benefit by sharing financial inputs (e.g. through co-finance);
11. To maximise the opportunities for wider national and possibly international application of outcomes;
12. The potential inclusion of international stakeholders in the development of the environmental investment projects.

1.4 PROCEDURE TO BE FOLLOWED

1.4.1 General

The programme will work across all the project affected communities including the Project Affected People (PAP), the Project Indirectly Impacted People (PIIP). It will also be working in the areas of the Yemeni tribes and tribal groupings down the pipeline route. As projects are implemented and proven to be sustainable, effective and efficient, the investment activities may be extended to outlying communities. In addition the community and environmental investment programme will also focus on areas outside the Project area.

YLNG Sustainable Development Manager will be responsible for managing and overseeing the whole process under the guidance of the YLNG Corporate HSSE Manager.

1.4.2 Projects Approval Committee

In addition, YLNG consider all proposed SDE projects which have a total budget in excess of \$10,000 to be implemented internally or in partnership with external parties through its Projects Approval Committee (PAC).

The PAC will have the following objectives:

- Decide on and implement Sustainable Development and Environmental (SDE) projects; and
- Coordinate activities with national strategies and plans.

PAC Members comprise:

- YLNG HSSE Manager (chairing the PAC);
- YLNG General Manager;
- YLNG Deputy General Manager;
- YLNG SD Manager (Secretary of the SDSC).
- YLNG Corporate Affairs Manager

In addition it is expected that the Managers for Procurement and Security may attend the committee from time to time, along with external experts with particular expertise. The SD manager will also liaise with a body of Yemen-based NGO (international and national) for the purpose of advice and consultation.

The PAC will evaluate only those projects which are submitted on the correct form and which have a total budget in excess of \$10,000 (see example at Appendix 1).

1.4.3 Evaluation Process

Once project proposals are received (generally from CLOs, CRCs, or in response to RFPs) the objective of the evaluation exercise will be to compare the submissions on a fair and equal basis and arrive at an overall ranking.

Applications will be reviewed against pre-defined organisational, administrative, legal and financial eligibility criteria by the YLNG Project Approvals Committee (PAC). Applications that do not meet these criteria will immediately be excluded from consideration.

Some proposals (for the more significant projects) may in addition also be evaluated by external social and environmental experts (e.g. individuals from organisations such as the World Bank, UN and other multilateral agencies, bilateral aid agencies etc).

Reviews will follow a pre-determined evaluation procedure that outlines the evaluation process, (including potentially guidance from a scoring system). All steps for the evaluation will be documented in writing in order to provide for transparent and accountable processes.

1.4.4 Selection and Evaluation Criteria

Selection and evaluation criteria, weighting procedures and the selection of potential external experts will be used for proposal review and selection. Evaluation and selection of proposals will be conducted according to the following criteria:

- Management Structure / Organisational Experience
 - This will include previous project management experience, management and implementation capacity, experience with similar programmes and capacity to provide technical support.
- Methodology
 - This criterion will look at the coherence of the overall project design, clarity & feasibility of the plan and its objectively verifiable indicators, the level & depth of involvement and interaction with implementing partners. Evaluation of the tangible impact on target groups and involvement of participants & communities in project design/ implementation will be reviewed.
- Programme Concept
 - Soundness of the proposed strategy and methodology in achieving project specific objectives, and in the value added in terms of innovation and good practice are essential elements here. Consistency with the CEIP strategic orientation and objectives. Coherence, appropriateness and practicality of the proposed activities.
- Sustainability
 - Potential multiplier effects; proposed financial sustainability; institutional sustainability; policy and structural impact as indicators for a sustainable approach; local contributions whether in cash or kind .
- Budget and Cost Effectiveness
 - Level of detail and completeness of the proposed budget; value for money; the extent of cost sharing; matching funds and leverage.

The selection criteria duly applied (aided by scoring) will allow the ranking of the proposals according to a “best fit” with the objectives identified for the CEIP. In the case of RFP applicants, those proposals with the highest scores will be invited to give a presentation to the Project Approvals Committee providing an opportunity for the reviewers to clarify outstanding issues and questions.

1.4.5 Partner Organisation Eligibility

To assist with the determination of eligible partners, a set of criteria have been defined to identify organisations eligible to make a submission under the Request For Proposal (RFP). Eligible organisations are those that are:

- Not-for-profit and private voluntary organisations officially registered with a permit to operate in Yemen. For those organisations that are not registered a commitment will be accepted to become registered within the timescale of agreement of contracts;
- Any combination of the above in partnership;
- Able to produce auditable accounts;
- Either from within Yemen or from outside Yemen for which the proposal is made but only in partnership with national organisations (national can be an international organisation with a registered presence in Yemen – or one undergoing the registration process);
- Combinations of larger and smaller capacity organisations in order to enable smaller and relatively new organisations to participate;
- Proven experience in the management and/or implementation of grant-type projects or equivalent initiatives;
- Details will be required of the type, duration and timing of the project and funding sources and structure;
- Able to demonstrate experience in the implementation of community and/or ecological projects; and
- Able to undertake all work in a manner that protects the health and safety of all individuals who are involved in the activities. It is expected that all organisations will conform with relevant Yemeni legislation and be aware of the core spirit of YLNG's corporate policies on HSE.

1.4.6 Organisation Selection

Eligible organisations will be evaluated based on their experience and capabilities in implementing relevant projects. The following criteria will be taken into consideration in the selection of partners:

- Extent of proven experience in the management and/or implementation of relevant projects;
- Extent of proven expertise in key sectors;
- Number and capability of employed staff (organisations will be required to commit named staff to the project);
- Number and capability of key volunteer staff;
- For partnerships between international and national organisations, the extent of capacity building and technology transfer anticipated;
- Organisational ability to deliver; and
- Experience of co-ordination with other initiatives.

1.4.7 Projects in Partnership with Other Commercial Entities

To maximise the leverage of funding, YLNG will consider seeking partnerships with other commercial or industrial entities, including expert consultancies to implement projects of significant complexity (e.g. with respect to the technical expertise required) and budget.

1.4.8 Projects Implemented Solely by YLNG

YLNG has identified various projects which will be implemented in the short term and solely by YLNG. These are mostly of more immediate support to ensure that external impacts are mitigated (in many cases there are impacts on livelihoods not linked to YLNG activities). Smaller SDE projects (\$10,000 and below) are dealt with in CMS document L3-HSSE-01-002.

1.4.9 Projects in Partnership with Government Agencies

A number of projects under the priority themes are optimally implemented by working in partnership with government agencies, (including for example projects focussing on biodiversity). Such partnerships may be desirable if they will require government procedures to be implemented or if they need to be undertaken in conjunction with existing programmes to maximise synergies between the initiatives.

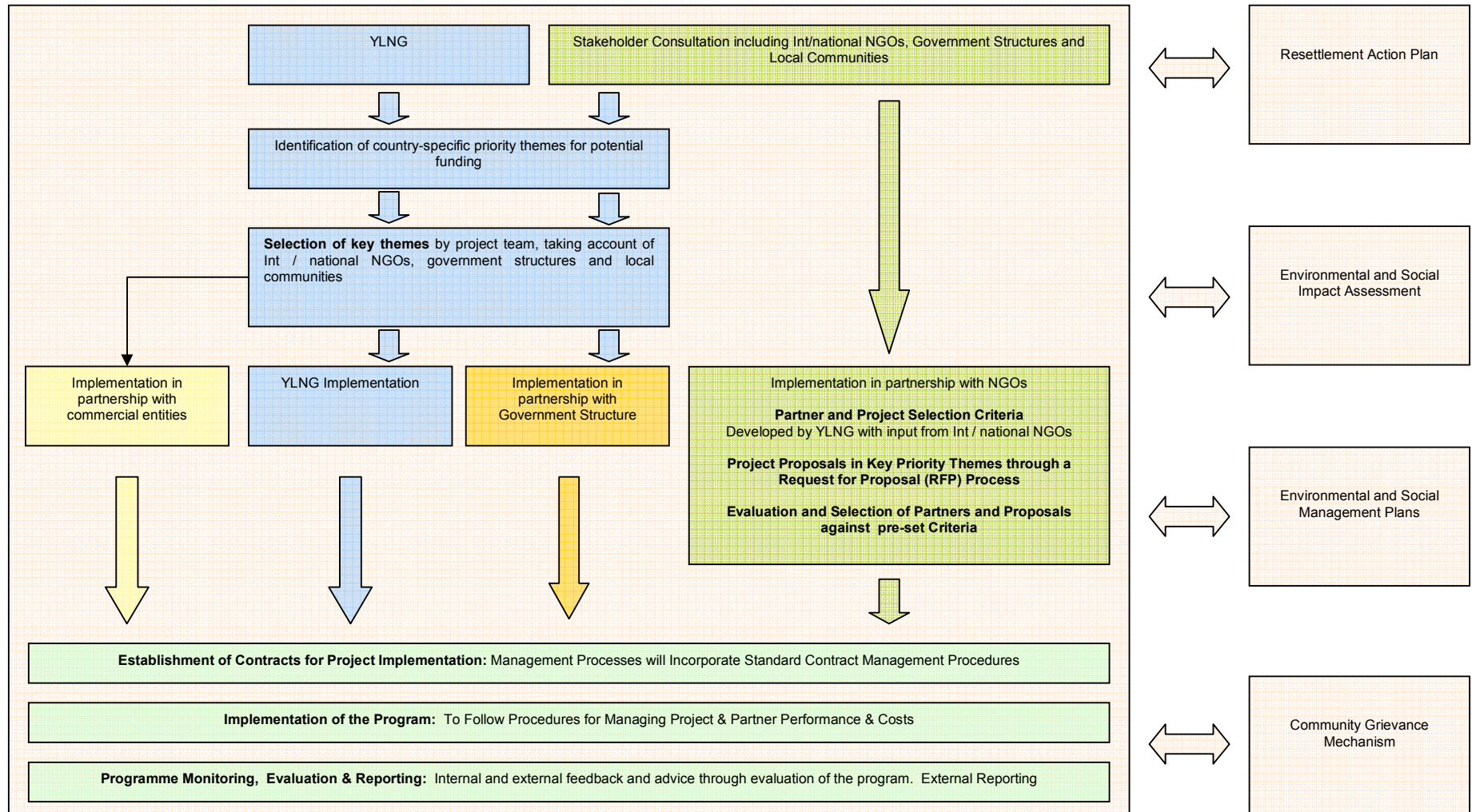
1.4.10 Establishment of Contracts for Project Implementation

Under the RFP process, once successful proposals have been selected, refinements will be negotiated if necessary and contracts established. Other contracts will be developed as necessary with government agencies and other commercial entities.

1.4.11 Programme Implementation

Each project implementation programme will be dependent upon the nature and scale of the projects selected.

Community and Environmental Development Strategy



Annex 4

A summary of the results of the biodiversity baseline survey carried out in September 2005

In preparation for the implementation of the YLNG project, a first general coastal environment baseline (EBS) has been carried out by Creoccean consultant from 3 to 19 March 1997. This survey has been performed in order to establish the ecological status of the Balhaf coastal area before any industrial activity. The work is composed of two parts: a bibliographical work and a field evaluation of the marine chemical and biological characteristics. Although this study was focused neither on corals, nor on fishes, it highlighted the presence of highly sensitive corals and fishes rich zone. In this way, when the project was re launched in 2005, a second baseline has been implemented from 05 to 11 September 2005, centred on the update of the 1997 baseline, on the evaluation of the biological richness and the ecological status of the coral and fish communities of the study area.

Ecological characteristics of the Balhaf coastal area

Balhaf physical environment

Balhaf cape headland is the first promontory into the Gulf of Aden along the south coast of Yemen in the 400 km from Aden. It represents the start of a rocky shore environment that stretches eastwards from Balhaf cape past Bir Ali 100 km to Burum. Balhaf site is the point of change from the 400 km of sandy beach stretching back westwards to Aden. In this way, the Balhaf site consists of a sandy coastline in the eastern part. The rocky area is formed by basaltic flows caused by volcanic activity. Some inactive old volcanoes and caldera can be found along the coastline.

Coral diversity and state of health

The Balhaf weather is dominated by two monsoon events: the summer southwest monsoon between June and September and the winter northeast monsoon between December and March. The transition period is characterized by variable winds.

During the four summer months, west blowing winds create a coastal *upwelling* in the north of the Gulf of Aden, leading to an ascent of cold and nutrient-rich deep sea waters. The seawater close to corals can reach low temperatures around 16 and 19°C, up to 10°C colder than the optimal average temperatures for coral growth (25 to 30°C). In this way, corals experience important seasonal temperature and *turbidity* variations (hot clear situation/cold turbid situation alternation). This regular change can tend to limit the coral growth. Indeed, the coral diversity of the Gulf of Aden is lower than the one observed in other surrounding the Middle East seas as the Red sea (respectively 93 coral species in Aden and 149 in the central Red Sea).

The Balhaf area is located at the westernmost boundary of the upwelling influence area, and is characterised by a relative small surface of hard bottoms and a short length of the coast (approximately 10 km of shoreline). Despite of these features, it presents an important coral diversity estimated at 73 species, belonging mainly to 9 coral families. According to the Yemen NBSAP [3], it would represent 81 % of the total recorded number of Yemen coral species. This important coral diversity can be explained by the association of various favourable characteristics such as the availability of hard substrate for the

establishment of new coral colonies and/or the relative absence of disturbance and pollution.

The Balhaf area is also characterised by the presence of particularly important coral species within the frame of the regional and Indo-Pacific coral biogeography, and their presence in Balhaf should be considered as a characteristic of the area (northwest Indian Ocean: Red Sea, Gulf of Aden, the Arabian Sea and Persian Gulf). Although all coral species are regarded as sensitive and endangered, these species are to be considered of special value and sensitivity for the Balhaf area.

Coral state of health

Between 1997 and 1998, all the coral reefs underwent the most important and destructive bleaching event to date [4,5,6] due to major oceanic disturbances (**El Niño**). This event was correlated with an increase of the oceanic surface water temperature, estimated between 3 and 5°C above the normal temperatures. In certain regions, notably in Indian Ocean, the coral mortality reached 90 % [6]. During this period, the loss of dominant coral species of shallow waters (notably tabular and branching *Acropora*) has been documented in Al Mukalla, Bir Ali and close to various Yemeni islands [7]. This phenomenon has been reported by both 1997 and 2005 baselines. Indeed, the presence of dead corals and a partial modification of the coral composition have been underlined in the Balhaf area. Most of the living *Acropora* colonies observed in 1997 in the east bay and on the west side of the cape disappeared and the colonization of their calcareous skeleton by the other coral species or by the crustose coralline algae was observed in 2005.

Despite this mortality phenomenon, these two baselines concluded that coral communities in Balhaf area are in very good health state, a conclusion supported by the lack of coral disease observation.

Fish population

It is observed that coral communities shelter a large number of marine organisms. The coral communities of the Balhaf area present an attractive support for diverse species of reef fishes, of both small and big size. The 2005 study has reported 148 fish species, belonging to 43 families.

Considering the limited sample area (approximately 1600 m²), the Balhaf area can be considered as an important fish diversity in comparison with results obtained in other close regions (e.g. Bir Ali - 7500 m², 195 species [8], Socotra - 20000 m², 211 species [9]). Moreover, according to several studies, it seems that the Balhaf area presents similar fish abundance to other coral reef area such as Moorea (French Polynesia), Hawaii or the Great Barrier Reef (Australia) [10]. At last, the Balhaf coral communities associate favourable environments for the reproduction, recruitment (presence of numerous *micro-habitats*) and growth of numerous fish species, notably commercial. For this feature, the Balhaf area presents a particular economic interest, supplying an important quantity of fishes to the local fishermen

To complete these observations, a fish nursery baseline has also been carried out during the construction phase.

Biodiversity of reef fish.

| Families | number of species | Families | number of species | Families | number of species |
|---------------|-------------------|----------------|-------------------|----------------|-------------------|
| Acanthuridae | 5 | Lethrinidae | 2 | Rajidae | 1 |
| Apogonidae | 4 | Lutjanidae | 8 | Scaridae | 3 |
| Balistes | 4 | Monacanthidae | 1 | Sciaenidae | 1 |
| Caesionidae | 1 | Monodactylidae | 4 | Scorpaenidae | 3 |
| Carangidae | 10 | Mugilidae | 1 | Serranidae | 6 |
| Chaetodonidae | 5 | Muraenidae | 2 | Siganidae | 1 |
| Dasyatidae | 2 | Nemipteridae | 3 | Sparidae | 1 |
| Ephippidae | 1 | Ostracidae | 1 | Soleidae | 1 |
| Fistularidae | 1 | Pempheridae | 2 | Sphyraenidae | 4 |
| Gerreidae | 1 | Pinguipedidae | 1 | Synodontidae | 1 |
| Gobiidae | 2 | Plotosidae | 1 | Teraponidae | 1 |
| Haemulidae | 5 | Pomacanthidae | 3 | Tetraodontidae | 6 |
| Holocentridae | 4 | Pomacentridae | 18 | Torpenidae | 1 |
| Labridae | 24 | Priacanthidae | 1 | Zanclidae | 1 |
| | | | | Total | 148 |

Benthic fauna

The 1997 baseline recorded 197 invertebrate species in the Balhaf area, belonging to 9 phyla, as molluscs and crustaceans. These values correspond to a high faunal richness, particularly for sediment which is composed mainly by sand particles and whose granulometric structure is relatively homogenous throughout the zone. Diversity seemed to be higher in the west of the cape, but to the contrary, the *benthic* fauna abundance is more important in the east of the cape.

All these features constitute an important ecological and economical value for the local Balhaf area and for Yemen.

Local description of the Balhaf coastal area

The global Balhaf area could be divided in three main zones, and each one, even if they form a functional unit, presents some different characteristics.

The east zone

The high exposure to the swell (perpendicular to the shoreline) and the important turbulent activity allow "to clean the zone" and to evacuate particles. In this way, the water is clear (low *turbidity*), which allows corals to extend more in depth (maximum depth limit between 12 and 14 m). The important quantity of corals supplies an large quantity of organic matter, which facilitates the development of a diverse marine community. Situated quite far from the plant construction area, this zone will only be submitted to the impacts of the water outfall pipe construction and the discharge of cool water. This water will be discharged offshore at 685 m from the coast and 20 m deep.

The west zone

The low exposure to the swell (protection by the cape) causes a high natural *turbidity* and fine particle sedimentation, which limits the development of the coral communities (maximal

depth limit 8 m). But, although the coral surface is less widened in this area, in some places, corals present high size and complexity which represents attractive media for reef fish (notably commercial) reproduction and grow-up. This area will be more directly impacted by the marine construction activities.

The south area

This zone will be not submitted to any direct impact of the project. Furthermore, this area presents the most important coral diversity of Balhaf, due to the offshore disposition of the area as well as to the both wind influences from the West and from the South. The baselines advised to use this area as reference to estimate the global quality of the water and to follow the health of the coral communities.

Pollution rate

The study of 1997 showed that the concentrations of metal elements and in hydrocarbons measured in sediments corresponded to values normally recorded in not contaminated environment. The contamination level of the Balhaf area in 1997 was very low. But, this baseline underlined that tar balls and other signs of oil contamination were observed on the shoreline, especially on the eastern coast of the cape, on the beach and the intertidal rocks. This contamination corresponded to recent isolated deposits and several large older deposits (2 or 3 cm thick, covering an area of 5 to 10 square meter). This pollution was attributed to chronic pollution provoked from earlier tanker traffic and associated deballasting.

Balhaf site sensitivity

To understand more site sensitivity and thus to precisely anticipate any potential impacts of the construction on the coral communities, the Balhaf site was successively divided into 7 then (later) 9 monitoring areas. The 1997 and 2005 baseline allowed establishing a sensitivity map of the BalHaf zone, according to the ecological diversity and the role of each area in the processes of reproduction, recruitment and nursery. This map has been updated during the monitoring surveys along the construction phase.

Annex 5

Potential Impact of Project on Biodiversity

Environmental Impact Assessment [11]

This Environmental and Social Impact Assessment (ESIA), publicly disclosed on 10th February 2006, addressed the key environmental and social issues of the YLNG project that are required by Yemeni regulation (EPL law No. 26 of 1995) and was prepared according to the guidelines of the World Bank Group operational policies OP 4-01. Concerning the Balhaf marine part, this study determined the potential impacts on intertidal and marine ecosystems of the YLNG project during the construction and the operational phase. It also described the mitigation measures associated to these impacts implemented by the Company.

Potential impacts during the construction phase

The main potential impact on intertidal and marine ecosystem during the construction activity includes the impact on some corals along the western part of the Balhaf cape by the construction of the jetty, the MOF and the shoreline protection. The impact on these corals is potentially a long term impact due to the slow recovery potential of some of these species. Two small high sensitive coral areas (presence of *Porites* and branched *Acropora*) will be directly affected by the MOF construction. Other potential impacts embrace an increase of seawater *turbidity* and sedimentation due to the dredging activities and the marine constructions. These disturbances may lead to the degradation of coral communities. Moreover, disappearance of coral will also represent a net loss in the sea production since the coral structure provides refuge and nursery for several fish species, notably commercial.

Due to these features and according to the World Bank criteria, the residual impact of the YLNG plant during construction on the marine and intertidal ecosystems is considered as no higher than *moderate*.

Potential impact during the operation phase

The main potential impact on the intertidal and marine ecosystems during the operation phase includes water current modifications in the west part of Balhaf due to the presence of harbour and jetty. This can lead to a change in sedimentation process and an increase of *turbidity*. Another potential impact is an increase of the seawater temperature due to the discharge of cooling water enriched with chlorine on the east side of the cape. But the 3D modelling studies undertaken by Sogreah consultants (1997, 2001, and 2005) have shown that the environmental conditions should remain favourable and it should not impact on the intertidal and marine ecosystem in the east part of Balhaf [12].

Due to these features and according to the World Bank criteria, the residual impact of the YLNG plant operations on the marine and intertidal ecosystems is considered as negligible.

Annex 6

Coral Transplantation Methodology and Outcomes

(extracted from a submission to the International Coral Reef Symposium 2008)

Large coral transplantation in Bal Haf (Yemen): an opportunity to save corals during the construction of a Liquefied Natural Gas plant using innovative techniques

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Abstract. As part of a mitigation measure associated with the construction of a Liquefied Natural Gas plant, four large coral transplantations were carried out in Yemen between January and October 2007. Around 1,500 selected coral colonies were removed from areas to be impacted, transported and cemented in new sites. Transplanted colonies belong to 36 species and 25 genera. Among those 140 large *Porites spp* weighing from 200 kg up to 4 tonnes, were moved using new transplantation techniques. Growth, *in situ* mortality and health condition of the transplants were monitored over one year on a quarterly basis and will be followed for another 2 years using photo quadrates, close up pictures and linear growth measurements. Overall, survival of corals one year after transplantation was 91%. Most losses of transplants were apparently due to sedimentation of fine particles in the transplanted areas, fish predation, fishermen activity and swell effects. Evidence of coral growth after transplantation was observed, especially on *Acropora* and *Porites* species, and on some faviids. The transplantation results demonstrate the capacity of corals to adapt to a new environment, in favorable conditions. They show that carefully designed coral reef rehabilitation strategies can be part of industrial development processes, whenever necessary.

Key words: coral transplantation, reef restoration, mitigation measures.

Introduction

The Yemen LNG project is a \$5 billion project to build a pipeline and a liquefaction plant to process and ship natural gas from Yemen to the world markets. In the plant the gas is compressed and liquefied at minus 160°C and transported via sea tankers. Yemen LNG's environmental approach is: first to eliminate or mitigate impacts by redesign when this is possible. If elimination or mitigation is not effective or possible, YLNG policy is to compensate for impacts, and to provide investment to promote sustainable improvement in marine environmental conditions, and monitoring the marine environment to ensure that these measures are effective. Creocan carried out an Environmental Baseline Study in 1997 and 2005. Up to that time, knowledge of corals in the region was limited to a few published references (Sheppard et al, 1992; Kemp and Benzoni, 1999; Kemp and Benzoni 2000; Benzoni et al., 2003). The EBS showed that Bal Haf cape where the LNG plant is being constructed was characterized by a high coverage of diverse corals, abundant and diversified fish, and highly three-dimensional coral communities. As part of the mitigation measures, a coral transplantation was proposed to save coral colonies from destruction on sites where the marine works would take place. It is an exceptional opportunity for Yemen LNG to show their interest for the environment and to implement a scientific solution on a large scale.

Three localised areas with dense coral communities will be impacted by the construction works on the North side: the Intake area where an intake water cooling pipeline will be placed to pump deep water, the Jetty area where a loading jetty will be built to receive tankers, and the Golf area, where a shoreline protection with concrete blocks is required. On the South side, one area will be impacted: the Outfall site where a pipeline is to be placed to discharge warm seawater after it has been used for cooling during the gas liquefaction process.

Different sites were chosen to receive the transplanted corals. Selected sites met the following criteria: they were close to the original sites but out of the impacts of the plant construction (the selected sites were from 100 to 1100 m away from the donor sites), and were characterized by similar depth, hydrodynamic and water quality conditions (Fig.1).



Figure 1: Aerial view of the area showing the donor and the receiving sites, south coast of Yemen.

A study of the coral communities on the donor sites revealed domination by the branching Stylophora with presence of large massive *Porites lutea* and *P. lobata*, and different faviids, especially *Platygyra daedalea* and *Favites* spp. A few table-shaped *Acropora* were also found. Because these areas were too large to be integrally transplanted and to increase coral chances of survival, it was decided a priori to selectively transplant the largest colonies, the rare or uncommon species, the slow

growing species, and only the colonies in good health. Edwards and Clark (1998) argued that there has been too much focus on transplanting fast-growing branching corals instead of slowly recruiting massive species, which generally survive transplantation well but often recruit slowly.

Material and Methods

The variety of colony shape and size among the transplanted corals required different methodologies of collection, transport and sticking. The small to medium-sized colonies (from 40cm up to 60cm) were removed using hammer and chisel and placed in plastic baskets underwater. The baskets were loaded on a boat and directly transported to their final location (Fig.2). They were protected from the sun and wind by a plastic cover and regularly watered to prevent them from drying. The medium-sized to large-sized colonies (from 0.6m up to 4m) were removed using a crowbar. The medium-sized ones (up to 1m) were placed onto a large steel cage directly underwater, which could be raised to the surface with lifting balloons and towed under the surface by a boat. The large *Porites* colonies were drilled to fix a stainless steel screw into the skeleton to adjust directly on it a lifting balloon (Fig.2). Each of these colonies were then lifted up to the surface and slowly towed by a boat to the transplantation site.

All the corals colonies were cemented at their final location to avoid damages due to swell or fish predation. Epoxy was chosen for the fragile colonies such as branching *Acropora* species. It took around half an hour for the cement to become strong and a few hours to be totally hard.

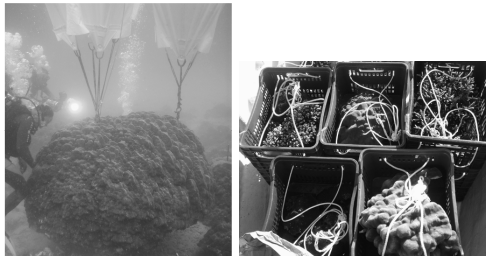


Figure 2: Moving of a large *Porites lutea* using lifting balloons (left), transport of small colonies in pierced plastic baskets out of water (right).

A monitoring program was set up to survey the different transplantation sites and to measure the adaptation of corals to their new environments. Every four to six months (2007: January, May, October; 2008: February, June) a picture mosaic was realized to show the evolution of the entire sites, after installing a square pattern. The survival was determined as well as the health of colonies and occurrences of diseases or damages were recorded for each colony.

Close up pictures were used to survey the health of a dozen of selective colonies per site, PVC quadrates were used to follow the extension of 10 table-shaped *Acropora* and growth measurements were realized on 15 branched *Acropora*, 17 massive *Favites* and 24 *Porites lutea*. Plastic collars fixed to the colonies at the beginning of the monitoring were used as references for diameter, radial, or branches extension measures. Some stainless steel cables were installed on the surface of massive *Porites* to monitor their growth by coral tissue extension on the cable.

Three samples were collected after one year on the marked *Porites* and were sent to be analyzed using micro Computer Tomography imaging (micro-CT). Linear coral growth was measured from the point below the steel cable section to the colony surface along the corallites growth direction. The steel cable section was measured with an electronic

caliper and used to scale measurements. Linear distance between skeleton density bands known to indicate annual growth cycles in *Porites* was also measured.

A fish inventory was organized once a year on the different sites to point out the fish attraction of a transplanted area, using the “fish roving diver technique”. Counts were realized during 30 min of swim around the site to record all fish species observed. Then an approximation of the density of each species was realized using logarithmic categories during 15 min (Hill & Wilkinson, 2004).

Results

The use of cement with an adjuvant to keep it compact underwater was successful for most of the corals. Three small colonies became unstuck after one year only on one site but 17 out of the 33 large *Porites* were moved by the strong swell on the most exposed site.

1,495 coral colonies belonging to 11 families (Table 1), 25 genera and 36 species were removed from sites to be impacted, then were transported and relocated to new areas safe from the effects of the construction works. The overall distribution of the transplants (Table 1) is dominated by the Faviidae family with a large number of *Platygyra daedalea* and different species of *Favites*. A lot of Poritidae were translocated as well, with a special care taken in the case of 140 particularly large ones, from 200 kg up to 4 tonnes (from 1m to 4m in average diameter).

Table 1: Number of transplanted colonies per Scleractinian family and relative percentage

| FAMILIES | NUMBER | % |
|------------------|--------------|------------|
| Acroporidae | 113 | 8 |
| Agariciidae | 71 | 5 |
| Dendrophylliidae | 7 | 0.5 |
| Faviidae | 750 | 50 |
| Fungiidae | 10 | 0.5 |
| Mussiidae | 17 | 1 |
| Oculinidae | 12 | 0.5 |
| Pocilloporidae | 102 | 7 |
| Poritidae | 376 | 25 |
| Psammocoridae | 7 | 0.5 |
| Siderastreidae | 30 | 2 |
| TOTAL | 1,495 | 100 |

Fourteen months after the first transplantation operation in January 2007, 91% of the transplants were alive and healthy. The survivorship for each operation is presented in Table 2, depending on their date of realization.

Table 2: Survivorship rate of the different transplantations.

| Area | Total (num b.) | Jan. 07 (%) | May0 7 (%) | Oct.0 7 (%) | Mar.0 8 (%) |
|---------|----------------------|-------------------|------------------|-------------------|----------------|
| Intake | 608 | 100 | 99 | 96 | 94 |
| Jetty | 400 | - | 100 | 89 | 82 |
| Golf | 79 | - | 100 | 78 | 74 |
| Outfall | 408 | - | - | 100 | 100 |

From the first monitoring after transplantation, some evidences of growth were observed on corals. Growth was observed at the base of the colonies where the living tissue overgrew the cement, the epoxy or the substrate directly. Colonies of the genus *Acropora* showed the most rapid growth, especially for the table-shaped colonies (Fig.3), with an average diameter extension of 1cm month⁻¹ (± 0.4 cm). On the graph showing on Fig.4 we observed a slow down in the growth of 4 table-shaped *Acropora* between the May and October survey. This phenomenon was observed as well for the branches extension measurements but was less visible.

For the branches extension, only 5 colonies with 3 measurements per colony, were available for measurements due to diverse damages or loss of marks, the average growth extension was 0.17cm.month⁻¹ (± 0.12 cm). However, this data showed a high variability within and between colonies. Nevertheless, although the growth could not be easily measured, it was visible on these transplants.

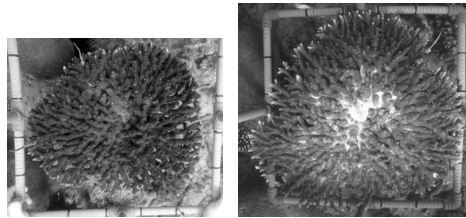


Figure 3: Example of a table-shaped *Acropora* extension between Oct.07 (left) and March08 (right) controlled with PVC quadrate.

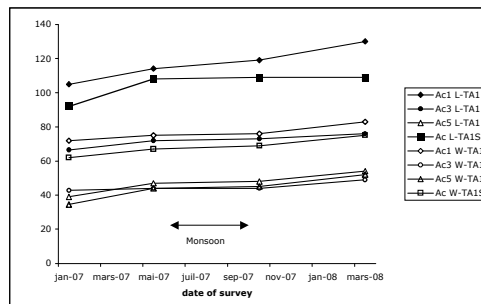


Figure 4: Table-shaped *Acropora* growth measurements between transplantation in January 07 and March 08 survey. L: length, W: width.

Evidences of growth was also visible on the large *Porites lutea* on which stainless steel cables were placed (Fig.5). They were quickly recovered by living tissue. The *Porites* samples sent for micro-CT analyses show an average linear growth per year of 10.25 (± 1.30) mm.y⁻¹ after transplantation (Fig.6).

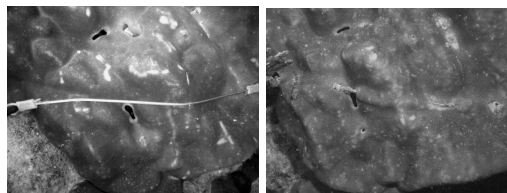


Figure 5: overgrowth of *Porites lutea* on a stainless cable between Jan. 07 and March 08.

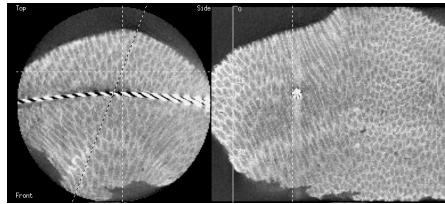


Figure 6: Example of micro-CT analysis on a *Porites lutea* sample marked with a stainless steel cable on Jan. 07, collected in March 08), Images courtesy of the Dept. of Geological Sciences and Geotechnologies, University of Bicocca, Italy.

The fish inventory performed on all transplant sites once a year clearly demonstrated that the transplanted coral colonies actually attracted different species of fish. Overall, 95 species belonging to 27 families were recorded. From 17 to 64 species were observed per site, depending on the area size and its location. The most abundant species belonged to the Pomacentridae and the Balistidae families. But the most diverse families were the Labridae, the Pomacentridae and the Serranidae (with, respectively, 13, 8, and 8 species per family). As soon as the corals were placed at their final location, the sites were colonized by fish, especially under the large *Porites* where caves and holes provide hiding-places and protection for fish, or inside the branches of *Acropora* species. Another remarkable attraction occurred during the collection phase where the fish followed the operators, waiting for coral removal. Indeed, they stayed very close to the hammer and chisel, ready to catch small invertebrates as soon as a colony was removed.

Different damages occurred on corals after transplantation. An invasive red sponge (*Clathria* sp) appeared and attacked corals on all sites, especially massive *Porites*. Its fast expansion induced high localised damages on transplanted sites, killing the coral by its development in place of the living coral tissue. This phenomenon has actually been studied by another scientist group and was recorded in different areas of the Aden Gulf (Benzoni et al., 2008). Infestation by pyrgomatid barnacles was also recorded especially on *Porites* colonies and seemed to be seasonal and may possibly have been linked to the sedimentation on sites. It was observed as well on non-transplanted corals. Fishermen caused additional damage. Fishing lines and nets were found on sites in January and May 2007; from October 2007 monitoring local coast guards increased the area survey to avoid these problems. Swell and current induced coral damages during the monsoon season occurred in July and August. Some of the large massive corals were turned upside down, especially on the most exposed site (see Fig.1, close to the cape) despite the sticking of all the colonies. Rubble, sand or gravels moved by the swell covered some of the branching colonies.

The fish were responsible for some coral damages, during the sticking phase. The large wrasse *Coris formosa* turned over the corals to eat boring shellfishes living inside the coral skeleton and revealed by the collection process. Damages due to the giant hogfish *Bodianus macrognathos* were observed on *Porites*. This fish is able to remove large part of a massive coral to eat marine dates and other boring organisms. Most of the loss transplants, especially on one of the areas where a large part of the transplanted corals belong to the Acroporidae (*Montipora* sp) and the Agaricidae families (*Pavona cactus*) were due to fish predation. Parrotfish and triggerfish scrape, scratch and break part of the corals to eat or build nest, but these damages are not depending on the transplantation, they occur as well on a natural reef. But it seems that fish are more attracted by stressed corals than by healthy ones.

Finally, sediment deposit, which formed on the coral colonies, induced necrosis on top of massive corals such as *Platygyra daedalea* and *Favites* spp, on the area closest to the plant construction works.

Discussion

The use of a screw drilled directly into the coral skeleton to fix a lifting balloon was an innovative technique to transport large corals. It allowed protecting corals against damages due to the collection and the transport phase (for example: scratches on the living tissue by lifting belts usually used to move large corals). Moreover, it allowed the coral to stay underwater and was very useful to place it carefully and precisely on the reef. No published references were available to compare the success of this technique because it is the first time such large corals were successfully moved. In the bibliography, only references concerning the transplantation of small colonies (from 10 to 20cm) were found (Clark and Edwards, 1995, Alcala et al, 1982, Plucer-Rosario et al, 1987, Yap et al, 1992) and they all used plastic baskets for underwater transports. These various authors had all the same problem: considerable loss of transplants is likely from higher energy sites, whatever methods of attachment. Following these results, we decided to cement all the transplants and we only had loss due to swell on the most exposed site. This points out that the location of a relocation site is one of the most important variables in a transplantation operation.

The differences in survivorship between our different operations (from 74% to 94% over one year) are most likely due to effects of the monsoon on water temperature, turbidity and movement, which are stronger between June and September (refer to Table 2). During the summer monsoon, extreme oceanographic conditions occur, with strong swell, current and wind, and an upwelling carrying really cold temperatures, around 17°C (Sheppard et al, 1992). We conclude that corals which were removed and transplanted just before the monsoon season did not have enough time to recover and adapt to their new environment before they faced strong sea conditions. Indeed, a transplantation process, even if it is doing well, is a very stressful time for corals (Clark and Edwards, 1995). They need time to become as strong as they were before and be able to resist new stress. This could be the reason why they seem to be more sensitive to predators and diverse attacks such as fish, red sponge or Pyrgomatids: their defenses are less efficient. The comparison between this work and other studies is favourable. For example, Alcala et al (1982) obtained 40% of survival of transplants after one year, Auberson (1982) 70%, but 20 to 50% on high-energy shallow sites, Clark and Edwards (1995) 75%.

Differences in *Acropora* growth were noted between the monsoon season and the rest of the year (Fig.3). We observed this for branched and table-shaped colonies. It is well visible for *Porites* as well, looking at the result of tomography analyses. The high-density deposition bands form in time of lower water temperature and lower light intensity, hence during the winter months, as shown in the northern Red Sea by Klein & Loya (1991). Judging from the position of the steel cable between the 2 high-density bands and its date of installation (January 07), it seems that the high-density deposition bands of the Yemen specimens actually correspond to the summer time (monsoon) instead of winter time. This could be explained by the low water temperatures and high turbidity values measuring in Bal Haf as result of the summer upwelling in the area.

To contend with fish predation, we adapted our methodology, for example sticking the corals directly after their removal. We think it is a natural process that fish are more attracted by stressed corals, may be due to the increase in the mucus production. The selection of corals in very good health before transplantation is very important to limit these attacks. Nevertheless, the fish presence is also a very good sign of adaptation, showing the recreated reef is efficient. A lot of mating behaviors were observed as well as cleaning stations on all sites.

To conclude, the survival rate after more than one year (91%) is encouraging but other surveys are needed to complete these data. We can determine the best period of the year to move corals, depending on the season and the weather conditions: for Yemen waters it seems to be during the months following the monsoon. According to other authors, the species that better support the transplantation seem to be the massive ones such as the Poritidae and the Faviidae. The best way to move corals depends on the species, the size and the distance to go through, towed underwater by boat for the large ones or transported out of water in pierced plastic baskets for the small ones.

These operations show that it is possible to do something to save part of the reef when a construction work is necessary. Different ways can be studying now, for example to use the transplantation sites to do an underwater trail for tourists or plant staff, such as in Duka Bay, Philippines (unpublished). It is possible to use these sorts of transplantation techniques during the building of plants, hotels, harbors extension, or any construction that will damage part of the reef for coastal development. The limitation of these operations is the cost because most of the work is achieved by hand, and the surface to be transplanted which has to be small. As an example, the cost of this operation represents less than 1% of the total amount of the plant construction. And the results are beneficial.

Acknowledgements

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Annex 7

EXECUTIVE SUMMARY OF 24 MONTHS OF CORAL HEALTH MONITORING - TAKEN FROM THE CREOCEAN “SYNTHESIS” REPORT OF SEPTEMBER 2008

Introduction

The Balhaf cape is bordered by a dense coral community forming a reef extending from the shore to a depth of 7-15 meters. Along this narrow strip, corals are very rich and diversified (85 species identified). In this part of the world, corals are exposed to high water temperature variations, to nutrients and natural high level of turbidity caused by the Arabian upwelling (cold and nutrient rich water coming from deepest areas). As they are used to face such stress (biggest corals are there for more than 400 years), coral communities are then supposed to be, to a certain extent, resistant to some potential perturbations by human activities.

On land, the works related to the construction of the Yemen LNG plant started in January 2006. Marine work consist in building a material offloading facilities (MOF), set up on the sea bottom, dredging part of the future port and to some works along the sea-shore. The main potential impacts on the sea environment from these works are supposed to be: 1) a coverage of the marine bottom at MOF location, 2) a change in the hydrodynamics and 3) the increase of suspended matters in the sea-water. In addition, the onshore works may generate much dust in the air blown by the winds into the sea creating increase in sea turbidity and suspended matters.

An intensive monitoring plan has been set up and implemented from the last two years; starting early 2006 and following a baseline in September 2005. The monitoring allowed to measure various parameters linked to these potential impacts. Some of them were related to the natural environment (temperature, natural turbidity, coral diversity). Others measured the inputs of stress factors in the water (turbidity, suspended solids and flux of deposited sediments) and finally most observations concerned a direct measurement of coral communities' health.

The sediment in the water column

The study quantifying the natural background values of sediment in the water column demonstrated that in some natural conditions such as the monsoon period or even strong winds, values can reach the threshold considered to be harmful to corals (10 mg/l of TSS and 29 NTU for turbidity). However thresholds are never considerably passed.

The magnitude of impact depends on the type of work. The discharge of rocks into the sea, like for the MOF erection, generated negligible impact as demonstrated by the measured values far below the thresholds. Dredging of bottom sediment is quite environmentally friendly as long as pumping techniques are used. Some turbidity is generated by this activity but values are not too high and the plume is easily contained by silt curtains so it does not reach the corals.

The flux of sediments over quite a long period can be considered as relatively low. Maximum values are less than 5 mg/day/cm² while most literature recognized levels for sensitive coral communities are about 100 to 200 mg/day/cm². In the areas close to the works, this sediment is composed of clay and chlorite which are the finest fraction of the sediment.

The coral communities

The coral monitoring initiated in February 2006 up to November 2007 resulted in the following observations. Coral assemblages and composition remained unchanged through the duration of this 24 months survey. Living even increased in all monitoring stations, except in area E where it remains stable.

Coral transplantations

This project was the largest attempt ever made to transplant large coral colonies. Sensitive coral colonies were transplanted away from the construction activities to promote new populations and new growth on natural substrate. Coral colonies were transplanted from the Intake area, the Jetty area, the shoreline area and the Outfall area to new transplanted areas closed to the collecting sites. Field transplantation missions were organised in January, May and September/October 2007.

A high percentage of healthy coral and sensitive corals have been successfully transported from threatened areas to new protected areas. No critical damages due to coral handling were noted. The 9 months monitoring demonstrated a very high survivorship which is to be monitored over several years to confirm the feasibility of massive and innovative transplantation of coral communities.

Transplantation of corals from sensitive areas was chosen by Yemen LNG as one of the biodiversity conservation measures, reinforcing their respective efforts aimed at promoting human health and protecting marine species.

Coral community composition

The composition of benthic assemblages at the nine study Areas around Balhaf has been monitored from 1 m depth to the deeper limit of coral distribution at each area. Dominant taxa remained the same since the inception of the monitoring and their relative proportion on each transect within each area is stable.

Coral growth

Coral growth from one monitoring mission to the other has been observed at all areas. Digital images of the same colonies taken at different times in successive broad scale monitoring allowed the documentation of such growth. The increase in colony size and substrate cover of fast growing hard coral taxa such as Montipora, Stylophora, and Acropora **Error! Reference source not found.**, has been recorded especially where these corals form large aggregations or monospecific patches. Growth of slower growing taxa like Porites has also been observed where the permanent transect lines have been overgrown in several parts by the living coral. For other common corals such as the massive faviids an evident colony growth was not observed like in the case of the Platygyra colony.

Summary

The Coral Monitoring from February 2006 to November 2007 tracked the following changes of the coral assemblages in Balhaf:

- Stable conditions of coral health for most areas,
- Unchanged coral assemblages composition, and a significant increase in living coral cover have been detected in most areas,

- The increase in living coral cover is mainly due to the growth of the dominant pocilloporid *Stylophora pistillata*. However, the growth of other corals, namely *Acropora* and *Montipora* species and *Pocillopora verrucosa*, was documented coral transplantation

Objectives of the Transplantation Program

The transplantation of corals was chosen to preserve colonies threatened by marine construction works or indirect impacts. Numerous restoration projects have been undertaken and provided valuable information through long-term monitoring efforts. Transplantation has been carefully evaluated in the framework of a global environment description before trials and realization.

Coral colonies were transplanted from the Intake area, the Jetty area, the Golf area (shoreline) and the Outfall area to new transplanted areas close to the collecting sites. Field transplantation missions were organised in January, May and September / October 2007.

The main objective of this submarine work was to remove the most sensitive and healthy coral colonies from impacted areas and to transport / cement colonies without any damage on living tissue to new areas that are clear of maritime work impact. Coral selection was based on sensitivity of the species concerned, their size, their morphology and health.

This restoration project is monitored in ways to help / inform management actions. This project is also designed to answer fundamental questions about the project's success as a function of the ecosystem as a whole. Objectives of the environmental monitoring done during the year 2007 were to check if coral colonies were still alive and healthy after the monsoon season, if they were growing and also to determinate the growth rate for species referring to natural corals.

Conclusions

This monitoring programme included work on suspended sediment values in water, determination of the origin of these sediments, monitoring of coral health and also performing some relocation of coral to preserve them.

Sediment work in water

The different missions allowed us to quantify the values of TSS and Turbidity in different situations:

During normal monsoon season, the environmental threshold for TSS can be over passed. As the threshold has been defined as a mean for worldwide corals, this observation could confirm that Balhaf corals are more resistant to suspended sediments than other corals in the world.

The dredging activity performed by a suction process is not harmful at all for the environment.

Sediment origin

The evidences gathered in this study indicate a clear increase of fine sedimentation and a switch to a more terrigenous origin of the fine particles deposited on the sea floor and

benthic organisms along the marine sites in correspondence with the building activities in Balhaf. This was demonstrated through comparative analyses of granulometry and composition of sediment samples collected from land, living coral surface, and seafloor and from sediment traps close to and far from the MOF and LNG plant building activities.

Silt curtains are effective in reducing the total flux of sediment and in avoiding the free transport of the majority of stirred grains from inside the dredging area to the external environment. However, silt curtains are unlikely to be completely effective in retaining the finest clay fraction and, of course, cannot prevent the sedimentation of particles stirred by the YLNG plant and MOF building activities on land and transported to sea by winds.

Both sediment re-suspended by dredging activities at sea and sediment moved around by building activities on land and transported to the sea by the wind significantly contribute to the switch from natural to impacted conditions. In order to clarify the matter, a detailed investigation of sediment transport dynamics is recommended.

Coral monitoring

The Coral Monitoring from February 2006 to November 2007 tracked the following events of the coral assemblages in Balhaf:

- Stable conditions of coral health for most areas
- Unchanged coral assemblages composition
- Increase in living coral cover detected in most areas mainly due to the growth of the dominant and fast growing pocilloporid *Stylophora pistillata*. However, the growth of other corals, namely *Acropora* and *Montipora* species and *Pocillopora verrucosa*, was documented.

Overall the main results of the coral monitoring indicate that thanks to the measures put in place during the construction phase (e.g. the silt curtains) coral communities in Balhaf have not undergone any change in diversity, composition, and structure.

Transplantation of corals

An innovative and daring programme of coral transplantation was implemented by Yemen LNG. This project was the largest attempt ever made to transplant large coral colonies. Sensitive coral colonies were transplanted away from the construction activities to promote new populations and new growth on natural substrate. A high percentage of healthy coral and sensitive corals have been successfully transported from threatened areas to new protected areas. No critical damages due to coral handling were noted. The 9 months monitoring demonstrated a very high survivorship which is to be monitored over several years to confirm the feasibility of massive and innovative transplantation of coral communities.

Annex 8

An overview of the components and procedures of the construction marine monitoring plan

Components and threshold values

In order to measure the impact of the construction activities on the seawater quality and on the coral communities, several studies were implemented in the Balhaf area by Creoclean. These measurements notably concerned the monitoring of various indicators of the water quality:-

Turbidity: according to literature, the standard value of 29 NTU, as a critical threshold for fertility and coral larvae survival, has been established by the Massachusetts Department of Environmental Protection [11].

Total suspended solid (TSS): according to literature, the threshold standards are 10 mg/L [12] and 50 mg/L. Over this value, the fertility and the coral larvae survival can be altered [13].

Dissolved oxygen (DO): values under 3 mg/L are unfavourable for marine life development. Contrary to that, good seawater oxygenation ($\geq 4\text{--}5$ mg/L) indicates a good water renewal and favourable conditions for marine life and organic matter recycling.

Salinity: the values of the water salinity recorded in the Indian Ocean are comprises between 36 and 36.5 g/L [14]. But it is important to note that during the 2005 baseline, the natural salinity reached 37.5 g/L close to the intended MOF construction area.

In the MOF construction influenced area, recorded values were made inside and outside of zones confined by the silt curtains.

Monitoring Sea water quality during normal weather conditions

The results concerning TSS and turbidity rates show that the highest values are measured in the work zones, in an enclosed environment, with a peak of turbidity in the point 1 north and the point 5 (zone of material discharge by trucks). This brings to light the efficiency of the silt curtains in the protection of the sensitive areas facing the sediment release.

Measurements close to the shoreline protection taken prior to works have been considered as baseline. They have been used as reference to estimate the impacts of the shoreline protection construction.

The results of the several measurements seem to show that the construction activities (between April 2006 and April 2007) have no impact on the seawater quality and therefore on the marine life. Indeed, the recorded values are always far below the threshold values.

The quality of the sea water near the coral communities remains favourable to the marine ecosystem. Moreover, the measurements implemented close to the intended shoreline protection area have given evidence of a natural gradient of TSS and, more pronounced, of turbidity, values increasing northwards.

Monitoring sea water quality during monsoon time

Measurements of turbidity and TSS were made during monsoon time in August 2007 in order to evaluate the background levels during the monsoon season. This presents maximum values for TSS and Turbidity calculated during different environmental conditions. It has been noted that natural TSS and Turbidity values increase during the monsoon and TSS exceeds the threshold.

Conclusion on Balhaf corals resilience

As these thresholds have been defined as mean for worldwide corals these observations could confirm that Balhaf corals are typically more resistant to suspended sediments than other corals in the world.

Monitoring Cumulative impacts of sediment

TSS and Turbidity values reflect the seawater quality at a specific time and do not allow taking into account any event limited in time (e.g. a discharge of an important sediment quantity) or assessing the cumulative effect of successive sediment deposition. Flux of sediments over a quite long period can be considered as relatively low. Maximum values are less than 5 mg/day/cm² while most literature recognized levels for sensitive coral communities are about 100 to 200 mg/day/cm².

Coral health monitoring [15]

Following the two environmental baseline studies (1997 and 2005), it was decided to monitor the impact of the marine construction on corals. This coral health survey is intended to make quantitative and qualitative observations and measurements every two months. It has been implemented since February 2006, by Creoclean (**Annex 7**).

This monitoring is mainly based on the estimation of the relative abundance of several benthic elements:

- living cover, non-living cover and sediments,
- hard corals, other benthos, rock (basalt-type lava), biogenic rock (dead coral skeleton) and sediments,
- nine main hard coral families.

In order to evaluate these relative abundances, divers estimated the cover percentage of each benthic elements by using a transect measurement technique called “Line Intercept Transect method” (LIT). This non destructive method presents the advantage of being internationally recognized and it has been successfully used in many Indo-Pacific countries.

The LIT protocol method

On each sampling site, four 20 m long permanent transects were laid on the sea floor. Any coral and benthic element which was encountered under the transect line was recorded by the operator and its projected length on the line was measured to the nearest centimetre. In the case of two or more coral colonies overlaying, the projected length of the largest colony was recorded for the cover percentage calculation (coral overlaying species were registered for the coral species analysis).

The cover percentage calculation has been implemented following this equation:

Cover percentage = (Total length of species or category / Length of transect) x 100

Some qualitative observations have been added to the transect method in order to bring to light potential impacts (e.g. bleaching event, coral mortality). Moreover, in order to test if the observed differences between two surveys results were significant or due to a possible sampling error, the statistical Mann-Whitney U-test was used.

Other coral monitoring method implemented in the Balhaf area

Following the appearance of several secondary events along the monitoring (e.g. red sponge growth, coral disease, sediment deposits), three other protocol methods to survey the coral health have been implemented:

Permanent photo quadrates



This allows close examination of coral health changes over time eg it has been used to monitor the red sponge growth on *Porites* colonies. To address the issue of the red sponge growth rate and amount of coral tissue loss, four permanent photoquadrats were installed in several studied stations. To measure the growth rate, red sponges were marked with a nail at the coral/sponge interface at the time T. During the next monitoring, at the time T+1, another nail was planted at the interface. Identical pictures at times T and T+1 were made, and the red sponge linear growth was measured by estimating the smallest length between the two nails.

Rapid assessment of Porites conditions

This protocol method allows assessing the *Porites* health. In each studied area, each *porites* colony totally or partially encountered within a 2 m wide belt centred along the 4 permanent transect lines was recorded (figure 24) and several elements were surveyed:

- the presence of the red sponge and the number of sponge infestations per colony,
- the frequency of pink blotch disease,
- the presence of sediment deposits onto living *porites* colonies.

Off-transects qualitative observations

At each studied area, qualitative data and photographic records were collected concerning the coral state of health. These observations were extended to the region situated 0.5 m depth under the limit of the coral distribution.

Annex 9

Fish nursery baseline

This fish nursery baseline analysis was implemented by MacAlister Elliot & Partners Consultant between May/June and November 2006. Its aim was to evaluate the importance of the waters around the Balhaf area in term of a function of nursery and source of commercial fish productivity. Moreover, this study analyses the link between reef-building corals and fish populations and shows the direct relationship between coral health and fish abundance and diversity.



The healthy and rich coral habitats are one of the two main pillars of the productivity at Balhaf, the second being the seasonal upwelling from the south west monsoon. This study confirms the links between the coral and the fish communities: the hard coral skeletons have created a complex three-dimensional structural relief which can

- enable the larvae of invertebrates (including corals) and vertebrates (including fish) to settle,
- provide refuge for species in their larval, juvenile and adult stages,
- provide nursery areas for many species,
- provide food and feeding habitat for many organisms, including commercially important fish.

In this way, the Balhaf coral communities are a source, enhancing the fisheries in surrounding waters. Excess organic production (e.g. mucus from corals, plankton) moves into the open ocean and supplies food chains, which in turn supports the productivity of commercially important fish species. This study has underlined an exceptional coastal fish diversity and an important abundance at Balhaf, with a total of 326 species recorded so far in the wider area, belonging to 65 families.

The Balhaf coral communities supply favourable framework for several fish ecological functions. For example, they represent a trap for pelagic larvae and nutrients, and a

settlement site for larvae from the pelagic environment for subsequent development into adulthood using the food and shelter provided by the corals.

As a consequence of the fine-tuned cross-linking of the habitats, the removal of one ecological function or component could result in a collapse of the ecosystem. The consequences of habitat loss include

- decreased abundance and diversity of associated reef-living species,
- disruption to ecosystem functions including the enhancement of open water fisheries,
- decreased abundance of commercially important species that come to the reef edge at dawn and dusk to feed on reef fish,
- loss of genetic diversity,
- decreased capacity for ecosystem recovery following natural disturbances,
- economic and food availability impacts for the people dependent on the fish productivity driven by or enhanced by the coral ecosystem.

It is important to note that this study showed area E to be the only area of the 5 studied where fish biomass estimates are lower after the monsoon than before. Construction impacts observed nearby are likely to account for at least some of this decreased productivity. Moreover, this analysis has underlined a lack of large individuals among the demersal species, which can be an indication of high fishing pressure in recent years, consistent with other YLNG studies which found that catch per unit of effort in the inshore fisheries has been dropping since 2002 due to unsustainable fishing practices.

Annex 10

Fisheries projects to support biodiversity 2005 – 2008

Gal'ah Breakwater

To compensate the affected fishermen of Al Ayn Bay for the loss of their southwest monsoon protected landing site at Balhaf, the construction of a 'harbour-like' breakwater structure was approved following discussions between Yemen LNG and the Minister of Fish Wealth (MFW) and it has been constructed by contractors working on behalf of Yemen LNG. The breakwater is situated at Gal'ah at the eastern end of Al Ayn Bay.

Detailed and comprehensive technical studies by SOGREAH have demonstrated that a three piece construction featuring 150m long units as illustrated below will be the most sustainable option and will be:

- Effective in protecting the beach landing area at Gela'a thereby providing shelter to boats attempting to leave or return during south west monsoon swell conditions;
- Sustainable in that it will not encourage long-term sand deposition or coastal erosion; and
- Will act as an encouragement to fish breeding and coral repopulation by acting as an "artificial reef" structure.

The objective is to reduce the wave action on the beachfront to a level where beach landing by Fishing Boats with a cargo of fish is manageable at all states of the tide without damage to the boats, and the cargo can be unloaded safely. The breakwater arms will reach up to the high water mark and much of the enclosed space will be dry at low tide. The technical design was completed in April 2006 and approved by MOM in May 2006. The breakwater has been constructed by using three temporary access piers (which were subsequently removed). Construction materials include natural rock of different sizes to act as artificial reef for fish breeding and aggregation.

The pre-construction detailed design study was completed on 18th August 2006 followed by a one month tendering process. The construction of the three breakwaters was done in a period between the two monsoons of 2006 – 2007 and it included the involvement of local contractors.

Breakwater Structure



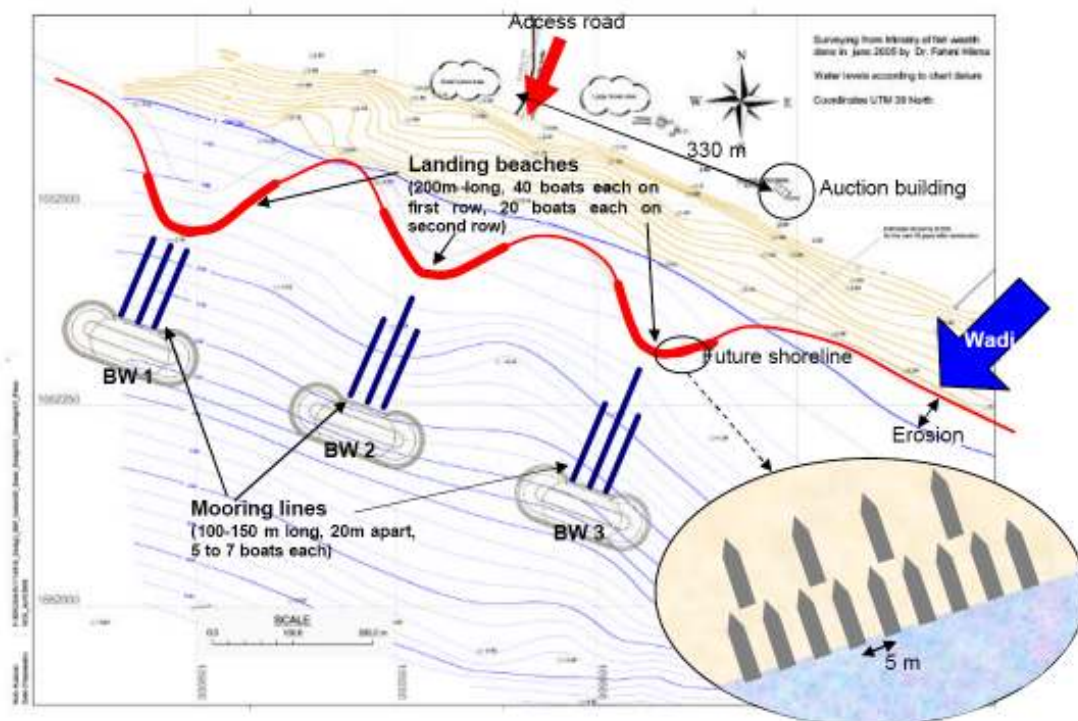


Illustration of the Gal'ah Breakwater

The beach sites on either side of Ras Masluk were also investigated as alternatives to determine if they could possibly be developed as alternative landing sites for Al-Ayn Bay fishermen. However, the southwest facing beaches are subject to similar wave action as the Gal'ah beach and would not be suitable. The east facing beach to the east of Ras Masluk looked more promising and would be sheltered during the south west monsoon; however it has surf landing conditions in the north east monsoon which would require civil works to provide protection. All sites in this area would require extensive road works to make them accessible for fish traders vehicles, in comparing road issues it was found that driving time to Ras Masluk would be similar to the time needed to go from Gal'ah to Bir Ali, which already has the markets and infrastructure, the concept was therefore abandoned.

Bir Ali Upgrade

The fish auctioning conditions at Bir Ali have been poor until recently. Although the MFW provided facilities here under the Third Fisheries Project completed in 1995, these were never used, said to be due to disputes between cooperatives. A large new auction facility built under the Fourth Fisheries Project right on the landing beaches was similarly not used with all fish being auctioned on the polluted beach in front of the building. Furthermore the site is congested with vehicles trying to buy fish and is subject to severe solid waste and sewerage problems.

One of the compensation mechanisms identified through public consultation was the upgrading of the Bir Ali auction house to support the potential development of Bir Ali as a principal fish landing site for larger fishing boats to provide higher quality products with export market potential.

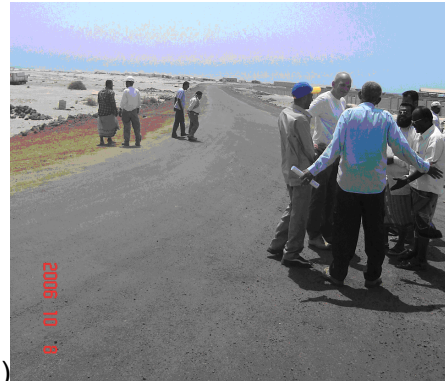
Yemen LNG will fund and project manage this upgrade which will include; public toilets, fencing, parking and upgrading the sanitation system. In support of this work, Yemen LNG has also constructed a new tarmac access road between the landing site and the

main Aden to Mukalla highway, to improve transportation of the landed fish from the Bir Ali Auction to export markets. This road was completed in late 2006.

Figure (a): Bir Ali Action Point to be refurbished as an Agreed Compensation Project and Figure (b): The Upgraded Road between the Mukalla-Aden Highway and the Bir Ali Auction Point



(a)



(b)

Gal'ah Upgrade

An additional compensation mechanism that Yemen LNG has committed to funding and project managing is the upgrade of the auction point of Gal'ah village, west of Balhaf. The planned upgrade also involves a new access road from the Mukalla-Aden highway to the auction site. The 465 m tarmac road will facilitate transport between the fish-landing site and the main highway thereby making it much easier for new vendors to trade at this site. The work on the access road is complete.

Yemen LNG has also provided a tractor to the Gal'ah village committee to assist with the hauling of boats onto the beach. Previously, a private contractor charged the local fishermen for this service. The new tractor was handed over to the village committee on 11th September 2006.

(a): The New Road between the Mukalla-Aden Highway and the Gal'ah Action Point Currently Under Construction, and (b): The tractor Presented to Gel'ah by Yemen LNG for Hauling Boats onto the Beach at Gal'ah



(a)



(b)

Offshore Fish Aggregation Devices (FADs)

Fish Aggregating Devices (FADs) are free floating or anchored structures constructed and deployed to attract schools of fish. The fundamental principle is the fact that oceanic fishes such as tunas are often found gathered around floating logs and other drifting objects, sometimes in very large numbers. Having observed this behaviour, fishermen learned that they often had higher catches when they found floating objects and fished near them than when they fished in the open ocean. Some industrial fishing techniques rely on this tendency for tuna to gather near natural floating objects to improve their catch; many tonnes of tuna have sometimes been taken around even small bodies of floating debris.

Yemen LNG, in collaboration with Macalister Elliott & Partners, has installed 3 trial FADs in the ocean around Balhaf. The project commenced with 3 trial aggregation devices featuring a clump weight on the seabed, a polythene coated tether and a floating aggregation device with navigation lights (see below). One has been placed in shallow waters and two in deeper waters. As the success of these trial devices has been demonstrated, it is intended to deploy a larger number of FADs around Balhaf. These will be manufactured locally.



Fish Aggregation Device

The “Boats Project”

Recognizing the loss of the fishing area around Balhaf, Yemen LNG have also started to investigate the possibility of a project that aims to provide fishermen from the area with the capabilities to move their fishing activities further offshore.

This will not only open up new fishing grounds, but will also increase the sustainability of the currently over fished areas in the region.

This project will be undertaken in coordination with the Compensation Committee and a joint “Fishing Executive Committee” has been set up to implement the boat project.

Yemen LNG is currently evaluating the relative merits of two basic options which have been suggested:

Distribution of a large number of small boats to individual fishermen; and ;

Implementation of a new and sustainable approach built around larger boats with storage capability, more efficient engines and greater range, thus offering enhanced “catch per unit effort”.

Together with the FADs and the coral transplantation activities currently ongoing, the provision of more efficient boats will improve the Catch per unit effort and will allow more efficient and sustainable fishing in the region.

Annex 11 – The YLNG Long Term Sustainable Development Strategy (LTSDS) and the Aquaculture Program

The purpose of this paper is to describe the long term Sustainable Development Strategy and 5 year plan.

1. INTRODUCTION

Yemen LNG's environmental and social philosophy is founded on human development and the protection of biodiversity⁹. The Company is committed to invest in the social development of its project neighbors in a sustainable way that would benefit the communities and the company in the long term.

Through specific and planned interventions based on the general principles of sustainable development, Yemen LNG intends to contribute to the social development of project neighbours by improving economic and social structures and by bringing about changes in thinking and in consumption and production patterns. This will lead to a change in local people's capacities and resources, how they organize themselves and how they relate to the outside in the long-term.

The paper describes the approach that Yemen LNG follows in order to achieve this goal.

2. BACKGROUND

Yemen LNG's sustainable development strategy has initially been focussed on supporting communities in the areas near the pipeline and plant. The first priority, during the period 2005 to 2007, was to gain the communities' trust, by supporting them with projects that could be developed in participation with local communities and implemented in the short term.

The priority themes during this early phase have been: sustainable fishing, water supply, and sanitation and school renovation / extension. Many of these programmes have benefited from the technical input of external consultants with the appropriate technical / Yemen expertise. In the case of water programmes (on the pipeline route as well as in the coastal area) Yemen LNG has partnered with international and national NGOs.

Yemen LNG is now looking ahead to structure community development projects over the coming 5 years, allowing sustainability criteria to play a more emphasised role in project selection and to increase partnerships with NGOs and donor organisations. Objectives

The objective of this Strategy is to structure the implementation of community development in the project affected areas and beyond to enable Yemen LNG to do the following:

- Bring social and environmental benefits to key stakeholders of the Yemen LNG Project;
- Display leading corporate, social and environmental responsibility;
- Promote support for the Yemen LNG Project;

⁹ Yemen LNG Environmental & Social Principles (Document No. L1-POL-01-010)

- Address stakeholder concerns;
- Comply with various World Bank and other IFI standards and best practices;
- Honour Yemen LNG's Environmental and Social Principles on human development and the protection of biodiversity;
- Provide visible positive results, encourage positive attitudes and reduce the risk of conflicts; and
- Translate these investments into longer-term self-sustained development.

3. METHODOLOGY

Yemen LNG interprets sustainable development as a process which requires our company to implement our activities *"in a way that meet the needs of present generations without jeopardizing the ability of future generations to meet their own needs"*¹⁰. It requires a vision of progress that integrates immediate and longer-term social objectives.

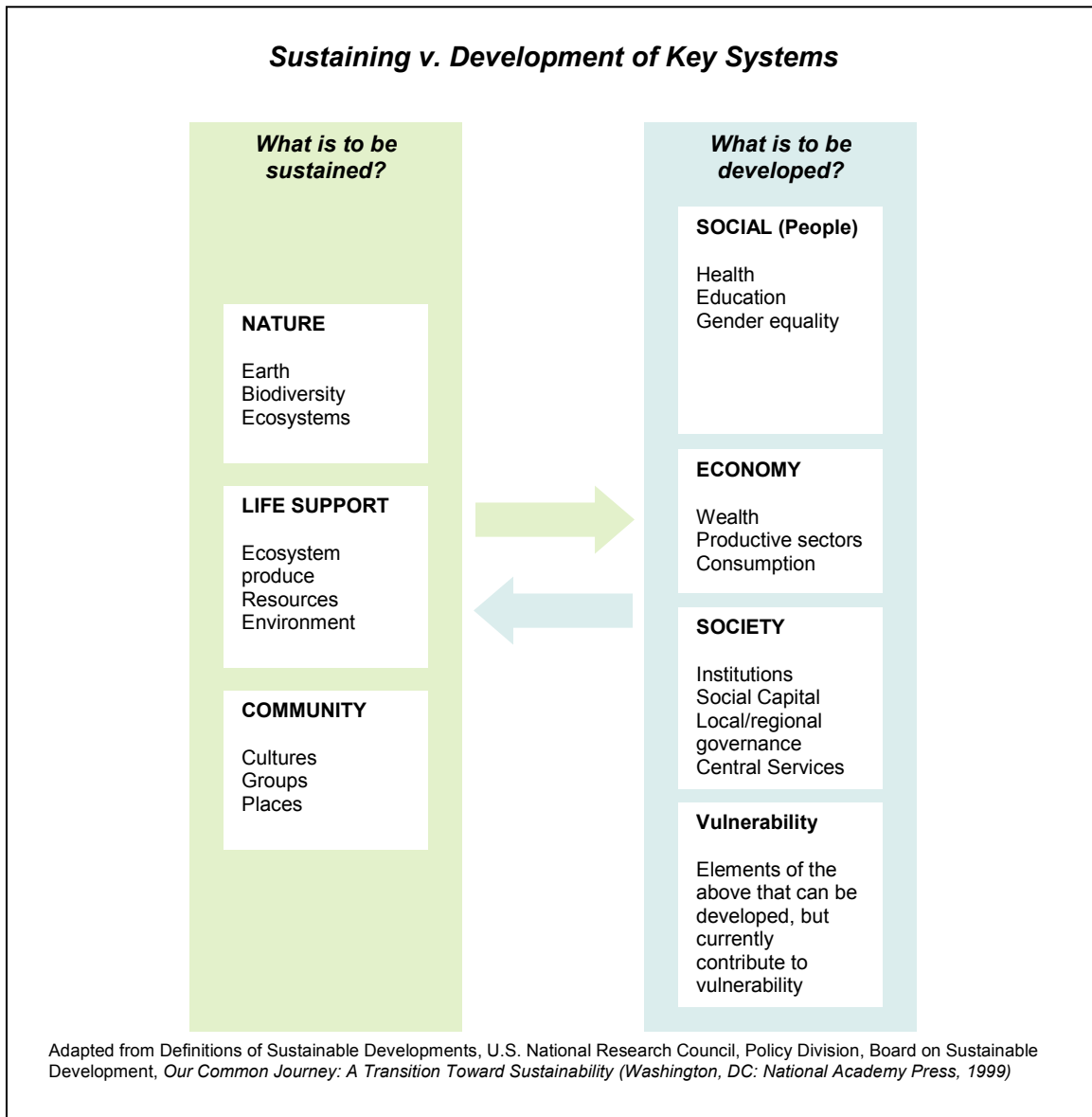
Yemen LNG follows this approach internally and externally. Internally it is implementing its construction activities, and will implement its future operational activities, in a sustainable manner. Externally it is implementing sustainable development projects, as much as possible in partnership with NGOs and/or Development Agencies, within communities and the environment on four levels:

1. In reaction to project related impacts (part of livelihood restoration and the Resettlement Action Plan);
2. As compensation for tribal land (where the project passes through land where communities are far away from the project (specifically Markha and Oseilan Districts in Shabwa and the Al Wadi District in Marib);
3. As community investment in the communities close to the ROW (generally within 5 kilometres) as an action to increase project acceptability by neighbouring communities; and
4. "Catalyst effect": successful projects in our neighbouring communities will enable NGOs and Development Agencies to build on the implemented projects and extend development in a wider area.

The approach that Yemen LNG has followed acknowledges the interdependence between four systems that are basic to development. First there is the biophysical system (including nature, life support and community), which cannot be developed but must be sustained. The other three are Society, Economy and Social Systems and can be developed. Deficiencies in any of these systems can lead to vulnerability of people's livelihoods and must be addressed as a priority.

To understand the interdependency of these systems in its neighbouring communities and how people's livelihoods are related to them, Yemen LNG has been communicating with the project affected population for almost three years and has completed various studies (as part of environmental and social management). In assessing the environment (who the people are, how they live, existing conflicts, resources, etc.) Yemen LNG considered the variety of relationships involved in families, households and communities.

¹⁰ Brundtland Commission



To understand all aspects of its neighbouring communities' livelihoods, Yemen LNG used the DFID Sustainable Livelihood Framework. This is based on the simultaneous investigation of the many – constantly shifting – forces and factors that affect livelihoods, their weight in ensuring an outcome and the dynamics between them. These include:

- **Livelihood Assets:** people's strengths (assets or capital endowments) and how they endeavor to convert these into positive livelihood outcomes. People require a range of interlinked capital to achieve positive livelihood outcomes. These can be grouped under human, social, physical, natural and financial assets or capital with no single category of assets being sufficient to yield a positive livelihood outcome;
- **Livelihood Strategies:** the activities and choices that people make / undertake in order to achieve their livelihood goals;
- **Livelihood Outcomes:** the achievement or outputs of livelihood strategies;

- **Local Vulnerability Context:** the framework of the external environment in which people exist including critical trends, shocks and seasonality over which people have no or limited control¹¹; and
- **Transforming Structures and Processes:** the institutions, organizations, policies and legislation that shape livelihoods⁴.

Central to this assessment was access and entitlement to assets or capital because the asset status of individuals, households and communities is fundamental to understanding the options open to them, the strategies they adopt to attain livelihood, the planned outcomes and the vulnerability context within which they operate. Our assessment therefore considered what individuals, households and communities have, and what they do not have, and how their access might change over time within the vulnerability context that frames the external environment within which people function.

Our analysis initially focused on livelihood strategies and vulnerabilities within the project affected area and allowed us to determine focus areas where development support would have the greatest impact on livelihoods and reach the most beneficiaries. In addition communities have identified areas of support which were the most critical to their immediate needs and Yemen LNG investigated the possibility of such support.

The analysis identified the following focus areas within the four development systems:

- **Key economic activities** where development support would benefit the highest number of households. These are:
 - Aquaculture (Fisheries)
 - Agriculture (Livestock and Crops)
 - Apiculture (Beekeeping)
- **Key social elements** impacting on households and communities where development support would benefit whole communities and increase their ability to access economic activity. These are:
 - Education
 - Health
 - Gender Equality
- **Key vulnerability factors** where development support would benefit both economic activities and social elements. These are:
 - Water
 - Electricity
- **Key society issues** that must be addressed are capacity building and improvement of the Social Capital (networks, formalized groups, cooperatives...). These cannot be regarded as standalone focus areas but are integrated in each of the areas listed above.

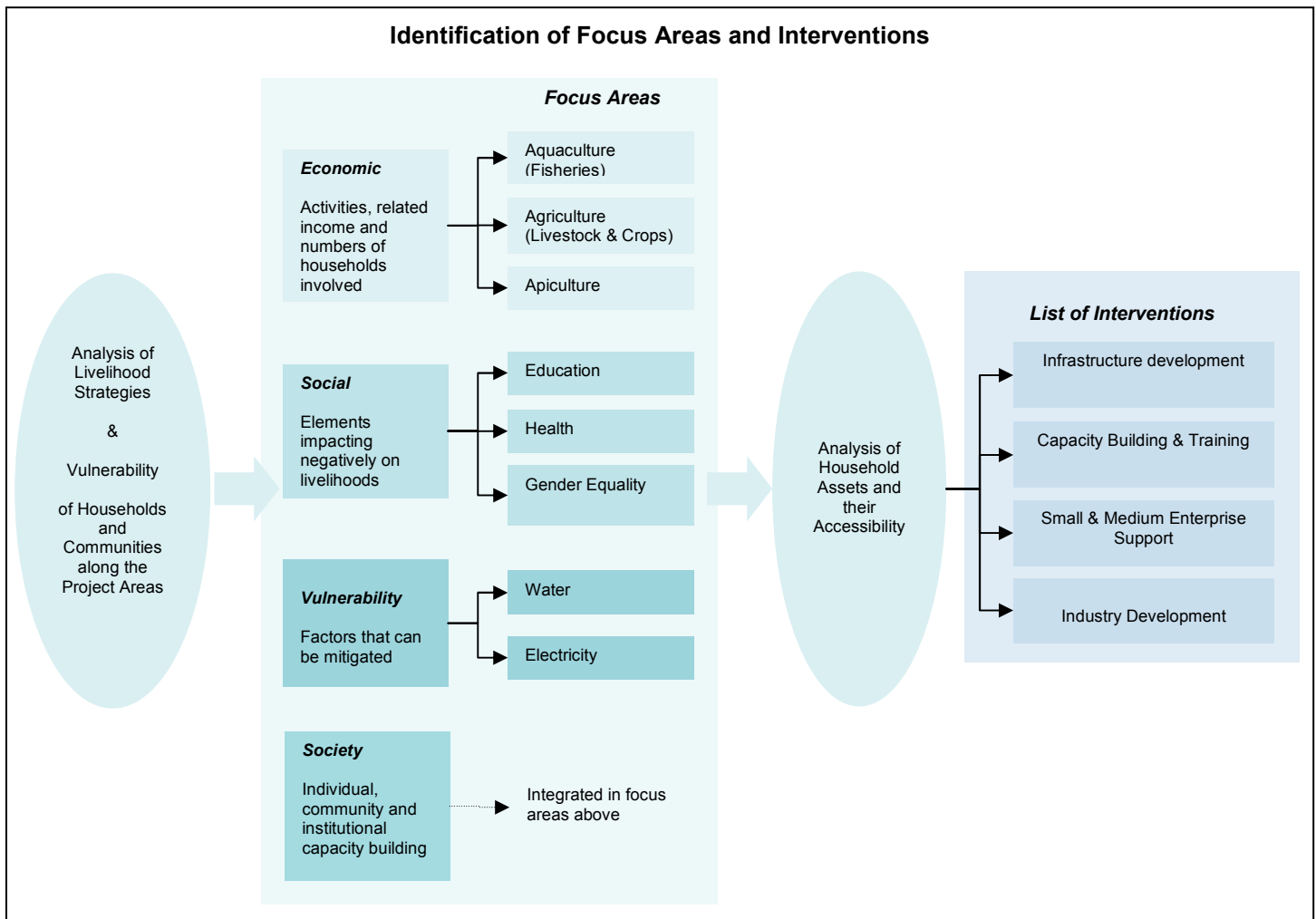
11 e.g. population trends, conflicts, national and international economic trends, politics, health shocks, natural shocks, economic shocks, crop and livestock health shocks, seasonality of prices, production, health and employment opportunity.

4 These effectively determine access to various types of capital, to livelihood strategies and to decision-making bodies, the terms of exchange between different types of capital and the economic returns on livelihood strategies

Having identified eight key focus areas, each focus area was then investigated further to determine household and community assets and their accessibility. This allowed the identification of key interventions that support the development of assets aimed at increasing overall livelihood strategies at a household and community level. The analysis identified:

- Infrastructure Development;
- Capacity Building and Training;
- Small and Medium Enterprise Support; and
- Industry Development.

The process can be illustrated as follows:



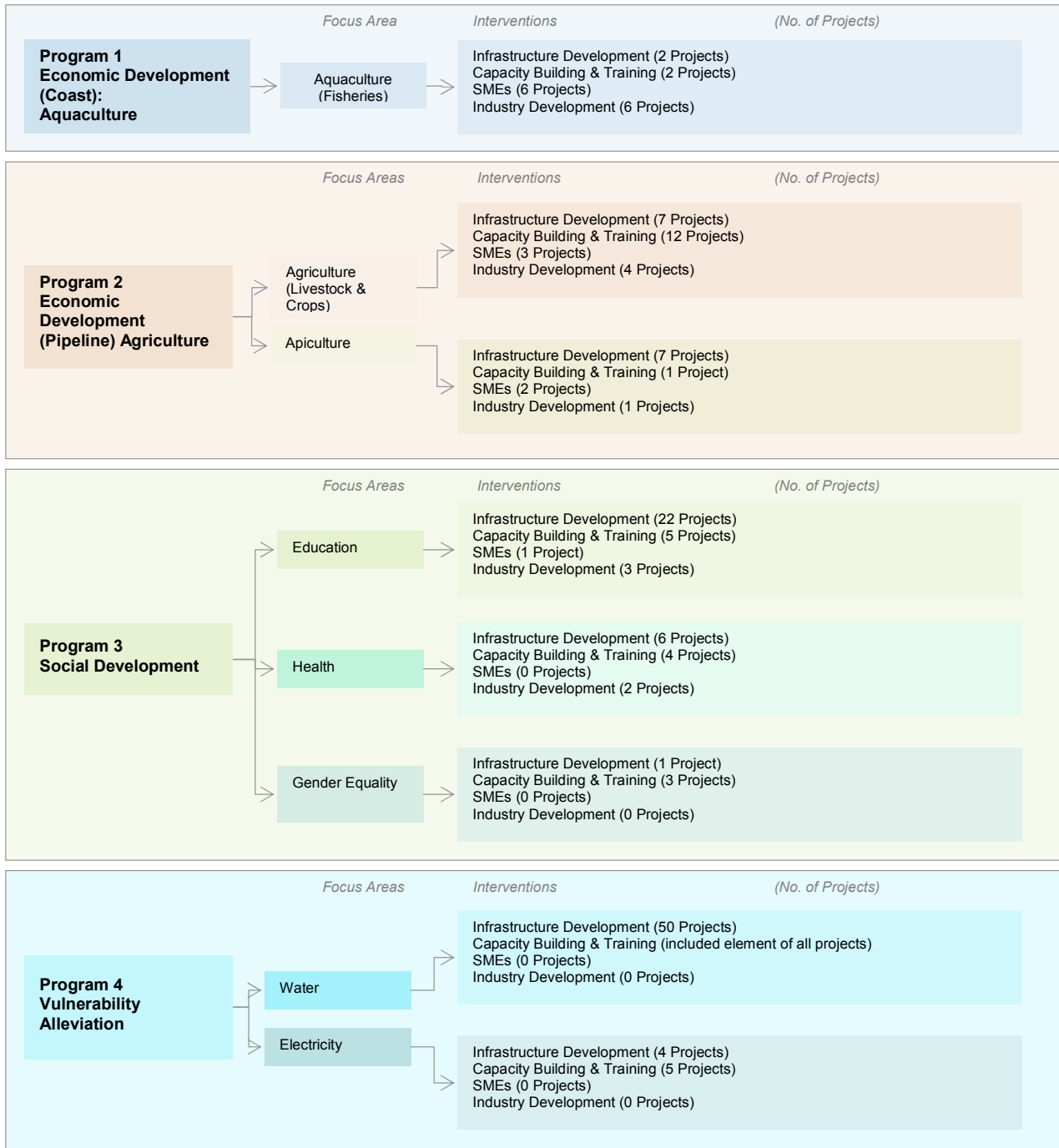
4. PROGRAMS

For management purposes the 8 focus areas are grouped into 4 programs, each with a specific set of supporting projects categorised under the 4 interventions listed above. For each program a set of supporting fact sheets have been annexed to this document. The fact sheets provide a brief outline of the following:

- Overall Objective;
- Meeting guiding principles;
- Program Description;
- Background;
- A list of suggested projects;
- Supporting Budgets;
- Timelines; and
- Project Distribution along project areas.

The following diagram presents the four program structures.

Structure of Sustainable Development Programs with Monitoring & Evaluation



5. BENEFICIARIES

The main beneficiaries for this Strategy will be the immediate project neighbors around Balhaf and along the pipeline. This represents approximately 17 000 individuals.

However, in various projects the target areas have either been increased (at minimal cost) or the project receptor (e.g. dams) supports households from both the affected areas and areas further away from the pipeline and therefore include more beneficiaries.

In addition the suggested interventions involve a large component of capacity building in the form of training and awareness that can be easily transferred from target communities and households to wider areas.

This will ensure that Yemen LNG does not create a corridor of wealth along the project areas.

Where an intervention is focused only on the communities closest to the project, Yemen LNG will search for development partners to expand the intervention to communities further away from the project. This will be considered when the initial projects prove successful.

6. PARTNERS

Yemen LNG acknowledges the existing skills in the area of human development that exists in Yemen through local and international NGOs and other development agencies. More important is the fact that the various related Ministries and Departments have existing systems and networks in place that would be beneficial to implementing this Strategy and partnerships and cooperation with these institutions are important for the success of this Strategy.

Yemen LNG will use as many local implementing partners as possible and coordinate the suggested activities with relevant Government infrastructure. Successful interventions will allow us to approach potential financial partners (in the form of large development agencies and funding institutions) to expand projects in the Shabwa and Marib Governorates.

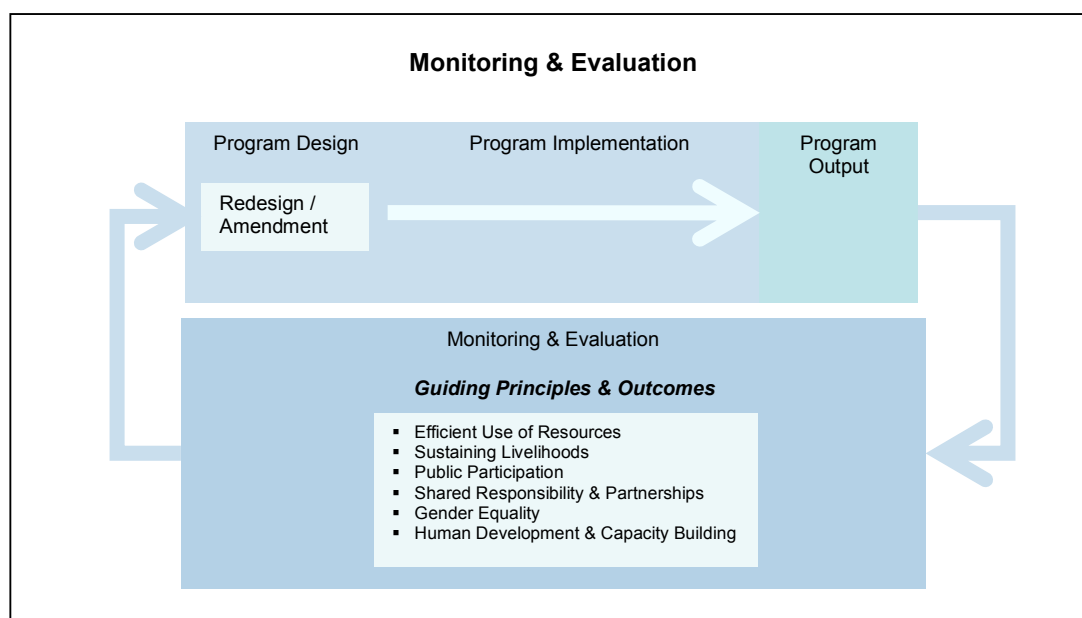
The timeline for the 4 programs with specific focus areas are as follows:

| | 1 st Half 2008 | 2 nd Half 2008 | 1 st Half 2009 | 2 nd Half 2009 | 1 st Half 2010 | 2 nd Half 2010 | 1 st Half 2011 | 2 nd Half 2011 | 1 st Half 2012 | 2 nd Half 2012 |
|---|---------------------------------|---------------------------------|---------------------------------|---------------------------------|---------------------------------|---------------------------------|---------------------------------|---------------------------------|---------------------------------|---------------------------------|
| Program 1: Economic Development (Coast): Aquaculture | | | | | | | | | | |
| | Phase 1 | | Phase 2 | | Phase 3 | | Phase 4 | | Phase 5 | |
| Program 2: Economic Development (Pipeline): Agriculture | | | | | | | | | | |
| Livestock & Crops | Phase 1 | | | | | | | | | |
| | Phase 2 | | | | | | | | | |
| | Phase 3 | | | | | | | | | |
| Apiculture | Phase 1 | | | | | | | | | |
| | Phase 2 | | | | | | | | | |
| Program 3: Social Development | | | | | | | | | | |
| Education | Phase 1 | | Phase 2 | | Phase 3 | | Phase 4 | | Phase 5 | |
| Health | Phase 1 | | Phase 2 | | Phase 3 | | Phase 4 | | Phase 5 | |
| Gender Equality | Phase 1 | | | | | | | | | |
| Program 4: Vulnerability Alleviation | | | | | | | | | | |
| Water | Phase 1 | | | | Phase 2 | | | Phase 3 | | |
| Electricity | Phase 1 | | Phase 2 | | Phase 3 | | Phase 4 | | | |

7. MONITORING AND EVALUATION

Primary monitoring and evaluation responsibility will rest with Yemen LNG. However, for certain elements Yemen LNG will rely heavily on input from external auditors. This will be implemented and managed by the Yemen LNG Health, Safety, Social and Environmental Department. Yemen LNG has appointed internal social specialists who will be able to undertake and/or manage the relevant monitoring. Yemen LNG will also appoint external specialists to conduct regular independent monitoring and verification. This evaluation will also include the evaluation of other social aspects of the projects e.g. the Resettlement Action Plan and Public Consultation and Disclosure Plan.

The process can be illustrated as follows:



8. ANNEX: PROGRAM FACT SHEETS

Program 1: Economic Development (Coast): Aquaculture

Program1: Aquaculture Development Fact Sheet

Overall Objective: To support the fishing communities around the project area to diversify their fishing practices, add value to their production and pave for the longer term of the industry.

Meeting Yemen LNG Guiding Principles

- Efficient Use of Resources ✓
- Sustain Livelihoods ✓
- Public Participation ✓
- Shared Responsibility and partnerships ✓
- Gender equality (not applicable) ✓
- Human Development and Capacity building ✓

Program Description:

The Aquaculture Development Intervention will combine fisheries, coastal and coastal zone management elements because of the interaction and dependency between these activities. The suggested approach will involve the following:

Infrastructure Development related to the fishing industry
Capacity building aimed at industry practice improvement and diversification to increase the quality of marketable products for export.

The related programs will be distributed in 5 phases (12 months each) over a period of 5 years. The related work that has already been completed as part of this intervention has been categorized as Phase 0.

Project Stages:

Phase 1 - Planned Duration: 12 Months

- Development of Infrastructure
- Capacity Building

Phase 2 - Planned 12 Months

- Development of Infrastructure
- Capacity Building

Phase 3 - Planned 12 Months

- Development of Infrastructure
- Capacity Building

Phase 4 - Planned 12 Months

- Capacity Building

Phase 5 - Planned 12 Months

- Capacity Building

Elements of Programs:

- Community Investment and
- Resettlement Action Plan

Partners:

- Local Communities
- Community leaders
- Local NGOs and CBOs



Background:

After oil and water, fish is one of Yemen's most important common property natural resources and the country benefits substantially from the valuable fish resources in its exclusive economic zone. Around the Bafra plant there are approximately 507 fishing boats providing direct employment to approximately 1800 individuals and indirect employment to approximately 150 individuals.

Yemen LNG's Sustainable Development Strategy along the coast has mainly focused on the offset or mitigation of project related impacts. The expected impacts and related mitigation activities were as follows:

| Actual/Anticipated Effect | Yemen LNG Strategy |
|---|--|
| Loss of landing site at Bafra Bay, previously used in the monsoon season to land fish and shelter boats | Construction of a breakwater and access road at Jafra to allow beach landing during the monsoon |
| Loss of fishing grounds due to the future implementation of the exclusion zone | Installation of Fish Aggregation Devices remote from the exclusion zone to provide alternative fish concentrations |
| Increased costs to travel to Bafra market | Construction of an access road at Jafra to service the area protected by the breakwater and to increase trade |
| Potential reduction of fish biomass due to construction activities at Bafra | Environmental management, protection measures and zone transplantation |

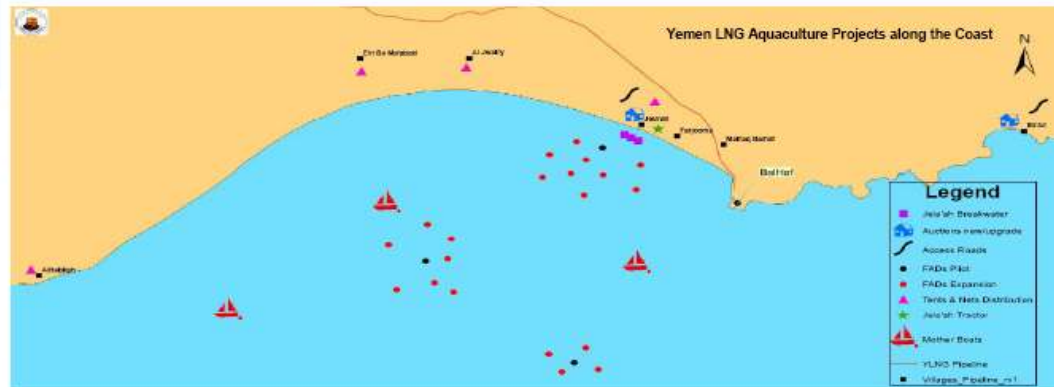
In most cases these projects have been completed and the future projects will aim to establish a well integrated natural resource base through a combination of infrastructure development, education and capacity building and support to government level coastal management.

The proposed aquaculture development intervention suggests an integrated approach to allow for increased biomass through the Coastal Zone Management Plan and the future exclusion zone; the ability for fishermen to have access to fish stock (either shield through the coastal program), and to ensure export quality of their catch through a new auction facility at Jafra. In addition there will also be opportunities for small programs aimed to educate selected fishermen about sustainable management of fisheries, etc.

List of Suggested Projects

The Aquaculture Development Intervention will consist of the phases over a period of 5 years and will include the following programs and projects:

| | PHASE 0 (Complete) | | PHASE 1 (2008) | | PHASE 2 (2009) | | PHASE 3 (2010) | | PHASE 4 (2011) | | PHASE 5 (2012) | | | | | |
|--|--------------------|-----------|----------------|-----------|----------------|-----------|----------------|-----------|----------------|---------|----------------|---------|------------|--------------|----------|--------------|
| | Who | \$ | Who | \$ | Who | \$ | Who | \$ | Who | \$ | Who | \$ | | | | |
| Intervention 1: Infrastructure Development Program | | | | | | | | | | | | | | | | |
| Breakwater | ✓ | 1788 | 7 000 000 | | | | | | | | | | Y LNG | Compensation | | |
| Jafra Beach Access Road | ✓ | 1788 | 110 000 | | | | | | | | | | TSD | Compensation | | |
| Be Al Access Road | ✓ | 1788 | 70 000 | | | | | | | | | | TSD | Compensation | | |
| Jafra Tractor and Trailer | ✓ | 1788 | 35 000 | | | | | | | | | | Y LNG | Comp Inv | | |
| Provision of Fishermen nets | ✓ | 1788 | 30 000 | | | | | | | | | | MEP | Comp Inv | | |
| Provision of Tents | ✓ | 1788 | 70 000 | | | | | | | | | | MEP | Comp Inv | | |
| Coral Transplantation | | | ✓ | 1788 | 1 451 100 | ✓ | 1788 | 730 000 | | | | | Greenpeace | Compensation | | |
| Be Al Furniture and Computer | ✓ | 1788 | 9 000 | | | | | | | | | | TSD | Comp Inv | | |
| Jafra Auction Support Services | | | ✓ | 1788 | 30 000 | ✓ | 1788 | 30 000 | | | | | TSD | Comp Inv | | |
| Jafra Boat Handling Service | ✓ | 1788 | 50 000 | | | | | | | | | | Y LNG | Compensation | | |
| Intervention 2: Capacity building and training | | | | | | | | | | | | | | | | |
| Mother Boats | | | ✓ | 1788 | 40 000 | ✓ | 1788 | 40 000 | ✓ | 1788 | 50 000 | ✓ | 1788 | 50 000 | TSD | Compensation |
| Sustainable Fisheries Education | | | ✓ | 1788 | 50 000 | ✓ | 1788 | 50 000 | ✓ | 1788 | 50 000 | ✓ | 1788 | 50 000 | TSD | Comp Inv |
| Intervention 3: SME development | | | | | | | | | | | | | | | | |
| Fish Aggregation Devices (FADs) support | | | ✓ | 50 | 30 000 | ✓ | 50 | 15 000 | | | | | Y LNG | Comp Inv | | |
| Crayfish Farming | | | ✓ | 50 | 50 000 | ✓ | 50 | 50 000 | ✓ | 50 | 50 000 | | Y LNG | Comp Inv | | |
| Intervention 4: Industry Development | | | | | | | | | | | | | | | | |
| Fish Aggregation Devices (FADs) | ✓ | 1788 | 130 000 | | | | | | | | | | MEP | Compensation | | |
| Fish Aggregation Devices (Expansion) | | | ✓ | 1788 | 200 000 | ✓ | 1788 | 200 000 | ✓ | 1788 | 200 000 | | MEP | Compensation | | |
| Be Al Auction Upgrade | | | ✓ | 1788 | 120 000 | | | | | | | | TSD | Comp Inv | | |
| Jafra Auction Yard Construction | | | ✓ | 1788 | 100 000 | ✓ | 1788 | 30 000 | | | | | TSD | Comp Inv | | |
| Mother Boats Training and Facilitation | | | ✓ | 1788 | 250 000 | ✓ | 1788 | 250 000 | ✓ | 1788 | 250 000 | | TSD | Compensation | | |
| Biodiversity Project | | | ✓ | 1788 | 200 000 | ✓ | 1788 | 200 000 | ✓ | 1788 | 200 000 | | TSD | Comp Inv | | |
| Coastal Zone Management Support | | | ✓ | 1788 | 700 000 | ✓ | 1788 | 700 000 | ✓ | 1788 | 50 000 | ✓ | 50 000 | Y LNG | Comp Inv | |
| Budget Totals | | | | | | | | | | | | | | | | |
| Community Investment | | 9 000 | | 3 021 100 | | 2 114 000 | | 1 250 000 | | 150 000 | | 150 000 | | 8 585 100 | | |
| Compensation | | 140 000 | | 200 000 | | 200 000 | | 200 000 | | 0 | | 0 | | 600 000 | | |
| Livelihood Restoration | | 7 015 000 | | 0 | | 0 | | 0 | | 0 | | 0 | | 0 | | |
| TOTAL | | 8 064 000 | | 3 221 100 | | 2 314 000 | | 1 450 000 | | 150 000 | | 150 000 | | 7 285 100 | | |
| TOTAL Requested 7 285 1000 | | | | | | | | | | | | | | | | |



Annex 12 – IUCN Proposal for Independent Scientific Review



Implementing the Yemen LNG Marine Biodiversity Protection Strategy

Towards a Biodiversity Partnership
of Yemen LNG, the Government of Yemen and IUCN

Paper to Yemen LNG Board 26th August 2008



Introduction

Following a number of discussions in Yemen, France and Switzerland, the potential for an IUCN facilitated independent scientific review of the work of Yemen LNG has emerged. This Board information paper proposes a programme of activities to support the planning and implementation of the Yemen LNG Marine Biodiversity Protection (MBP) Strategy which is an integral component of the company's overall Sustainable Development and Environment (SDE) Strategy. The YLNG Board is requested to endorse this proposal in order that it may be implemented in a timely manner.

The YLNG SDE Strategy has:

“three distinct levels of action, undertaken in close consultation with concerned stakeholders:

- to minimise and mitigate any possible harm or damage, whether to populations, wildlife or the environment, ensuring the residual impact is either nil, negligible or moderate at most
- to provide proper offset or compensation to international standards where impact cannot be fully redressed
- to establish a positive and enduring legacy in Yemen”

In support of this overall set of commitments, this concept note proposes a Biodiversity Partnership of three key partners:

- Yemen LNG (representing the private sector);
- the Government of Yemen (representing the public sector); and
- IUCN (representing civil society and sustainability professionals).

The Partnership will work to ensure that the planning and implementation of the company's MBP Strategy is undertaken in a manner which is mutually acceptable to key stakeholders within the private sector, the public sector, and also the broader conservation community. Its programme of work will focus on an independent review of the design and implementation of the MBP strategy.

Independent review of the MBP Strategy

In partnership with Yemen LNG and the Government of Yemen (as represented by the concerned environmental entities such as the Ministry of Water and Environment in liaison with the Ministry of Oil & Minerals), IUCN will establish a cooperative process under a panel of six independent reviewers (IRs) who will monitor, review and advise on the planning and implementation of the Yemen LNG MBP Strategy. Within IUCN, the partnership will be coordinated by the IUCN Global Marine Programme.

The IRs shall be prominent international or regional experts proposed by IUCN (see Annex A) and approved by Yemen LNG. Their fields of expertise will include marine biodiversity, ecological restoration and impact assessment.

The main responsibilities of the IR advisory panel will be:

- to review the MBP-related work of Yemen LNG in cooperation with the company itself and to provide regular monitoring and advisory reports to the Partners on the design and implementation of MBP Strategy according to agreed-upon technical and financial guidelines (see Annex B);
- to identify any material/substantive modifications in the MBP Strategy;
- to identify significant problems that may arise in the implementation of the MBP Strategy; and
- to notify the Partners of any such modifications and problems in a timely manner.

The reports of the IRs, as they determine to be necessary, will be based on:

- documents provided by Yemen LNG;
- site inspections; and
- consultations with company personnel and other relevant stakeholders.

Twice annually, the IRs will submit to the Partners a detailed report reviewing and evaluating the status of the MBP Strategy. Each report will include:

- a concise summary of implementation plans;
- a concise statement of the status of activities;
- a concise summary of the results of any MBP assessments;
- a summary of periodic and total expenditure reported against the budget;
- a detailed evaluation of whether the technical and financial aspects of the activities remain reasonable;
- any other information, which in the opinion of the IRs will assist the Partners to determine whether the MBP Strategy continues to be a reasonable plan of action; and
- a list of documents and other information that were considered in the preparation of the report, with brief descriptions.

The first “baseline” mission should include all six IRs and the IUCN coordinator. The first report of the IR advisory panel should be a “baseline” report which includes:

- a thorough review of relevant work undertaken to date, including the relevant components of the company’s Environmental and Social Impact Assessment;
- interviews with key stakeholders within the company and the country; and
- initial visits to relevant sites.

Finally, IUCN will also manage the budget (outlined below) for the work of the IR panel. This budget will be reviewed annually and will be subject to the approval of Yemen LNG.

Annex 12a:

Proposed members of the independent review advisory panel

IUCN will endeavour to select six prominent international or regional experts in fields such as marine biodiversity, ecological restoration and impact assessment. This annex provides an indication of the type of professionals which IUCN would approach to join the panel. Two alternative specialists for six fields are proposed.

- Fisheries and marine resources
Ross Shotton (retired from FAO, Yemen experience)
or
Gert van Santen (retired from World Bank, Yemen experience)
- Oil and gas impact specialist
Olof Linden (World Maritime University)
or
Ezio Amato (ICRAM, regional experience)
- Impact assessment
Francis Vorhies (IUCN WCPA and CEM member, regional experience)
or
Jack Ruitenbeck (World Bank consultant)
- Marine protected areas specialist
Dan Laffoley (IUCN WCPA marine chair)
or
Andrew Price (University of Warwick, regional experience)
- Coral reef ecologist
Michel Pichon (Australian Marine Science Institute, Yemen experience)
or
Friedhelm Krupp (Senckenberg Research Institute, regional experience)
- Ecological restoration specialist
Alasdair Edwards (chaired Bank/GEF Coral Reef Restoration Group)
or
Thomas Walker (formerly with the UN Compensation Commission)

Annex 12b: Draft technical guidelines for the IR panel

The general principles for guidance in the development and implementation of the MBP Strategy are as follows:

- mitigation and offset approaches or techniques that pose unacceptable risks of ecological harm should be avoided;
- mitigation and offset activities should be undertaken only if they are likely to result in more positive than negative effects;

- mitigation and offset methodologies and techniques that facilitate natural ecosystem processes should be preferred;
- mitigation and offset approaches should rely on proven and well-established technologies and techniques in preference to experimental or untested approaches;
- the effectiveness of mitigation and offset activities should be monitored to ensure that MBP Strategy objectives and targets are met;
- MBP programmes should be designed to be sufficiently flexible and responsive to new information obtained from monitoring and review;
- where more than one approach or technique is appropriate to achieve a desired goal, the most cost-effective option should be selected; and
- decisions should consider both the short-term and long-term effects of MBP activities on neighbouring ecosystems.

Yemen LNG will work with IUCN and the IRs to develop and report information on environmental indicators and related performance criteria that can be used to track the progress and effectiveness of MBP measures as compared to well-functioning reference ecosystems.

Environmental performance indicators should be those that can assist in evaluating whether the impacted natural ecosystems are making adequate progress towards maintaining their diversity and integrity as a result of the measures taken. In this respect, indicators should be selected to represent a variety of scales of ecosystem organization as appropriate including:

- genetic;
- species/population;
- community;
- ecosystem;
- sea/landscape.

Indicators should be selected to:

- track positive sustainability progress;
- track any unintended adverse consequences of the MBP measures; and
- track any damage to previously undamaged ecosystems.

Goals specified as performance criteria should be developed for each environmental indicator for:

- determining the rate of sustainability progress, and
- ascertaining when MBP objectives are being met.

Environmental indicators and performance criteria should provide empirical evidence of the effectiveness of the MBP measures in maintaining the impacted ecosystems in a well-functioning condition. A well-functioning ecosystem includes:

- a characteristic assemblage of native species;

- the presence of key functional groups of organisms necessary for development or stability of the ecosystem;
- the ability of the system to reproduce and sustain itself over time;
- the demonstrated resiliency of the system to stress; and
- the integration of the ecosystem into the larger ecological and social matrix of the sea/landscape.

IUCN will expect that the IR advisory panel evaluates the actual or potential success of MBP measures by reference to indicators of progress toward well-functioning, comparable ecosystems. Whenever necessary, IRs should verify progress through field visits to the sites.

Carl Gustaf Lundin

Head Global Marine Programme

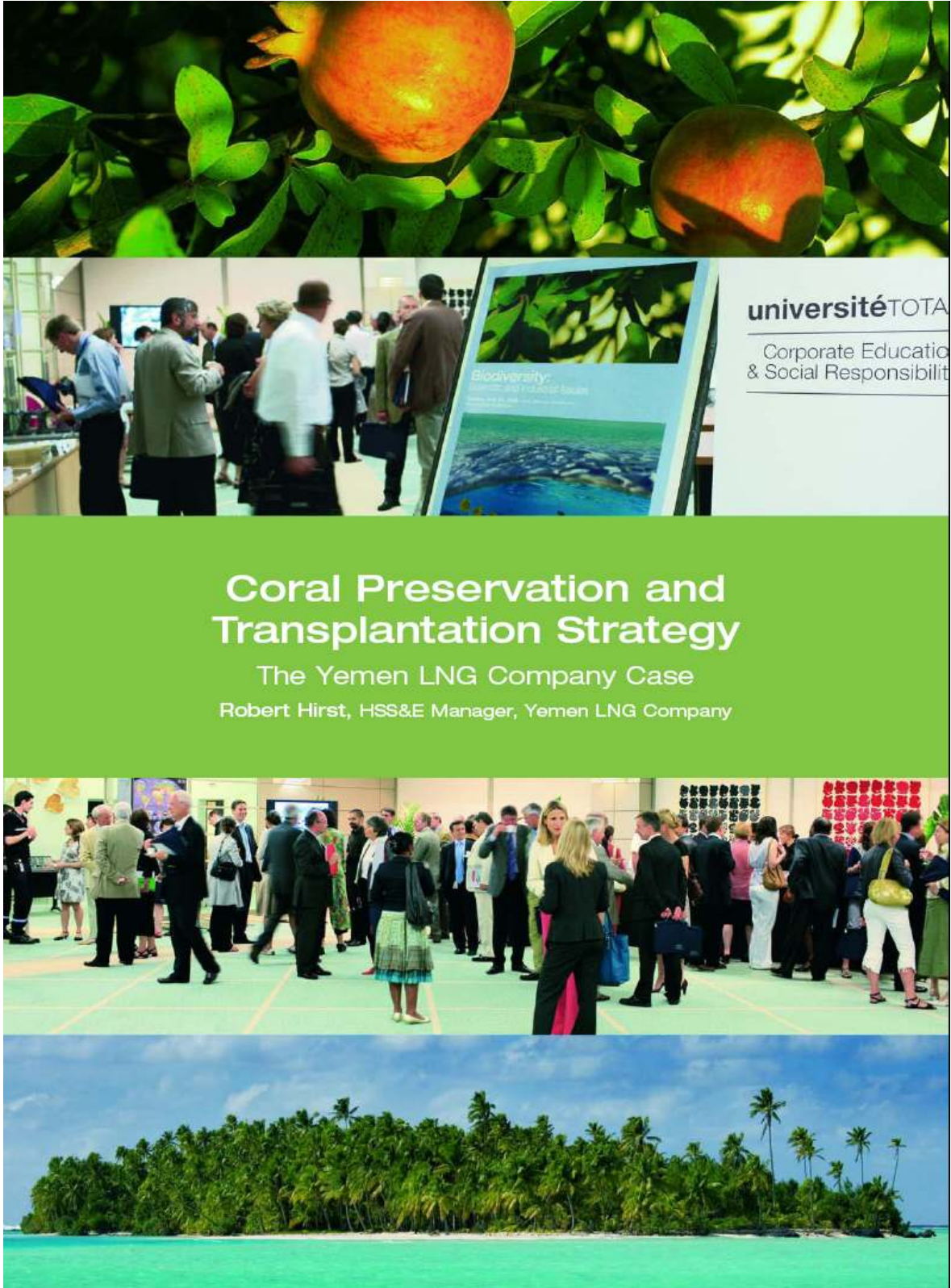
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Annex 13 – Biodiversity Conference in Paris; 24th June 2008





Strategy for preserving and transplanting coral: Yemen LNG case study

Robert Hirst,
HSS&E Manager, Yemen LNG Company

Yemen is located to the south of Saudi Arabia and to the west of Oman, on the Gulf of Aden. A very large gas field is located near Marib, in the central part of the country. The Yemen LNG project involves building a pipeline from the field to the coast, as well as a liquefaction plant at a natural harbour at Balhaf. Once liquefied, the gas will be shipped to global markets for a production lifetime of 25 years.

Representing an investment of over €4 billion and creating over 11,000 jobs during construction, the project has proven technically challenging. The 320 km pipeline crosses both desert and mountainous regions. What's more, liquefaction technology, in which gas is compressed and chilled to -160°C, is difficult to implement in a developing country like Yemen. Solutions have been found, however, and the project is progressing strongly and it should be completed on time. The first LNG deliveries are scheduled for early 2009.

Discovery of coral reefs off Yemen

When the project was initially launched in 1997, the gas field had been identified, but Yemen LNG had not yet chosen a location for the liquefaction plant. Nine sites were under consideration. Balhaf offered the best solution in relation to the project's technical, environmental, social and financial criteria.

We commissioned an environmental baseline study from Creoccean in Montpellier. To their surprise, Creoccean's researchers discovered rich and diverse coral reefs off Balhaf. Yemen is still relatively unexplored, and its coral reefs were virtually unknown before this study. The first scientific article mentioning them dates from 1995. Creoccean identified nearly 70 different coral species at Balhaf and discovered countless varieties of fish living among the reefs.

The project was put on hold between 1997 and 2005, as global gas prices were not high enough for the field to operate profitably. But when prices took off in 2005, the project became economically viable. We ordered a new environmental baseline study from Creoccean to see if recent events such as El Niño (1998) had changed the situation (the oceanic warming phenomenon had wiped out 90% of the corals in the Indian Ocean). Yet contrary to what they'd predicted, Creoccean's researchers found the Yemeni coral reefs were in excellent condition. The reefs had proven to be extremely resistant to the events that had bleached the Indian Ocean coral, most likely because they live in relatively harsh conditions, shaped by strong sea currents and wide temperature swings, which appear to have made them more resilient than the same species elsewhere.

We decided to have a 3D map made of the coral reefs along the coastal area near the plant. Francesca Benzonì, one of the world's leading coral specialists, produced the map based on underwater drawings which she made at the site. Her study determined that certain very large colonies existed which were probably around 500 years old. Some were located just below the surface, very close to the coastline.

Clearly, we had to take this situation into account in managing the project. The way we went about preserving the coral—designated by IUCN as a worldwide protected species—and the exceptional ecosystem around it



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would reflect on the reputation of both YLNG Company and its main shareholder, Total. Yemen LNG complies with the World Bank's extremely stringent corporate social responsibility (CSR) criteria, and it would have been unthinkable not to apply these criteria to the Yemen LNG project. Not only is coral a protected species, but the people who live along the Yemen coast, with average monthly income of typically \$50 per capita, also depend mainly on fishing for their survival. Any deterioration in the coral reef would have a negative impact on the fish population and on the coastal residents' standard of living.

A three-stage strategy

In response to this situation, we adopted a three-stage strategy to limit the project's environmental impact.

The first stage involves avoiding impacts whenever possible, for example by moving the impact zones, modifying the blueprint or drawing on different constructional techniques.

In the second stage, when impacts cannot be avoided, we define and deploy measures to offset them.

The third stage calls for investments to sustainably improve the environmental situation so that we preserve biodiversity both onshore and offshore.

Modifying the loading dock

It was predictable that a \$4 billion project would have a modest environmental impact, and this was confirmed by the ESIA (Environmental and Social Impact Assessment) undertaken by URS. However, we reduced this impact by modifying the facility's blueprint. The ESIA report showed that the 300 meter-long loading facility (MOF) initially planned for the project would significantly encroach on the coral reef's footprint. As a result, we decided to build a piled bridge so we could significantly reduce the footprint on the coral colonies. This solution had the added advantage of preserving the circulation of the currents and fish populations on each side of the bridge, which was also necessary to protect the ecosystem.

The Board of Directors approved the modification, even though it would cost \$10 million. If we had anticipated this problem at the FEED (Front End Engineering Design) stage, we would have certainly prepared ourselves for this design change earlier, and perhaps reduced the cost burden, but the Board felt that protecting biodiversity was worth the investment and the change was approved and implemented.

Moving forward, we realized that we would need to install water silt curtains at both ends of the bridge to filter sediment and silt stirred up by the construction work. Coral is extremely sensitive to silting and can be irreparably damaged after just a few hours of exposure. The silt curtains, which will remain deployed at key construction locations until the plant is built, provide effective protection against siltation. Each day, divers take measurements to assess water quality and every two months a full monitoring mission is held by marine scientists to evaluate coral health using internationally accepted techniques. We use this information to modify our methods if a problem is detected. Two and a half years into construction, the reports show that water quality is excellent, which is very encouraging. Furthermore, coral health is generally as good as, or even better than, before construction commenced.

Moving coral colonies

Despite these relatively expensive measures, we knew that we would inevitably impact coral reefs in four specific small areas - notably around the cooling water inflow and outflow pipes, and along the shoreline protection works, which required major marine excavation work. In response, we looked for ways to offset these impacts.



Strategy for preserving and transplanting coral: Yemen LNG case study

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An experimental technique

I contacted a number of scientists who told me about a technique for transplanting coral. The concept is theoretically quite straightforward - you detach a coral colony at the base and re-attach it elsewhere-but the reality is much more intricate. Coral is extremely sensitive and will die if taken out of the water, even for a few hours. For the transplant to succeed, you need to take enormous precautions during transportation, make sure that the host site has the same characteristics as the coral's original location, take into account the different varieties of coral in modeling the new configuration, and much more, some of which is only beginning to be understood by coral scientists.

The method had been tested on an experimental basis, but never on such a large scale as we anticipated. Published opinions in the scientific community were very mixed; some researchers felt that the technique was reliable while others did not. The estimated survival rate following transplantation typically varied from 50% to 70%. We decided to test the technique and conducted our first trials in November 2006. To oversee this delicate operation, we called in Fanny Séguin, one of the world's few coral transplant specialists.

Application

Since the first trials were successful, we decided to go ahead and transfer the coral located at the four impacted areas. Each area was populated with hundreds of colonies. We selected the colonies very carefully based on whether we thought they could survive the transfer. Depending on the case, we determined that between 70% and 100% (depending on the species) could be moved. Certain species are very fragile and some of the colonies were in poor condition due to damage from fishing nets, fish predation etc.). Only colonies in good health could be transplanted. In all, we moved around 1,500 coral colonies of widely varying sizes. The smallest weighed around 1 kg while the largest logged in at 4 metric tons-equivalent in size to a Toyota Land Cruiser. We were told by the marine scientists that this was a world record for successfully moving a living coral colony.

The procedure for detaching the coral was very simple, using a hammer and chisel. While this may seem a bit brutal, surgeons use the same tools to repair fractured bones. The smallest colonies were transported in plastic baskets, while the larger colonies were fastened with a lifting belt, attached to air balloons and transported by a small boat. Those weighing two tons or more were placed in a specially designed steel cage that was also attached to air balloons. The campaign was relatively complex, both logistically and in terms of ensuring the divers' safety.

The host sites were only 600 to 800 meters away, which reduced the risk of failure. Some transplanting experiments have involved moving coral several dozen kilometers. We had carefully analyzed the sites ahead of time and established a plan for planting the various colonies. Because some species are very aggressive with each other, we had to be careful to keep them apart when transplanted at the new location.

Each of the 3 campaigns lasted 20 days, with the divers working eight hours a day. The work was very fulfilling, but physically demanding. Highly professional, certified scientific divers with very impressive qualifications were recruited for the job, and we benefited from their extensive expertise in organizing the transplantation operation.

Results

Each colony was identified and tracked individually. Marine scientists will observe the coral health for several years. Although we had been given a predicted success rate of 70% at best, the 15-month data show a very encouraging survival rate of 95% of which we are extremely proud.

This very positive result reflects the Yemeni coral's great resilience, the very detailed preparation work carried out upstream and the careful selection of the colonies to be moved. Not only have the transplanted coral colonies acclimated well to their new home, as seen by their strong growth rate, but the fish that inhabited the original sites have migrated as well and colonized the new locations.



Strategy for preserving and transplanting coral: Yemen LNG case study

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The results are monitored by our own scientific teams, as well as by the Yemeni government's supervisory committee and by sponsors who co-financed the Yemen LNG project. External stakeholders, notably NGOs, also keep a close eye on the coral. Clearly, any missteps on our part would cost us dearly. This internal and external monitoring is very important for guaranteeing our approach's validity and success.

Sustainably improving the environmental situation

As I mentioned earlier, the third stage of our strategy calls for investments to sustainably improve the environmental and social situation both onshore and offshore.

To preserve environmental and social conditions over the long term, we earmarked funds in our budget to facilitate the living conditions of workers at the site, residents of villages near the pipeline and local fishermen who fished in the waters near the site.

A permanent 20-person liaison team has been set up to work with the local community. For the fishermen, we built a new \$10 million breakwater five km from the site, as well as a new fish auction. We will also provide larger boats, and have already provided computers to track fish populations and training on more efficient and sustainable fishing methods. To lead the training, we recruited a local fisherman with 40 years of experience who understood perfectly what we were trying to do.

In the beginning, the fishermen and the rest of the population were very hostile to the Yemen LNG project. The local media presented us as predators swooping in to destroy local infrastructure and the environment. There are just as many articles about us today, as we are the largest company in Yemen, but their overall tenor has changed. There is much less criticism and far more recognition of the role we can play in promoting sustainable economic development. This reflects the hard work we have done in working together with the local communities to promote a sustainable benefit to them.

Conclusion

Through these various measures, we have succeeded in minimizing the Yemen LNG project's environmental and social impact. We have risen to the challenge of maintaining a high level of biodiversity around the site and, in doing so, met the expectations of our stakeholders, including shareholders, NGOs, the scientific community and our contacts in Yemen.

Much of what we have learned here will be useful elsewhere. A key lesson is that it is extremely important to initiate impact studies very early in the game. The sooner the studies are conducted, the more effective the solutions and the lower the cost. We also discovered the advantages of working in partnership with scientists. As engineers, we do not have the same competencies. Scientific specialists can provide precious input for solving difficult problems and making the best management choices.



43

Débat

Anti-silt curtains

Participant: In your presentation, you explained that the bridge was built to make it easier for fish to circulate between the two areas. Don't the anti-silt curtains block this circulation?

Robert Hirst: Yes, but only temporarily. As soon as construction is finished, the curtains will be removed and the fish will be able to swim across this area. The sea currents will disperse any remaining silt and the situation will very quickly return to normal. I'd add that we managed to have fishing banned around our sites, which is a first in Yemen. This will make it possible to raise juveniles that will later be used to rebuild the local fish stocks.

Project cost

Participant: How much did the entire biodiversity preservation project cost?

Robert Hirst: It's difficult to give an overall figure, because there were direct and indirect costs. One of the direct costs stemmed from changing the design of the materials loading facility. Another was the redesign of the shoreline protection. The price tag for that came to \$25 million, but that's marginal compared to the project's overall cost of \$5 billion. The budget for the scientific work came to €5 million, but here too, we're talking about a relatively small amount in relation to the whole. All in all, I'd estimate the biodiversity project's cost at around \$40 million, but the advantages greatly exceed the outlay.

Participant: Are you talking about the advantages in terms of image, or more tangible benefits?

Robert Hirst: It would be extremely complex to make a cost/benefit analysis, and I've never tried to do that for the Board of Directors. However, I can give you a few answers. Under Yemeni law, companies that damage coral—either by polluting or through direct destruction—are subject to large fines. What's more we are monitored by very powerful NGOs. If our operations had hurt the coral reefs, we would have been forced to suspend the project, at least temporarily. Any delay in this type of project can very quickly cost millions of dollars. That said, I didn't present the program to the Board of Directors from that angle. Coral are quite simply recognized worldwide as an endangered species and we had to do everything we could to meet our obligations in the area of biodiversity.

Future monitoring

Participant: You indicated that some of the coral was 500 years old. How can you be sure, after 15 months, that the transplant was successful?

Robert Hirst: I became a grandfather three days ago, and three days is enough to see if a newborn is in good health or not. The same is true for coral. After a year, or even two months, you can see if the graft has taken or not. What we're seeing month after month is that the coral is thriving, and that's proof that the transplant has succeeded.

Participant: Are you also planning to monitor the coral that remained in the impacted areas?

Robert Hirst: The monitoring program will continue throughout the plant's useful life, which is set at 25 years. We will track all the coral in the area, including both the original and transplanted colonies. Let me just say in passing that we've discovered something very interesting thanks to this monitoring. The new infrastructure we built—notably the breakwater installed a year ago for the fishermen—are attracting new ecosystems. Coral, shrimp and lobsters are starting to move in around them. Scientists are also studying this phenomenon.

Annex 14 – FAD assessment study and results



1

Introduction

YLNG has identified measures to compensate and mitigate the effects of the loss of access to Balhaf Bay landing and the loss of fishing area with the establishment of the exclusion zone around Ras Balhaf on the Al Ayn Bay fishing communities.

This report on the Pilot Phase of the Fish Aggregation Device (FAD) Program assesses the effects of the current deployment of FADS on the target fisheries, benefits to fishermen and makes recommendations on the future development of the FAD's.

View Under FAD 2 showing fish aggregation



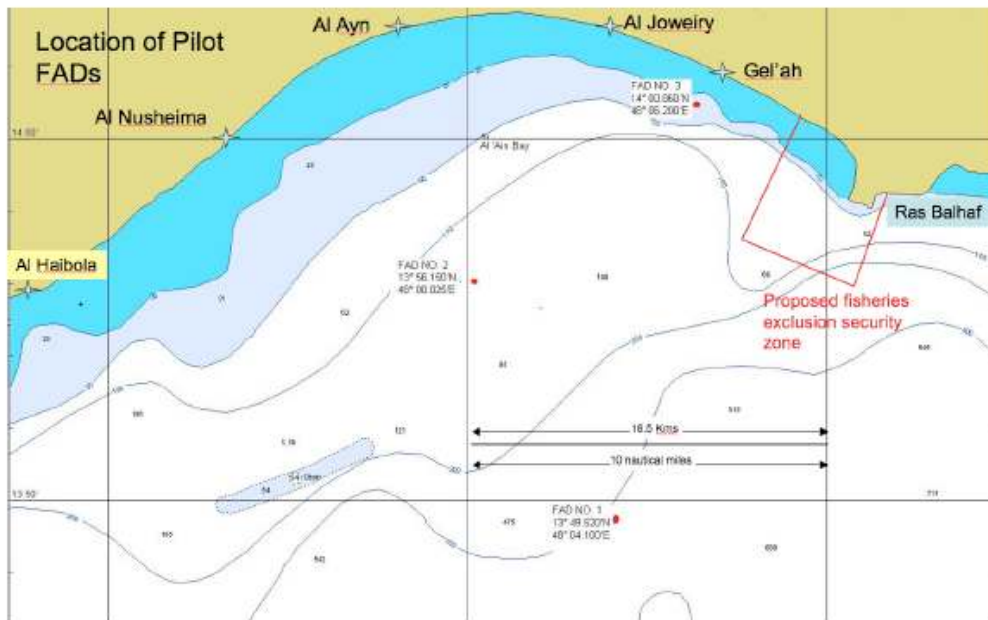
Jel'ah fishing boat at FAD 1



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| AL AYN BAY FISH LANDING STATISTICS AFTER FAD DEPLOYMENT | 4 |
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Fish Aggregation Device (FAD) Deployment

Three FADs were deployed in June 2007, No 1 offshore in 480 metres of water depth known to the fishermen as Balhaf, No 2 in 160 metres of water known as Al Ayn and No 3 close inshore in 60 metres of water known as Jel'ah.

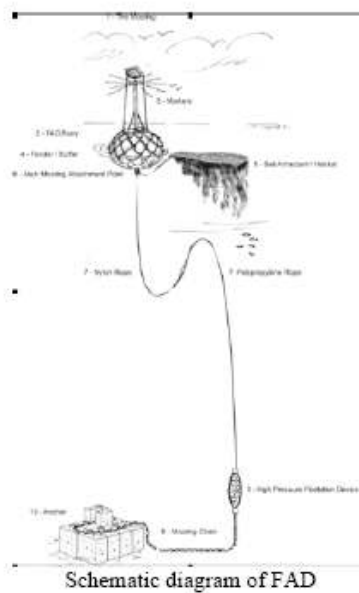


Objective

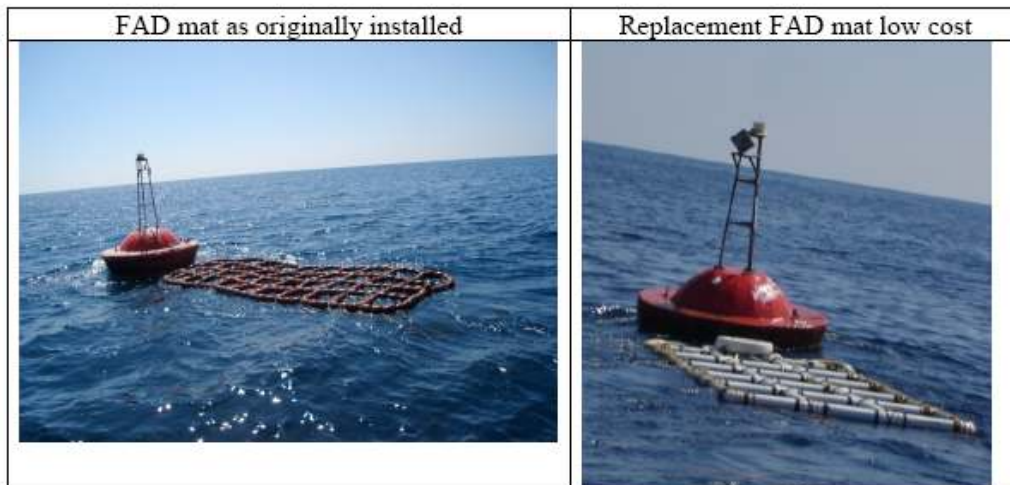
Based on the observation of the fishery along the coast of Yemen close to Balhaf, it is reasonable to expect that FAD's would be an effective means to increase fish catches of the Al Ayn Bay region. Trials with the proposed three pilot project FAD's have provided valuable information on the effectiveness of FAD's in the region. Fish Aggregation Devices placed in the adjacent regions of the bay will be an alternative to compensate for the closed fishing areas off Ras Balhaf, the most important fishing area for the fishermen in the region.

Jel'ah committee members expressed that moored FAD fishing would be a new experience to the fishermen. The concept of utilizing moored FAD's has never been tried in the region, though the use of floating materials for fish attraction is known, and therefore FAD's have been established at various depths / distances off shore. It was decided that FAD's too far offshore may be inaccessible for those fishermen who operate in small boats. However, offshore FAD's are more likely to produce better fish aggregation. To determine the most suitable depth and/or distances from shore and at the same time the best locations of productivity, the above sites were identified for installing the initial trial FAD's.

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The surface FAD mats, which increase the environment on the surface for fish aggregation, used fishing floats in the first pilot FAD deployment; these proved irresistible to local and passing Somali fishermen and were all stolen. The MEP team replaced the mats with much lower cost plastic pipe structures with slight negative buoyancy, some FAD's were without mats for some months during the pilot phase which may have reduced their efficiency.



Al Ayn Bay fish landing statistics after FAD deployment

To determine what effect the FAD deployment is having on the Al Ayn Bay a study was developed using forms to register all fish landed and auctioned. Registration forms were filled by appointed community members at the auctions of Al Ayn, Al Joweiri and Jel'ah. Forms were also issued at Bir Ali auction to the East of Ras Balhaf. Boats from Bir Ali fish in Al Ayn Bay, and Al Ayn Bay boats sometimes land direct to Bir Ali auction.

| FAD Assessment Form | | | | | | | | | | |
|------------------------------|--------------------|------------------|-------------|-------|----------------|------------------|-----------|------------------------|---------------------------|--------------|
| Date التاريخ | | | | | | | | | | |
| Place مكان | | | | | | | | | | |
| Catching place مكان الاصطياد | | | | | | | | | | |
| FADs | | Details التفاصيل | | | | | | Boat Owner مالك القارب | Number of landing per day | Date التاريخ |
| Other Position | FAD 3 (near-shore) | FAD 2 (Middle) | FAD 1 (Far) | Value | Average Weight | Number of Pieces | species | | | |
| | Golah | Al Ayn | Balhaf | | | | | | | |
| * | | | | 31 | 1 | 52 | KAWAKAWA | فيل محمد شعير | 1 | 01/11/2007 |
| * | | | | 86 | 1 | 8 | KAWAKAWA | فيل محمد شعير | | |
| * | | | | 35 | 1 | 80 | KAWAKAWA | علي عمر النبلش | 2 | |
| * | | | | 500 | 3 | 7 | KAWAKAWA | علي عمر النبلش | | |
| * | | | | 600 | 3 | 5 | KAWAKAWA | علي عمر النبلش | | |
| * | | | | 450 | 3 | 4 | KAWAKAWA | علي عمر النبلش | | |
| * | | | | 450 | 2 | 3 | KAWAKAWA | علي عمر النبلش | | |
| * | | | | 2700 | 15 | 1 | SAIFISH | سلح باعري | 3 | |
| * | | | | 1500 | 7 | 8 | MAHI MAHI | سلح بولك شعير | 4 | |

Figure 1: Sample of completed fish landing registration form. The Total Value and Total Weight were later calculated for each entry.

Records of fish landings were made between August 2007 and April 2008. This report is based on data from a 6 month period between the 1st November 2007 and 30th April 2008 where records are complete for all 4 auction sites.

No actual weights of landed fish are recorded anywhere in Yemen so this study has made assumptions on the Total Value (t) calculated from the value per Kg and the average weight and number of pieces. The Total Value (t) is used as an indication of Productivity (p).

FAD productivity

Over the 6 month study period the value of fish caught at the 3 FADs was 47% of the total of all fish landed. FAD2 produced the highest value of the 3 FADs with 27% of the total value. FAD1 only contributed 2% of the total value.

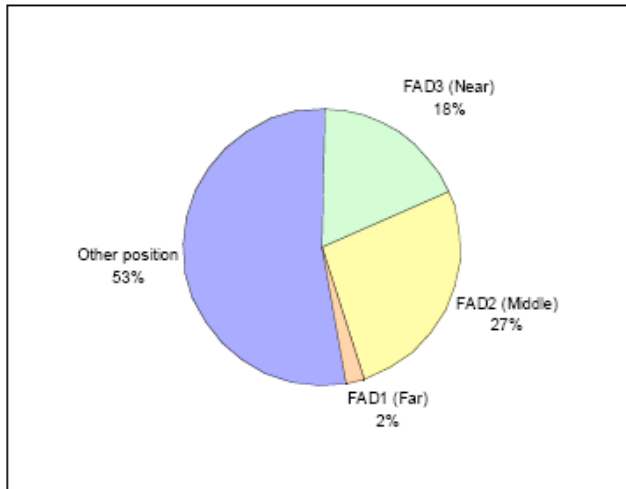


Chart 1: The percentage each FAD contributed to the total value of fish landed in Al Ayn Bay during the 6 month study period.

The value of non FAD fish landed was 53% of the total catch, with FAD associated fish making up 47% of fish landings.

| Location | Value Fish Landed (YER) | Value Fish Landed US \$ |
|-----------|-------------------------|-------------------------|
| Other | 251,317,255 | 1,269,279 |
| FAD3 | 85,661,899 | 432,636 |
| FAD2 | 127,512,320 | 644,002 |
| FAD1 | 9,953,543 | 50,270 |
| Total FAD | 223,127,762 | 1,126,908 |
| Total | 474,445,017 | 2,396,187 |

Table 1: Total Productivity in YER and US \$ over study period, non FAD and FAD associated

The value of non FAD fish caught compared to each FAD was consistently higher except in March when FAD2 produced the highest catch value. This anomaly coincides with peak pelagic fish productivity (see *chart 4*). The value of fish caught at FAD1 remained low, however this does not necessarily imply a low productivity per unit effort. *Table 2* indicates low use of FAD1.

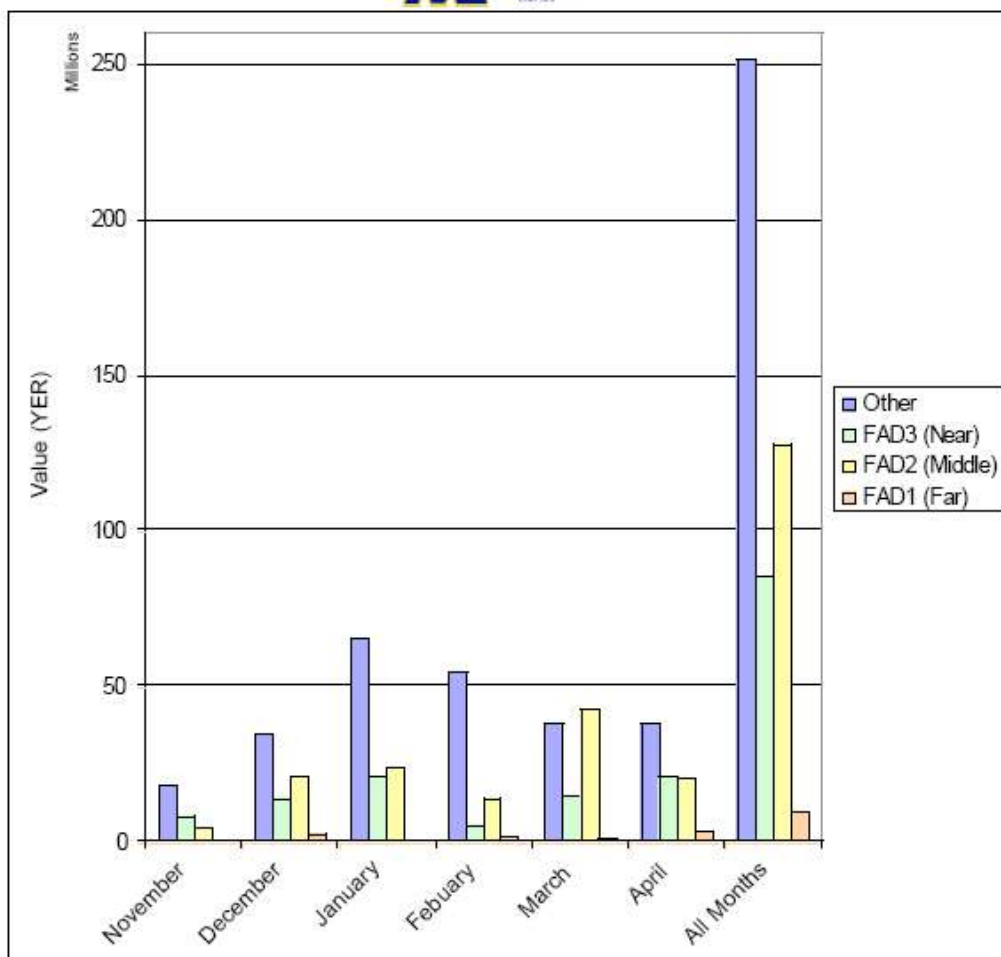


Chart 2: Value of fish caught each month at the each FAD s and non FAD .

The table below shows the number of months during the 6 month study period that a fishing community made visits to each FAD. It is unlikely that trips to FADs would yield no catch so if no catch was landed from a FAD in a month it can be assumed the FAD was not visited. FAD1 the most distant FAD showed low use.

| Community | No. Months of 6 month study period each site was utilised | | | | Total |
|------------|---|------|------|------|-------|
| | Other Position | FAD3 | FAD2 | FAD1 | |
| Al Ayn | 6 | 2 | 6 | 0 | 14 |
| Al Joweiri | 3 | 2 | 6 | 0 | 11 |
| Bir Ali | 6 | 6 | 6 | 3 | 21 |
| Jel'ah | 5 | 6 | 6 | 5 | 22 |

Table 2: The number of months each fishing community visited each of the 3 FADs or Other Positions during the 6 month study period.

Catch composition

Habitat classification

About habitat classification.

| | Demersal | Pelagic | Meso Pelagic |
|-----------------------|--|--|--|
| Classification | Territorial, dependant on habitat, reef dwellers, need local management, easily overfished | Hunters, travel large distances, seasonally available, quantities dependent on international management and spawning oceanic waters | Migratory between inshore and deep water habitats, highly seasonal |
| Description | Needs rocky substrate, found on reefs and rock shelves. | Seasonal inshore waters in search of food provided by upwelling as at Ras Balhaf. | In season (monsoon), found in all parts of Al Ayn Bay |
| Species | Catfish, Croaker, Emporors, Grouper <i>Sp</i> , Reef <i>Sp</i> , Shark | Barracuda, Cobia, Kawakawa, Kingfish, Longtail Tuna, Mackerel, Mahi Mahi, Other Tuna <i>Sp</i> , Rainbow Runner, Ray, Sailfish, Yellowfin Tuna | Caranx <i>Sp</i> , Cuttlefish, Pompano <i>Sp</i> , Mullet |

The proportion of fish caught from the different habitat classifications at the FAD sites differs greatly from the proportions caught away from the FAD sites. The commercial fish species associated with the FADs are predominantly Pelagic fish caught with hand lines and ring nets. Demersal and Meso Pelagic species are either not associating with the FADs or caught inshore with traps and gill nets.

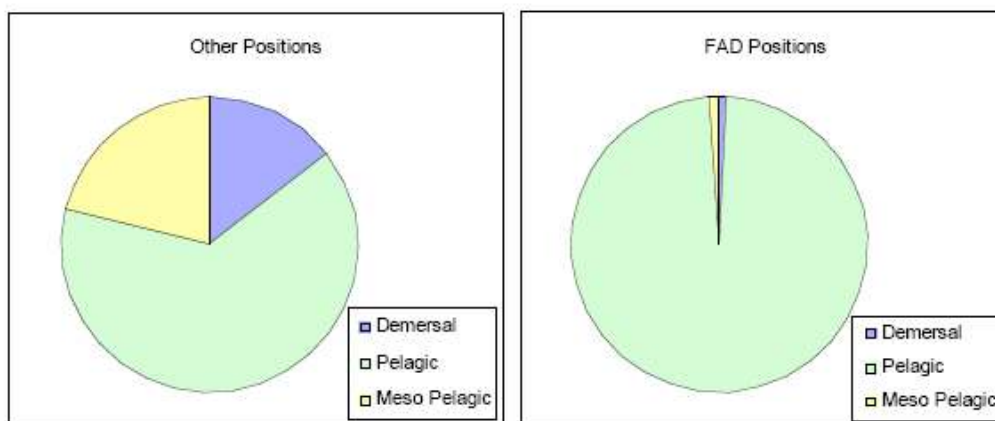


Chart 3: Distribution of the productivity at each FAD and other positions between the 3 habitat groups (Demersal, Pelagic, Meso Pelagic) during the 6 month study period.

The use of FADs in the fishery will relieve the pressure on the more vulnerable Demersal and Meso Pelagic species from depletion by overfishing. Use of the FADs targets the more valuable and resilient pelagic species.

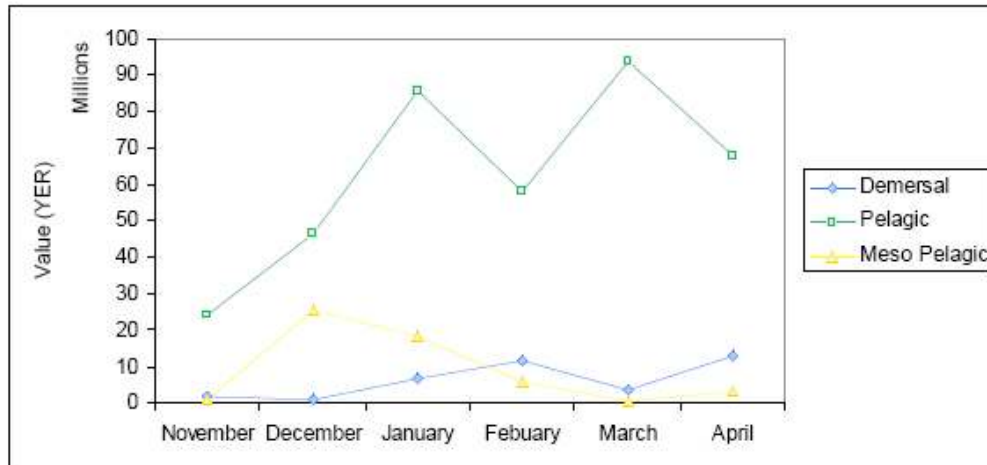


Chart 4: Productivity of each habitat classification throughout the 6 month study period.

Species composition

Each fish entering the auction during the study period was classified to species level or when this was not known to family level. This gives an opportunity to assess how each species contributes to the total value of the catch and where the species are being caught.

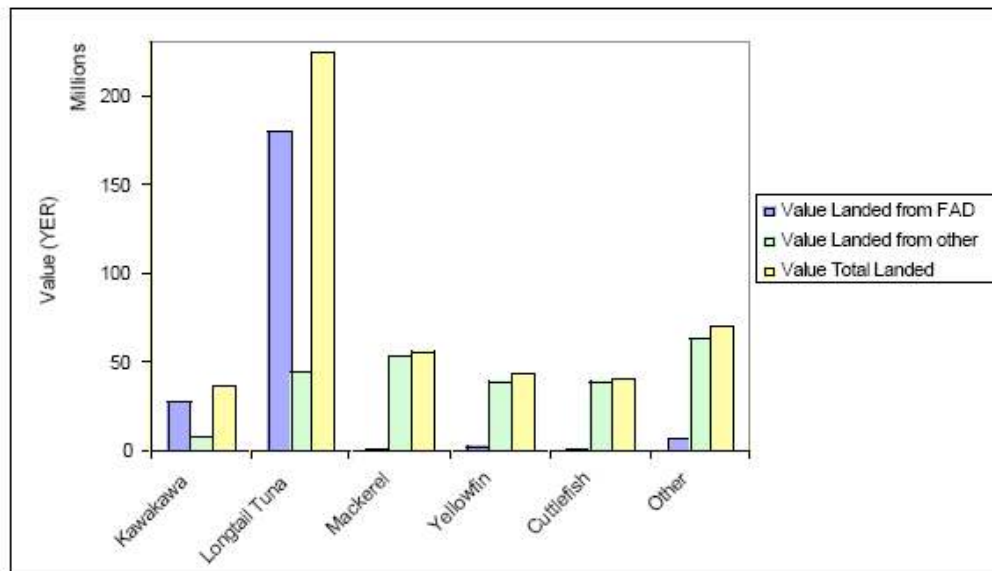


Chart 5: The value of the 5 most Productive species over the whole study period compared to the Productivity of all other fish caught.

The study has identified the 5 most productive fish species:

| Species | Habitat Class | % of total Productivity |
|---------------|---------------|-------------------------|
| Longtail Tuna | Pelagic | 48 |
| Mackerel | Pelagic | 12 |
| Yellowfin | Pelagic | 9 |
| Cuttlefish | Meso Pelagic | 9 |
| Kawakawa | Pelagic | 8 |
| | Total | 86 |

Table 3: Top 5 productive Species

The method used identifies Total Value (t) as an indication of productivity which in relation to a method of weight as productivity will show species with the highest market value as most Productive rather than species landed the most. Species targeted by the export market will fetch a premium value when sold in good condition. Species which do not have an export value may not be kept in such good condition and sold without a premium at the local market.

The value of Longtail Tuna caught during the 6 month study period is the highest proportion of the overall productivity (48% of all landings). Catches of Longtail Tuna at the FADs consisted of 80% of all Longtail Tuna caught, of which 47% was caught at FAD 2 alone. Longtail Tuna caught over the study period at FAD 2 comprises 22% of the overall value of all species landed. This is the highest landing for this species in Al Ayn Bay that fishermen can recall and is attributed to the FAD effect.



Long Tail Tuna (*Thunnus tonggol*)

Kawakawa like Longtail Tuna seem to be associating with the FADs, 77% of Kawakawa caught are caught at a FAD.



KawaKawa (*Euthynnus affinis*)

Indian Mackerel and Yellowfin Tuna both contribute to the overall productivity (12% and 9% respectively). Yellowfin tuna landings were from FAD 1 offshore that was rarely visited as it has been another poor season for Yellowfin in general and fuel costs are higher for the extra distance of travel, therefore it is not known if the offshore FAD No 1 had aggregations of yellowfin that were not exploited by fishermen.

These results show some species are associating more readily with the FADs than others. The method in which each species is fished also effects where they are caught. Yellowfin Tuna are generally only caught at the shelf edge 25km offshore. The only FAD currently in place near to the drop off is FAD1 which not used regularly by fishermen. The traditional methods of catching Yellowfin Tuna involve fishing with hand lines around pods of dolphin that are found along the edge of the shelf. Fisherman will not risk travelling to these areas when Yellowfin is not generally available and are not used to the possibility that the FAD may aggregate them to be caught.

Fishing Communities

The fishing communities of Al Ayn Bay vary in fishing effort and fishing techniques, each has a different mix of fishing vessels and gear.

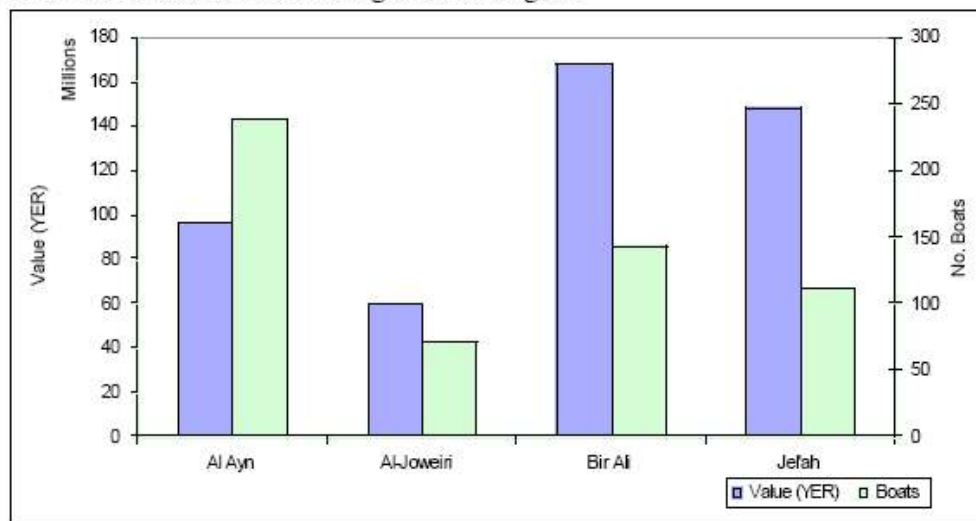


Chart 6: The Total Value (YER) of fish caught by each fishing community over a 6 month study period in relation to, total number of boats each community regularly have in use.

The fishing communities of Al Joweiri, Bir Ali and Jel'ah over the 6 month study period were all productive for the number of boats regularly in use

| Community | Value per boat study period YER | Value per boat per month YER | Value per boat per month US \$ | Value per boat per month from FADs US \$ |
|------------|---------------------------------|------------------------------|--------------------------------|--|
| Al Ayn | 404668 | 67445 | 341 | 160 |
| Al Joweiri | 842349 | 140392 | 709 | 333 |
| Jel'ah | 1330090 | 221682 | 1120 | 526 |
| Bir Ali | 1173282 | 195547 | 988 | 464 |

Table 4: Values of fish landed from FAD's by community and per boat averaged

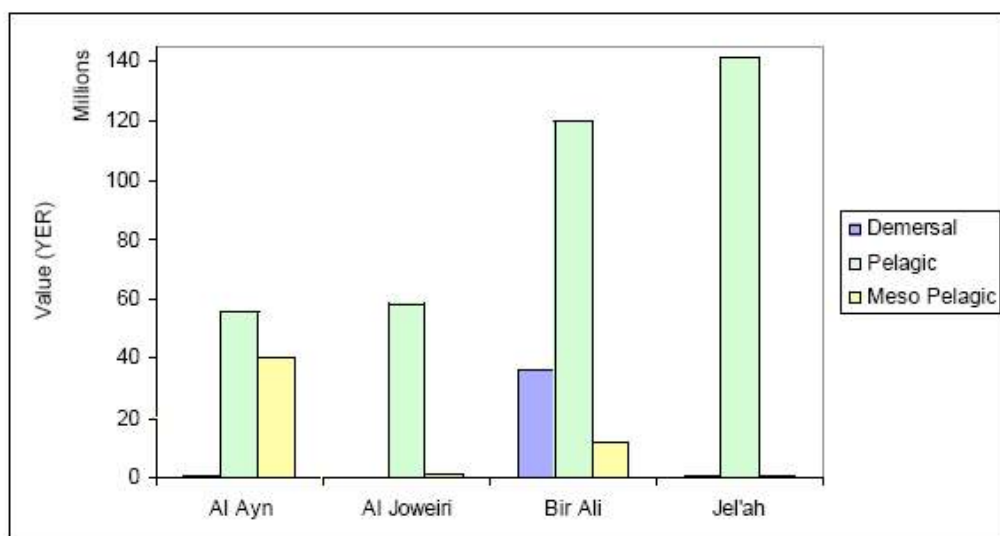


Chart 7: Total Value (YER) of catch for each habitat class landed by each of the 4 fishing communities.

The Jel'ah fishing community most regularly utilise the FADs (see *Table 1*) but also still fish in other positions i.e. 100% of mackerel still caught away from FAD positions on the bank to the west of Ras Balhaf.

Bir Ali showed the next highest productivity but fished mostly away from the FAD positions. This is due to Bir Ali's distance from the FAD positions being outside of Al Ayn Bay where the FADs have been deployed. Bir Ali fishermen landed 97% of all the Demersal fish recorded during the study period (22% of Bir Ali total productivity over the study period).

Al Joweiri landed fish almost exclusively from FAD2 and caught predominately pelagic species.

Al Ayn with the lowest productivity in relation to fishing boats available landed fish primarily from positions other than the FADs (89% of all landings during the study

period). Boats from AL Ayn use a high proportion of traps with 42% of total landings over the study period being Cuttlefish.

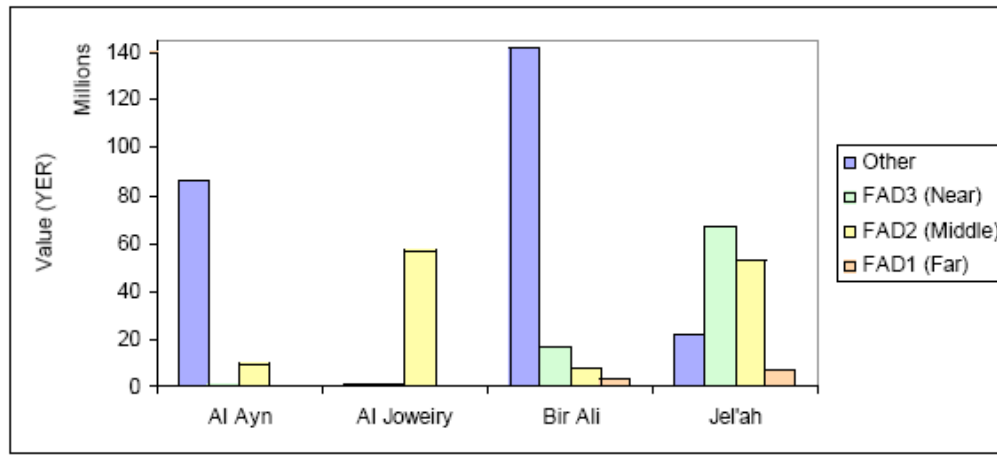
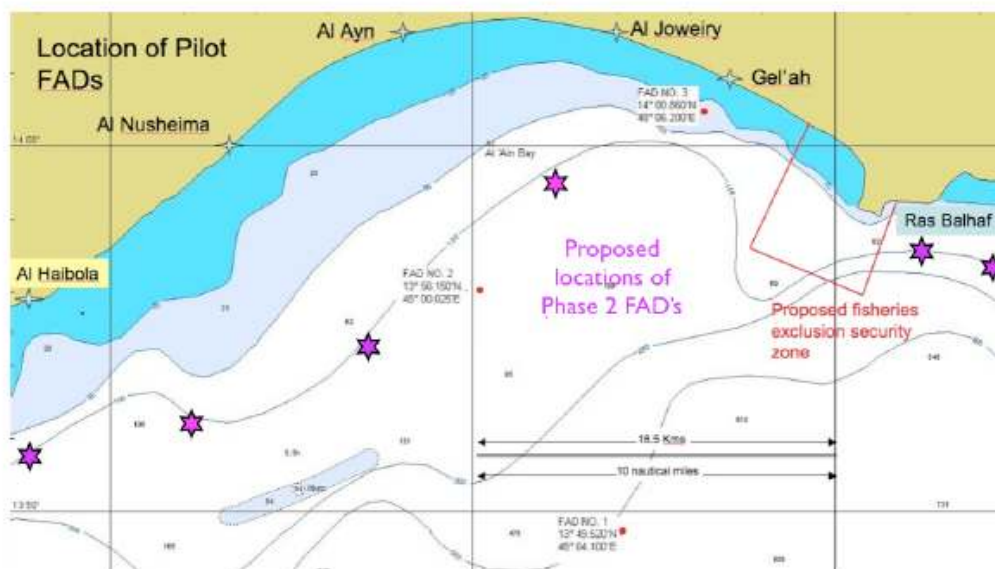


Chart 8: Value (YER) of catch for each FAD and other position landed by the 4 fishing communities.

Conclusions

1. The pilot FAD project has shown a remarkable aggregation effect particularly for Long Tail Tuna in inshore waters that made up 80% of all FAD landings and have increased sustainable income to fishermen in the pilot period.
2. The theft of the FAD mats delayed the build up of the micro environments for fish aggregation, however fish attraction rates have been high even without mats, which have now been replaced (for 1 and 2 , 3 in progress) with low cost structures not suitable for theft.
3. FAD 2 has been particularly successful in attracting longtail tuna and Mahi Mahi showing that the depth and location are most suitable.
4. Fad 1 offshore has not been fully tested due to a perceived low availability of yellowfin tuna by fishermen and an unwillingness to invest the fuel cost in travelling the distance, also this is the FAD that spent the longest in the period without a mat due to its theft early in the pilot period.
5. The pilot FAD program has successfully achieved a main objective of attracting and holding valuable pelagic species away from the planned security exclusion zone for target community fishermen to catch, as an alternative to previous activities close to Ras Balhaf.
6. Income from fish caught at FAD's is sustainable in that it is all pelagic fish, in the trials period each fishing boat using FAD's has landed an average of \$370 value of fish per month sourced from the FAD's.

7. Jel'ah fishermen have had the most value with \$ 526 per boat per month from FADs, increasing their income by 48% from the no FAD and no access to Ras Balhaf situation.
8. The pilot FAD program has not replaced income previously derived from fishing at Ras Balhaf but it has shown that a higher proportion of fishing income can be derived from sustainable fisheries for pelagics.
9. An array of 4 FAD's along the 60 metre depth contour at 5 mile centres stretching to the west in Al Ayn Bay and a further 2 FAD's to the east of Ras Balhaf for Bir Ali fishermen, as shown below, may be expected to provide increased sustainable fishing opportunities to further mitigate the loss of fishing at Ras Balhaf and within the expected security exclusion zone.
10. Consultation with fishermen, fisheries committees and cooperatives will be essential to the positioning of the phase 2 FADs to ensure community participation in the process and utilise local knowledge of sea bottom features. As part of the consultative process further discussion on community FAD management will explain options and methods for management and maintenance.



Annex 15 – CZMP Management Plan and Initial Costs



Republic of Yemen
Ministry of Water and Environment
Environment Protection Authority



COASTAL ZONE MANAGEMENT

FOR

BIR ALI – BURUM

PROJECT DEVELOPMENT BRIEF

October 2007

Environment Protection Authority (EPA)

BACKGROUND

A Coastal Zone Management Plan (CZMP) has been prepared for the two distinct coastal land and sea areas of 'Bir Ali-Burum' (Area 01) and 'Sharma-Jethmun' (Area 02), representing the main output of a EPA led CZM Preparatory Project which operated under a grant of the Global Environment Facility (GEF). The Plan aims at directing the implementation of integrated, participatory management of human development, land-and-sea use and conservation in these CZM Areas over the course of five years i.e. from 2008 to 2012. The Areas are located towards the eastern end of the northern shore of the Gulf of Aden in Hadramaut and Shabwa Provinces and are considered to be of national, regional and global significance due to their coastal landscapes and their biological diversity, high productivity and the economically important living marine resources they support.

The CZMP and its integral Zoning Plan is expected to be legally promulgated by way of a Prime Minister Decree by the end of 2007. Altogether the scope of the Plan engulfs 2,028 km² of land and sea and a total human population of approximately 35,000. The Goal for management of the Areas has been defined as:

To ensure that present and future generations have equitable access to the marine and coastal resources of the two CZM Areas by sustainably managing them, and to conserve their excellent biodiversity and landscape sites.

With the completion of the preparatory project the Environment Protection Authority (EPA), as the legally designated lead agency, is faced with the task to prepare a follow-up project which will implement the CZMP, and to find partners for its execution and financing. To this purpose EPA has successfully approached the Yemen Liquefied Natural Gas Company (YLNG), a joint venture of the French oil giant Total and a suite of national and international stakeholders. With YLNG currently constructing a major development within the envisaged CZM Area 01 (Bir Ali – Burum), it has pledged, besides its ongoing compensation and mitigation measures, to support the implementation of the CZMP in Area 01. The Area extends from west of Balhaf (14°1.32'N, 48°8.00'E) along approximately 150 km of mainland coast to north east of Burum (14°25.82'N, 49°0.86'E), and encompasses c. 1,459 km² of land and sea within both the Shabwa Governorate and Hadramaut Governorate.

EPA has decided to take advantage of this opportunity and to kick-off an inception project for Area 01 beginning early 2008, bearing with the option to expand the activities subsequently to Area 02 as additional funding opportunities arise.

COASTAL ZONE MANAGEMENT APPROACH

Coastal Zone Management is the process of planning, implementing, and monitoring beneficial uses of coastal resources through participation, collective action, and sound decision-making involving all relevant stakeholders and sectors. A *Participatory Management* approach in the context of CZM has been adopted for the present CZM Areas. Given the local and national context with its history of centralised policy-making and resource management the management framework will essentially be *Collaborative*, with community-based and governmental stakeholders exercising a shared responsibility for the management of the Areas in a balanced fashion. Guided by the goals and objectives of the Plan, the project will be consistent with the tenets of *Community-based Natural Resource Management* (CBNRM), and (1) aim to ensure long-term access to resources by regulating their exploitation in a sustainable fashion; (2) act in favour of conservation, and; (3) alleviate rural poverty by empowering coastal communities, e.g. embodied in Community-based Organisations (CBOs), to manage and develop resources for long-term social, economic and ecological benefits.

MANAGEMENT FRAMEWORK

A legal, institutional and administrative framework for the coastal zone management of the Areas will be established (Fig. 1) that integrates the various stakeholders and political factors, that is decentralised and largely community-based (collaborative). The CZM Area implementation and day-to-day operation will largely rest in the hands of the to-be-built CZM Administration (CZMA), which work will be overseen by the *Management Board*, which is equally composed of governmental and community members. A vital feature for the functioning of the system is that all concerned governmental authorities will collectively exercise their input via the Management Board, thus avoiding conflicts between the CZMA and existing lines of jurisdiction. The management framework shall put regulative resource use measures and development activities in a central position and enable conservation and environmental protection as necessary.

PROPOSED PROJECT ARRANGEMENTS

EPA would like to seek an agreement with UNDP for a trust fund arrangement for the contributions of YLNG, with UNDP acting as the main responsible party for the execution of the project according to details provided below.

UNDAF Outcome and Indicator(s): tbd

Expected Outcome(s) and Indicator(s): tbd

Expected Output(s) / Annual Targets(s): tbd

Implementing partner: EPA, MFW, UNDP, YLNG

Responsible parties: UNDP

Programme period: xxx, refers to the Country Programme period

Programme component: MYFF Goal, tbd

Project title: *Coastal Zone Management for Bir Ali-Burum*; Duration: 2 yrs (+3yrs)

Management arrangement: DEX (justification to follow)

Total budget: approx. US\$ 3,000,000 (2 yrs)

Co-funding from UNDP will need to be discussed, and co-funding options from additional sponsors will need to be explored, especially with regard to expanding the project to CZM Area 02.

TOWARDS INCEPTION

The objective of the present document is to assist the preparation of a project which will kick-off the implementation of the CZMP for Bir Ali-Burum in early 2008.

It is proposed to hire an international “Inception Advisor” which tasks would include to identify additional partners among the development community, conduct stakeholder consultations, write a Project Support Document (PSD), secure funds and prepare an inception action plan and budget.

The implementation effectively starts with the endorsement of the PSD, inception action plan and budget. Following the signature to this document a project start-up team shall be appointment as soon as possible. The inception phase (year 1) will pave the way for the subsequent implementation phase (year 2) of the project, establish basic administrative and management capacities and assist the formation of the collaborative management bodies i.e. the Management Board (MB) and Technical Management Committees (TMCs). For year 2 an implementation plan, revised sectoral action plans and budgets will be prepared, lessons-learned incorporated, and the initial management framework be evaluated and refined as necessary. The end of year 1 marks a point to evaluate the performance of the initial management team. Timed implementation targets (milestones) are indicated in Table 1.

Tab. 1: Inception and implementation milestones, indicating 20 timed targets by quarters of years, over an estimated phase of two years.

| TIME TARGET | 2007 | | 2008 | | | | 2009 | | | |
|---|------|---|------|---|---|---|------|---|---|---|
| MILESTONES | 3 | 4 | 1 | 2 | 3 | 4 | 1 | 2 | 3 | 4 |
| Year 0 | | | | | | | | | | |
| 1. CZMP endorsed among all stakeholders | | | | | | | | | | |
| 2. Implementing agencies & partners identified | | | | | | | | | | |
| 3. Funds for launch of inception phase raised | | | | | | | | | | |
| Year 1 | | | | | | | | | | |
| 4. CZM Areas legally enacted by PM Decree | | | | | | | | | | |
| 5. International Inception Advisor appointed | | | | | | | | | | |
| 6. Project document & inception plan prepared | | | | | | | | | | |
| 7. PSD signed & Project officially launched | | | | | | | | | | |
| 8. Inception team appointed & fielded | | | | | | | | | | |
| 9. The Project launched on the ground | | | | | | | | | | |
| 10. CZMA, MBs & TMCs constituted | | | | | | | | | | |
| 11. Draft Phased 5-Years Budget prepared | | | | | | | | | | |
| 12. Inception facilities & equipment in place | | | | | | | | | | |
| Year 2 | | | | | | | | | | |
| 13. Mid-term action & procurement plan prepared | | | | | | | | | | |
| 14. Funding raised till Year 3 | | | | | | | | | | |
| 15. CZMA key staff & core departments active | | | | | | | | | | |
| 16. Work flow of CZMA & MBs consolidated | | | | | | | | | | |
| 17. CZMA Headquarters in permanent premises | | | | | | | | | | |
| 18. Action & procurement plans till Year 5 | | | | | | | | | | |
| 19. Core funding for Years 3-5 secured | | | | | | | | | | |
| 20. CZM capacities commensurate with core tasks | | | | | | | | | | |

ANTICIPATED BUDGET (YEARS 1-2)

Tab. 2: Budget overview (draft), indicating planned annual expenditures in US\$

| BUDGET ITEMS | 2008 | 2009 | Sub-total |
|------------------------------|------------------|------------------|------------------|
| 100 Personnel | 533,264 | 742,085 | 1,275,348 |
| 200 (Sub)Contracts | 135,962 | 214,554 | 350,516 |
| 300 Training | 143,128 | 194,079 | 337,208 |
| 400 Infrastructure | 163,446 | 242,156 | 405,602 |
| 500 Miscellaneous (part) | 79,388 | 128,400 | 207,788 |
| Prelim. Subtotal Base | 1,055,187 | 1,521,275 | 2,576,462 |
| Contingencies @ 10% | | | 257,646 |
| Support Services @ 5% | | | 128,823 |
| TOTAL US\$ | | | 2,962,931 |

Annex 16 – Scope of Environmental and Social Consultant Verification Visits during Construction

The description of the Independent Environmental Consultant (the “Consultant”) monitoring visits below applies to the YLNG Project.

Purpose and Scope

The Consultant will provide independent monitoring to assess the implementation of the ESMP. In conducting its review and monitoring activities, the Consultant will act independently and will not represent the views of YLNG or the Senior Lenders.

The purpose and scope of the visits will be to:

- verify compliance with the ESMP, including the CCPs and Management Plans, and Applicable Lenders E&S Standards;
- follow-up on issues identified during previous monitoring visits relating to compliance with the ESMP; and
- verify the accuracy of the Project's periodic semi-annual and annual reports to Lenders.

The scope is confined to the review of the implementation of the commitments contained within the ESMP.

The scope of the verification visits excludes issues that have been resolved, the content of approved documents, communications plans and environmental and social investment. Social and resettlement aspects will also be covered by the consultant. The consultant will also be expected to provide a written summary list, and verbal briefing, to the Senior Lenders and YLNG of any social and community issues that arise during the course of its monitoring visits that require further verification or investigation.

The scope of verification excludes technical, engineering, quantitative risk assessment and design aspects, including safety engineering where these are covered by the Senior Lenders' Independent Facilities Engineer.

Monitoring Visits

The monitoring team will consist of specialist/specialists with environmental, social (including resettlement action) and auditing expertise, as well as experience in pipeline and LNG plant construction and oil and gas development projects. The Consultant will provide two or three relevant specialists for the team. YLNG will provide logistical support for the monitoring visits and a YLNG representative will coordinate the requested meetings. The Consultant representatives will work and travel as one team. The Consultant will travel in transport arranged by YLNG and will comply with YLNG health and safety standards, and any constraints arising either in advance of or during the trip as a result of weather or security advice provided by YLNG.

The monitoring schedule will include three verification visits per year (four-monthly) for the YLNG Project prior to Physical Completion and thereafter two verification visits per year (semi-annually) prior to delivery of the Operational Completion Certificate. Each visit will be approximately 1 week in duration. Four weeks prior to commencement of the trip YLNG will propose a monitoring schedule based upon construction progress and activities, logistical, security and safety constraints, as well as the topics and geography covered in the previous

monitoring visit. The Consultant will refine the schedule in discussion with YLNG. The final detailed schedule will be set three weeks prior to the commencement of the trip.

Two weeks prior to the visit the Consultant will provide a detailed monitoring checklist and protocol to YLNG. During each visit the Consultant will compile working records of meetings, site visits, interviews, data list and data requests, etc. The Consultant will provide a written list of data requests made during the visit, and of those documents and records received. As far as possible the documents should be sourced while in country so that there are no outstanding requests after the end of the visit. Where requested documents are outstanding, a list will be agreed and provided to YLNG at the end of the visit. Where possible within logistical constraints, a brief close-out meeting will be held in order to highlight findings and issues, and allow direct discussion between YLNG and the Consultant.

YLNG will collate and provide to the Consultant pre-read material to assist in the preparation of the visit, including management plans, internal monthly reports, non-compliance and incident registers, health and safety statistics, construction progress overview and complaint registers. It is expected that the majority of the documentation required by the Consultant will be provided during the monitoring visits themselves. In advance of the first monitoring visit, the Consultant will be provided with access to the ESMP, CCPs, YLNG Management Plans, Commitments Registers, ESIA and associated approved documents.

Verification visits will include a combination of activities including interviews and discussion with key personnel, review of relevant documentation and records, and on-site and field visits to inspect visually the implementation of commitments as well as reasonable periods for rest and report consolidation. YLNG project personnel will accompany the Consultant on these activities and provide coordination with the other parties involved. The Consultant shall have the right to request reasonable local variations to the schedule of visits and meeting should the need arise although subject to logistical constraints that can arise with planning at short notice.

Report

A visit verification report will be produced for the YLNG Project. Each report will assess the compliance of the Project against the commitments contained within the ESMP. The reports will be written concisely in a factual audit style and will include an executive summary, and list of non-compliance findings and recommended corrective actions.

The YLNG report will have the following contents structure:

- Glossary
- Summary
- Introduction
- Construction Status (Facilities and Pipelines contracts)
- Environmental and Social Management Overview
- CCP and Management Plan Implementation
- Health and Safety
- Resettlement Action Activities
- Community and Environmental Investment Programme
- Appendices
 - Terms of Reference
 - Documentation and Records Reviewed
 - Non-Compliances, Observations and Recommendations
 - Photographic Register

The report will clearly identify instances of non-compliances with the ESMP commitments and reference the specific commitment. The severity of the non-compliance will be indicated using the three-tiered ranking system from the ESMP (Section 4.6.4). An appendix of non-compliances will be included in the report. Project identified non-compliances can be noted in the report but the intention is to focus on any areas not already identified by the Project as requiring improvement.

The draft reports in English will be produced by the Consultant within 10 working days of the end of the visit and provided to the Senior Lenders and YLNG for comment. The Senior Lenders and YLNG will respond with comments within 10 working days. The Consultant will then have 10 working days to respond to the comments and issue the second draft of the report for comment. The Senior Lenders and YLNG will have 5 working days to comment on the second draft report. The Consultant will then respond to these comments within 5 working days and issue the final draft of the report. The Senior Lenders and YLNG will have 5 working days to comment on the final draft report. The Consultant will then have 3 working days to finalize the report for publishing.

The Consultant will translate the final executive summary into Arabic. The executive summary in English and Arabic will be made publicly available through the Senior Lenders and through posting onto the YLNG website. Paper copies will be made available upon reasonable request.

Resolving Disagreements

If as a result of the monitoring, (i) the Consultant or the Senior Lenders believe that YLNG is in material non-compliance with the ESMP, applicable Environmental Laws or Applicable Lender E&S Standards, (ii) YLNG disagrees with that finding, and (iii) the disagreement cannot be resolved within the 10 working days comment period, then the executive summary of the Consultant's report will not be publicly released until the disagreement is resolved to the satisfaction of all parties. YLNG or the Senior Lenders may request that the disagreement be resolved through international arbitration in accordance with the provisions of the Common Terms Agreement for the YLNG Project financing.

Annex 17 – Reporting Requirements to the Financing Agencies

1. Outline of Environmental and Social Semi-Annual Report (Construction)

Abbreviations

Executive Summary

1. Introduction
2. Brief Summary of Construction Progress
3. Update of Construction Phase Environmental and Social Studies and Surveys, if any
4. Management of Change
5. Update on Environmental and Social Training Activities during the period
6. Summary of Consultation and Communications Activities during the period
7. Summary of Land Acquisition and Compensation activities during the period, if any
8. ESMP Implementation
9. Update on any reportable incidents or non-compliances during the period, if any, and YLNG's response to such incident or non-compliance, as applicable
10. Summary of Internal Monitoring during the period
11. Summary of key Health and Safety statistics for the period. Topics may include:
 - a. Performance and Achievements
 - i. General
 - b. Health and Safety Incidents
 - i. Medical Treatment Cases
 - ii. Lost Time Incidences
 - iii. Fatalities
 - iv. Serious Incidents
12. Summary of Additionality Programs activities during the period
13. Update on significant changes in applicable Environmental Laws during the period, if any
14. Description of any material environmental claims against the YLNG Project during the period

2. Outline of Project Environmental and Social Monitoring Annual Report¹²

1. Abbreviations
2. Executive Summary
3. Management of Change
4. Overview of Compliance with Applicable Lender E&S Standards and Environmental Laws
 - Update on any reportable incidents or non-compliances during the period, if any, and remedial actions implemented by YLNG in response to such incident or non-compliance, as applicable
 - Summary of air emissions
 - Summary of environmental discharges
5. Update on significant changes in applicable Environmental Laws during the period, if any.
6. ESMP Implementation;

¹² Following completion of construction, the annual report will not cover items that are relevant only to construction. In addition, if matters are covered in the Operations ESMP that are not reflected in the contents for the annual report, this outline will be amended as appropriate to cover these matters.

- Summary of ESMS monitoring commitments completed during the period, including summary of results, comparison of environmental performance to Applicable Lender E&S Standards and Environmental Laws and summary of performance against KPIs
7. Summary of environmental and social training activities during the period.
 8. Summary of consultation and communications activities during the period.
 9. Overview of land acquisition and compensation activities during the period, if any.
 10. Summary of Internal Monitoring during the period.
 11. Summary of key Health and Safety statistics for the period. Topics may include:
 - a. Performance and Achievements
 - i. General
 - b. Health and Safety Incidents
 - i. Medical Treatment Cases
 - ii. Lost Time Incidences
 - iii. Fatalities
 - iv. Serious Incidents
 12. Summary of Additionality Programs activities during the period.

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