Product 7

Revised Cost-Benefit/Effectiveness Analysis

As already indicated the Adaptation to the Impacts of Climate Change on Peru's Coastal Marine Ecosystem and Fisheries applies the concept of piloting community based ecosystem management for artisanal fishermen through the introduction of "areas of exploitation" in the regulation. These areas of exploitation are well defined coastal marine zones upon which the government agrees giving the community the rights for an exclusive use of the marine natural resources and creates the incentives for the community to manage their area in a sustainable manner. To do this the government will also provide training, knowledge and accurate information as well as the implementation of tangible and very specific adaptation measures, selected from the list of good practices recommended by FAO and complementary interventions to provide alternative sources of employment and income to the fishermen community (for example eco-tourism activities). These no-regret activities will be complemented with actions to enhance the enabling environment (working with local governments in developing land use plans compatible with and reinforcing the long-term sustainability of the productivity of the coastal marine ecosystem.) Furthermore, the Project includes activities to monitor the ecosystems, their productivity and the wellbeing of the fishermen community to provide feedback to the day to day operation as well as to secure that lessons learned are identified and used by local and national government in guiding further policy development and facilitating the scaling up of similar interventions.

The cost-effectiveness argument for this integrated approach runs a two prone track. Onone hand each individual investment will be tested to produce benefits greater than the costs, while the overall program of activities is a pilot at selected sites from which the Government of Peru (GOP) could learn on the effectiveness and sustainability of empowering local communities to manage coastal marine ecosystems sustainably. Community management will be flexible tothe input from science and the information collected through the monitoring system, creatingan adaptive management environment to incorporate and cope with the impacts of climatechange.

As indicated, each single adaptation measure will be selected only if it proves to befinancially viable. Although at this time there are only preliminary cost benefit analyses forthe proposed adaptation measures, the GOP has indicated the need for each individualmeasure to demonstrate that benefits generated are greater than the costs incurred. Following are the examples of the cost benefit analysis expected by the GOP.

Component 1: Cost-benefit analysis

The project has been designed so that most of the budget is directed toward the implementation of concrete *technical solutions*. The cost-benefits analysis focuses on four main activities in the pilot areas: i) Adoption of sustainable fishing methods, including the start-up of a certification process; ii) Restoration of natural banks; iii) Development if sustainable aquaculture: and iv) Creation of eco-tourism activities. Each activity has a positive resulting VAN. The comparisonbetween the cash inflows and outflows for a period of 10 years were estimated and are listed in Annex 1, 2 3 and 4.

Intervention	VAN
Sustainable fishing practices and marine certification	*2,793,546*
Aquaculture activities	*1,916,164*
Eco-tourism Activities	*1,128,297*
Natural Banks repopulation	*1,073,604 (*)*

(*) Cost- effectiveness – Annex 4.

Revision process

The source of the data for the "Investment" section in all of the Cost-Benefit Analysis schedules is the "Presupuesto v9" worksheet. The source for the "Operations" and "Maintenance" sections in the "Sustainable Fishing and Certification..." schedule, as well as "Creation of ecotourism enterprises..." schedule is the "Calculos v5" file; the source of data for the "Development of sustainable aquaculture..." and "Restoration of natural banks..." is the "Presupuesto v9" file.

The source data was reviewed for integrity, the cost-benefit schedules were reviewed for accuracy and all additional information was completed as necessary.

In the "Sustainable Fishing and Certification" and "Ecotourism enterprises" schedules the growth of demand was factored down, thus making the cash inflows and eventually the VAN substantially smaller than previously estimated. All VANs remain positive, thus the analyzed Outputs can remain part of the project.

Component 2:

- The project proposes concrete activities for the development of fine-scale hydroclimatological information and a climate change monitoring/prediction system that will provide detailed and timely information to facilitate local decision-making regarding adaptation to climate change. This includes the participatory development and operation of a local early warning system with local communities so that their needs regarding risk and vulnerability reduction are considered, as well as their knowledge about climate variability. The alternative is the status quo, in which hydrological information is collected, analyzed, and distributed by SENAMHI where information is used to satisfy national and regional needs for analyzing and forecasting climate change. In addition, this alternative develops vulnerability and risk scenarios at coarse scales that limit the possibility of developing adaptation strategies that will respond to needs of local communities. The project will produce micro scale data that will allow climate change forecasting at local level. It is argued that the proposed outcome is more cost-effective; with the proposed investment, the existing hydroclimatological information system will be enhanced with fine-scale data that will facilitate decision making for adaptation to climate change at the local level (i.e., municipalities and local communities).

Component 3:

- Pilot interventions are proven approaches through which governments experiment complex management options, collect information and lessons learned before embarking in scaling-up (large investment) the initiative. This is a sound and effective way to explore new policy and management options without risking large volume of resources. The approach selected is therefore cost effective
- The proposed approach will integrate ecosystem-based approachand EFA approach as a guiding principle for resource management and development to address risks and vulnerability associated with climate change.In response to the need to address the precarious state of many fishery resources and the fact that conventional fisheries management frameworks – focusing on target species fish stocks – have in many instances proved ineffective, it is essential that appropriate response mechanisms are

developed to deal with the increasing vulnerability. The strengthened interconnectedness between hazards and climate change suggests that an integrated approach to address them simultaneously is needed. In this sense, the costs related to the loss of ecosystem goods and services and the subsequent need for the ecosystems' rehabilitation, will continue to be generated in the project area if the adaptation alternatives proposed herein are not duly considered.
    - EAF allows taking into account the complexity that often characterizes marine, coastal and inland aquatic ecosystems. Moreover, EAF aims at balancing the human dimensions with the natural aspects of fisheries and related ecosystems in a holistic, integrated and participatory manner, which is particularly relevant for small-scale fisheries.
    - To embark on an EAF does not mean that all existing polices have to be scrapped or that everything has to be done at once. More often than not, EAF implementation is an evolutionary process, and it allows for a step-by-step approach
- In addition, the project strategy proposes to implement measures to allow the diversification of income sources and the creation of surpluses for the vulnerable fisheries communities through the introduction of adaptive practices to allow them to better cope with future and possibly more frequent extreme climate events. This strategy will be implemented with the active participation of the most vulnerable communities (i.e. co-management), for whom the project will develop actions that strengthen their organizational capability as well as their knowledge of issues related to climate change and variability. These newly acquired skills will be fundamental for the sustainability of actions developed by the project and the replication of the most successful experiences. Through the active participation of the communities in incorporating management measures and adaptation into local environmental, and sector planning instruments, which will be done in coordination with local and regional civil authorities, adaptation to climate change will be ensured as an integral part of the local plans based on the real needs of the most vulnerable population.
- The project's learning process will provide an important foundation for the GoP to replicate and enhance interventions in other regions of the country based on the experience and results generated from the proposed project and to scale-up investments in the Pilot Areas to extend beneficiaries

Component 4:

- The proposed project will be used by the GoP as a pilot initiative that will provide expertise in addressing climate change adaptation at a local/regional level by generating and integrating relevant climate information into decision-making, strengthening capacity among diverse national and sub-national agencies to address climate change and integrating lessons learned and knowledge in the development of adaptation measures in other regions of the country.
- The project will enable an inter-sectorial and inter-government coastal marine policy, in order to facilitate the coordination of actions to avoid duplication of effort and resources invested, and more efficient planning of how to address climate change issues. EBA is a set of measures and policies that consider the role of ecosystems in reducing society's vulnerability to climate change, with a multisector and multi-scalar approach. EBA involves different actors (i.e. local and national authorities, local communities, private sector, NGOs) to achieve a more sustainable management of ecosystems with a view to adapting society. This approach presents opportunities for adaptation to ecosystems and the sustainability of adaptation to climate change.The alternative is the status quo where actions have been developed in isolation, both sectorial and government.

Annex 1

Cost-Benefit Analysis using Net Present Value Method

Sustainable Fishing & Certification

Summary

(in Nuevos Soles)

Aggregated Net Flow - Máncora & Huacho	-357,345	-1,526,515	-1,243,208	232,286	892,253	1,142,689	1,393,124	1,643,559	1,753,994	2,144,429	1,854,864
VAN	2,793,546										

Cost-Benefit Analysis using Net Present Value Method

Sustainable Fishing & Certification

Only Huacho

(in Nuevos Soles)

	Period										
Description	**0**	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**
Cash Outflows											
Investment	295,418	1,246,472	1,218,126	154,096	0	0	0	0	0	0	0
Operation Costs without Project											
Fuel		-33,522	-33,522	-33,522	-33,522	-33,522	-33,522	-33,522	-33,522	-33,522	-33,522
Change of Fishing Gear		0	0	0	0	0	0	0	0	0	-2,200,000
Sub total		-33,522	-33,522	-33,522	-33,522	-33,522	-33,522	-33,522	-33,522	-33,522	-2,233,522
Operation Costs with Project											
Fuel		-6,552	-6,552	-6,552	-6,552	-6,552	-6,552	-6,552	-6,552	-6,552	-6,552
Annual Audit for Certification		0	0	0	0	-100,000	-100,000	-100,000	-100,000	-100,000	-100,000
New Certification Process		0	0	0	0	0	0	0	0	-70,000	0
Sub total		-6,552	-6,552	-6,552	-6,552	-106,552	-106,552	-106,552	-106,552	-176,552	-106,552
Maintenance without Project											

Maintenance Fishing Gear (cerco)		-160,000	-160,000	-160,000	-160,000	-160,000	-160,000	-160,000	-160,000	-160,000	-160,000
Maintenance with Project											
Maintenance Fishing Gear (lift net)		-30,000	-30,000	-30,000	-30,000	-30,000	-30,000	-30,000	-30,000	-30,000	-30,000
Cash Inflows											
Nenefits without Project											
Income - Sales of Anchovy for Fish Meal		548,632	548,632	548,632	548,632	548,632	548,632	548,632	548,632	548,632	548,632
Benefits with project											
Income - Sales of Anchovy for Human Consumption		548,632	676,581	804,530	932,478	1,060,427	1,188,376	1,316,325	1,444,274	1,572,223	1,700,171
Net Flow	-295,418	-1,089,503	-933,208	258,771	540,816	668,765	796,714	924,663	1,052,611	1,180,560	1,308,509
Net Present Value	1,342,365										

Notes

1. Discount rate 10%	*10%*
2. Project duration - 10 years	*10*

3. Artisanal fishery is not subject to IGV or IR taxes

Cost-Benefit Analysis using Net Present Value Method
Sustainable Fishing & Certification
Only Máncora

(in Nuevos Soles)

	Period										
Description	**0**	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**
Cash Outflows											
Investment	61,927	520,991	516,465	355,436							
Operation Costs without Project											
Fuel		-1,282,883	-1,282,883	-1,282,883	-1,282,883	-1,282,883	-1,282,883	-1,282,883	-1,282,883	-1,282,883	-1,282,883
Change of Fishing Gear											540,000

Sub total		-1,282,883	-1,282,883	-1,282,883	-1,282,883	-1,282,883	-1,282,883	-1,282,883	-1,282,883	-1,282,883	-1,282,883	-742,883
Operation Costs with Project												
Fuel		-1,349,005	-1,349,005	-1,349,005	-1,349,005	-1,349,005	-1,349,005	-1,349,005	-1,349,005	-1,349,005	-1,349,005	-1,349,005
Annual Audit for Certification					-100,000	-100,000	-100,000	-100,000	-100,000	-100,000	-100,000	-100,000
New Certfication Process									-140,000			
Sub total		-1,349,005	-1,349,005	-1,349,005	-1,449,005	-1,449,005	-1,449,005	-1,449,005	-1,589,005	-1,449,005	-1,449,005	
Maintenance without Project												
Maintenance Fishing Gear (cortina, cerco)		-204,100	-204,100	-204,100	-204,100	-204,100	-204,100	-204,100	-204,100	-204,100	-204,100	-204,100
Maintenance with Project												
Maintenance Fishing Gear (espinel, pinta)		-54,000	-54,000	-54,000	-54,000	-54,000	-54,000	-54,000	-54,000	-54,000	-54,000	-54,000
Cash Inflows												
Benefits without Project												
Income: Local Sales of Fresh Yellow-Fin Tuna		1,901,001	1,901,001	1,901,001	1,901,001	1,901,001	1,901,001	1,901,001	1,901,001	1,901,001	1,901,001	1,901,001
Benefits with Project												
Income: Export Sales of Fresh Yellow-Fin Tuna		1,901,001	2,023,488	2,145,974	2,268,460	2,390,947	2,513,433	2,635,919	2,758,405	2,880,892	3,003,378	
Net Flow	-61,927	-437,012	-310,000	-26,484	351,437	473,924	596,410	718,896	701,382	963,869	546,355	
VAN	1,451,181											

Notes

1. Discount rate 10%	*10%*
2. Project duration - 10 years	*10*

3. Artisanal fishery is not subject to IGV or IR taxes

Annex 2

Cost-Benefit Analysis using Net Present Value Method

Sustainable aquaculture

(in Nuevos Soles)

Description	**Period**										
	0	1	2	3	4	5	6	7	8	9	10
Cash outflows											
Investment costs	186,320	372,640	372,640	0	0	0	0	0	0	0	0
Operation & maintenance costs		218,506	437,012	437,012	437,012	437,012	977,012	437,012	437,012	437,012	437,012
Sub total		591,146	809,652	437,012	437,012	437,012	977,012	437,012	437,012	437,012	437,012
Cash inflows											
Income		525,000	525,000	1,050,000	1,050,000	1,050,000	1,050,000	1,050,000	1,050,000	1,050,000	1,050,000
Net flow		-66,146	-284,652	612,988	612,988	612,988	72,988	612,988	612,988	612,988	612,988
Net Present Value (NPV)	1,916,164										

Notas

1. Discount rate 10%
2. Project duration - 10 years
3. Period for replacement of lines - 5 years
4. Years 1 and have only one harvest
5. Years 3 - 10 have two harvests
5. Artisanal fishery is not subject to IGV or IR taxes

Annex 3

Cost-Benefit Analysis using Net Present Value Method

Ecotourism enterprises

Only Máncora

(in Nuevos Soles)

	Period										
Description	**0**	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**
Cash Outflows											
Investment	449,265	1,150,848	61,078	61,078	0	0	0	0	0	0	0
Operation costs		61,928	61,928	61,928	61,928	61,928	61,928	61,928	61,928	61,928	61,928
Maintenance costs		16,200	16,200	16,200	16,200	16,200	16,200	16,200	16,200	16,200	16,200
Sub total		1,228,976	139,206	139,206	78,128	78,128	78,128	78,128	78,128	78,128	78,128
Cash Inflows											
Growth of demand		0.20	0.40	0.60	0.80	1.00	1.00	1.00	1.00	1.00	1.00
Income		142,730	285,460	428,189	570,919	713,649	713,649	713,649	713,649	713,649	713,649
Net flow		-1,086,246	146,254	288,984	492,791	635,521	635,521	635,521	635,521	635,521	635,521
Net Present Value (NPV)	1,128,297										

Notes

1. Discount rate 10% *10%*

2. Project duration - 10 years *10*

3. Artisanal fishery is not subject to IGV or IR taxes

Annex 4

Cost-Benefit Analysis using Net Present Value Method

Natural Banks Restoration

(in Nuevos Soles)

	Period										
Description	0	1	2	3	4	5	6	7	8	9	10
Cash outflows											
Investment	216,600	201,600	191,200	191,200	0	0	0	0	0	0	0
Operation & maintenance costs		117,375	117,375	117,375	117,375	0	0	0	0	0	0
Sub total		318,975	308,575	308,575	117,375	0	0	0	0	0	0
Cash inflows											
Income		0	0	0	0	0	0	0	0	0	0
Net flow		-318,975	-308,575	-308,575	-117,375	0	0	0	0	0	0
Net Present Value (NPV)	-1,073,604										

Notes

1. Discount rate 10% *10%*

2. Project duration - 10 years *4*

3. Artisanal fishery is not subject to IGV or IR taxes

Repopulation	480,000	
Losses	0.2	
Effective / net repopulation	384,000	
Density	38.4	ind/m2

VAN	1,073,604
Effectiveness Index (EI)	38.4
Effectivenes Cost (EC)	27,958.4