A Review of the Ecuador Mahi Mahi Fishery Improvement Project

Manta, Ecuador

March 26-27, 2014

Prepared for

WWF-US

WWF

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Contents

1 BACKGROUND

1.1 HISTORICAL OVERVIEW

In September 2007, Ecuador's Subsecretary of Fishing Resources (SRP), World Wildlife Fund (WWF), Marine Stewardship Council (MSC), CeDePesca, and Sustainable Fisheries Fund convened a workshop in Manta, Ecuador to initiate discussions with the governments and industry of Ecuador and Peru on sustainability of mahi mahi. The workshop produced a series of science and management recommendations for future improvements in the fishery. Subsequently, the MSC initiated a pilot program, the Guidance for Assessment of Small Scale and Data Deficient fisheries (GASS-DD), that included the Ecuador and Peru mahi mahi fishery. A certification body conducted the assessment and a report describing the GASS-DD assessment was completed in November 2008. After completion of several GASS-DD reports, the MSC revised the GASS-DD to a new assessment procedure known as the risk-based framework (RBF). The MSC determined that the Ecuador-Peru GASS-DD report was insufficient, and in conjunction with WWF initiated a re-assessment using the RBF. Another certifier facilitated a July 2009 workshop in Manta to review the Ecuador portion of the GASS-DD report with government, industry, and NGOs and to conduct a Scale-Intensity-Consequence Analysis (SICA) using the MSC RBF. Following the July workshop, and based on a draft RBF assessment, the certification body prepared a scoping document that described the performance indicators that were likely to fail (score <60) or pass with conditions (score $\geq$60 but <80), and presented these results at a FIP workshop in Manta in October 2009. At the October meeting, participants developed a set of recommended action steps and a preliminary timeline to make necessary improvements in the fishery. This provided an opportunity for all stakeholders to contribute what they perceived as the main threats to the fishery and what action needs to be taken. The Ecuador mahi mahi fishery improvement project (FIP) Action Plan was completed in January 2010 and used as the basis to develop a series of project proposals to address key aspects in the Plan. This work is ongoing. The Final RBF Assessment Report was completed in January 2010. FIP review meetings for the Ecuador mahi mahi fishery to assess the progress of the FIP against the MSC standard occurred in March of 2012, 2013, and 2014. This report summarizes the results of the 2014 FIP meeting.

1.2 AIMS AND OBJECTIVES

A FIP review meeting was held at the Manta Host Hotel on 26 and 27 March 2014 to review the FIP Action Plan. The aims of this meeting were two-fold:

- Present the results of a range of studies initiated from or related to the Action Plan; and
- Critically review and update the FIP Action Plan.

A list of participants and an outline of the meeting agenda, which includes the presentations during the meeting are given in Appendix 1 and 2, respectively.

1.3 THE STANDARD: MARINE STEWARDSHIP COUNCIL (MSC)

The MSC is an independent, global, non-profit organization. It works to enhance responsible management of seafood resources, to ensure the sustainability of global fish

stocks and the health of the marine ecosystem. It is supported by a broad coalition of those with a stake in the future of the global seafood supply. The MSC harnesses consumer power by identifying sustainable seafood products through an eco-label. Further details of the MSC can be found at the MSC website www.msc.org.

1.4 UNIT OF CERTIFICATION

In order to assess a fishery against the MSC Standard, the unit of certification must be clearly defined. This includes information on the exact species, geographic area, methods of capture, stock structure and distribution, management system in place and client group (see box below). This definition is also necessary to enable the traceability of MSC related products (i.e., mahi mahi) to be audited as part of the MSC chain of custody.

Species	*Coryphaena.hippurus*
Geographical Area	Pacific Ocean
Method of Capture	Surface Longline
Stock	Proposed as a southern Eastern Pacific Ocean (EPO) stock, currently undergoing evaluation and analysis to determine suitability as a separate stock.
Management System	Ministry of Agriculture, Livestock, Aquaculture and Fisheries (Vice Ministerio de Acuacultura y Pesca – VMAP y Subsecretaría de Recursos Pesqueros – SRP) Inter-American Tropical Tuna Commission (IATTC)
Client Group	To be determined

Mahi mahi is a highly migratory species and genetic analyses to date show no separate populations or subpopulations in the Pacific, so the mahi mahi is considered as a single population. However, as described in Section 2.1, the FIP process has developed a working hypothesis of a unit stock for management purposes consisting of the southern EPO regions fished primarily by the fishermen from Ecuador and Peru.

1.5 MSC PRE-ASSESSMENT: A BASELINE

To review progress made towards a set goal (i.e., MSC Standard), it is important to establish a baseline from which to compare subsequent results. An MSC RBF assessment was conducted in 2009 and provides an indication of the likely scores expected at that time for a range of performance indicators. These are presented in the table below for each Principle. The fishery was deemed not to pass an MSC assessment in 2009. The FIP Review Workshop used these results to monitor progress towards the MSC Standard.

It is important to note here that these results are based on the views and opinions of an independent consultant and not that of WWF or an MSC assessment team. The results may therefore differ in an actual scoring of the fishery.

Within the FIP Action Plan, a high priority refers to a potential MSC score below scoring guidepost 60 (i.e., outright fail), medium priority between SG60 and SG80 (i.e. pass with conditions) and low priority above SG80 (i.e. pass).

Since the average score for each MSC Principle must equal or exceed 80, it is highly recommended that all efforts be made to progress the fishery towards the highest MSC scores obtainable to minimise the risk of failing. **Fisheries with an average score at 80 or just above 80 for a Principle are more likely to experience an objection than fisheries with scores substantially higher than 80 (MSC personal communication).** Therefore, FIP action plans should strive for scores as high as practicable.

Table 1: Summary of 2009 RBF assessment of the Ecuador mahi mahi fishery showing level of priority for each of the 31 MSC Performance Indicators within three major Principles. High priority refers to a potential MSC score below Scoring Guidepost 60 (fail), medium priority between SG60 and SG80 (pass with conditions) and low priority above SG80 (pass).

Component	PI No.	Performance Indicator Category	Priority	Timeframe	Linkages
Principle 1: Sustainability of exploited stocks					
Outcome	1.1.1	Stock Status	**High**	Medium/Long	1.1.2; 1.2.1; 1.2.4
	1.1.2	Reference Points	**High**	Medium	1.1.1; 1.2.1; 1.2.4
	1.1.3	Stock Rebuilding	**-**	-	1.1.1; 1.1.2; 1.2.1; 1.2.4
Management	1.2.1	Harvest Strategy	**High**	Medium	1.1.1; 1.1.2; 1.2.2; 1.2.4
	1.2.2	Harvest Control Rules and Tools	**High**	Medium	1.1.1; 1.1.2; 1.2.1; 1.2.3; 1.2.4; 3.1.1; 3.2.3
	1.2.3	Information and monitoring	**Medium**	Medium	1.1.2; 1.2.1; 1.2.2; 1.2.4
	1.2.4	Assessment of Stock Status	**High**	Medium	1.1.1; 1.1.2; 1.2.2; 1.2.3
Principle 2: The impact of the fishery on the marine environment					
Retained Species	2.1.1	Status	**Low**	-	2.1.2; 2.1.3
	2.1.2	Management Strategy	**Low**	-	2.1.1; 2.1.3
	2.1.3	Information and Monitoring	**Low**	-	2.1.2; 3.1.1
Bycatch	2.2.1	Status	**Low**	-	2.2.2; 2.2.3
	2.2.2	Management strategy	**Low**	-	2.2.1; 2.2.3
	2.2.3	Information and Monitoring	**Medium**	Medium	2.2.2; 3.1.1
ETP species	2.3.1	Status	**Medium**	Medium	2.3.2; 2.3.3
	2.3.2	Management Strategy	**Medium**	Medium	2.3.1; 2.3.3
	2.3.3	Information and Monitoring	**Medium**	Medium	2.3.2; 3.1.1
Habitat	2.4.1	Status	**Low**	-	2.4.2; 2.4.3; 3.2.5
	2.4.2	Management Strategy	**Low**	-	2.4.1; 2.4.3; 3.1.1; 3.2.3
	2.4.3	Information and Monitoring	**Low**	-	2.4.1; 2.4.2; 2.5.1; 3.1.1
Ecosystem	2.5.1	Status	**Low**	-	2.5.2; 2.5.3; 3.2.5
	2.5.2	Management Strategy	**Medium**	Medium	2.5.1; 2.5.3; 3.1.1; 3.2.3
	2.5.3	Information and Monitoring	**Medium**	Medium	2.5.1; 2.5.2; 3.1.1
Principle 3: The fishery management system					

Component	PI No.	Performance Indicator Category	Priority	Timeframe	Linkages
Governance and Policy	3.1.1	Legal/Customary Framework	National - **Low**	-	1.2.2; 2.1.3; 2.2.3; 2.3.3; 2.4.2; 2.4.3; 2.5.2; 2.5.3
			International - **High**	Medium-long	
	3.1.2	Consultation, Roles and Responsibilities	National - **Low**	-	3.2.2
			International - **High**	Medium-long	
	3.1.3	Long Term Objectives	National - **Low**	-	2.4.2; 3.2.4
			International - **High**	Medium-long	
	3.1.4	Incentives for Sustainable Fishing	**Low**	-	3.2.5
Fishery Specific Management System	3.2.1	Fishery Specific Objectives	**Medium**	Short	3.1.3; 3.2.4; 3.2.5
	3.2.2	Decision Making Processes	**High**	Medium	3.1.2
	3.2.3	Compliance and Enforcement	**High**	Medium	1.2.2; 3.1.1; 3.1.2; 3.2.1
	3.2.4	Research Plan	**High**	Medium	3.1.3; 3.2.1
	3.2.5	Management Performance Evaluation	**Medium**	Medium	1.1.1; 2.1.1; 2.2.1; 2.3.1; 2.4.1; 2.5.1; 3.1.4; 3.2.1

1.6 FIP ACTION PLAN

The original FIP Action Plan was finalised in January 2010 and identified a range of tasks within six major categories that would promote sustainable utilisation of the resource and improve fisheries management. In turn this would help to elevate the scores of certain high priority performance indicators within an MSC assessment. The six major categories include:

(i) Definition of the Stock
(ii) Stock Status and Abundance Indices
(iii) Monitoring and Evaluation
(iv) Turtle Bycatch Reduction
(v) Education and Outreach
(vi) Management and Governance

Due to time constraints and other limitations, the FIP Action Plan did not include detailed terms of reference or potential sources of funding for each task. These were to be identified and developed at a later date.

The performance indicators identified as likely to fail were associated with Principle 1 and Principle 3 (see
During 2013 and 2014 FIP meetings, the focus changed from providing basic biological and management information to addressing stock status and stock assessment, and to addressing actions for international management. The work conducted by Ecuador and its partners in the FIP has resulted in completing many of the original tasks set for the

FIP. But the recent FIP process resulted in the addition of several new tasks to complete stock status/stock assessment and concomitant harvest strategies, and international management.

To maintain a historical record, the original tasks are maintained in the original order, and new tasks added at the end. The revised matrix with updated tasks for the FIP is provided in Table 2B.

Table **2**A). The P1 indicators were stock status (PI 1.1.1), reference points (PI 1.1.2), Harvest Strategy (1.2.1), Harvest Control Rules and Tools (PI 1.2.2), and stock assessment (PI 1.2.4). The harvest strategy and the harvest control rule are contingent on improvements in other performance indicators so were designated as Phase 2, recognizing that actions could not occur in the near term. The P3 indicators were PI 3.1.1 (Legal and Customary Framework for the international management of the transboundary stock), PI 3.1.2 (Consultations, Roles, and Responsibilities for the international management of the transboundary stock), PI3.1.3 (Long Term Objectives for the international management of the transboundary stock), PI3.2.2 (Decision Making Process), and PI3.2.4 (Strategic Research Plan). Without further improvements, the fishery was expected to fail an MSC assessment on these key topics.

During 2013 and 2014 FIP meetings, the focus changed from providing basic biological and management information to addressing stock status and stock assessment, and to addressing actions for international management. The work conducted by Ecuador and its partners in the FIP has resulted in completing many of the original tasks set for the FIP. But the recent FIP process resulted in the addition of several new tasks to complete stock status/stock assessment and concomitant harvest strategies, and international management.

To maintain a historical record, the original tasks are maintained in the original order, and new tasks added at the end. The revised matrix with updated tasks for the FIP is provided in Table 2B.

Table 2A: Original outline of 2010 FIP Action Plan for the Ecuador mahi mahi fishery, where M = Medium priority; H = High priority.

Links to MSC Performance Indicators — P1. Stock Status: 1.1.1 Stock Status; 1.1.2 Reference Points; 1.2.1 Harvest Strategy; 1.2.2 Harvest Control Rules and Tools; 1.2.3 Information and monitoring; 1.2.4 Assessment of Stock Status. P2. Environmental impacts: 2.2.2 Bycatch Information and Monitoring; 2.3.1 ETP Status; 2.3.2 ETP Management Strategy; 2.3.3 ETP Information and Monitoring; 2.5.2 Ecosystem Management Strategy; 2.5.3 Ecosystem Information and Monitoring. P3. Management: 3.1.1 Legal/Customary Framework; 3.1.2 Consultation, Roles and Responsibilities; 3.1.3 Long Term Objectives; 3.2.1 Fishery Specific Objectives; 3.2.2 Decision Making Processes; 3.2.3 Compliance and Enforcement; 3.2.4 Research Plan; 3.2.5 Management Performance Evaluation.

Note: H = high priority and M = Medium priority according to scoping document

TASK	ROLE	TIMEFRAME	Ongoing	Additional 'NEW' work	1.1.1	1.1.2	1.2.1	1.2.2	1.2.3	1.2.4	2.2.2	2.3.1	2.3.2	2.3.3	2.5.2	2.5.3	3.1.1	3.1.2	3.1.3	3.2.1	3.2.2	3.2.3	3.2.4	3.2.5
1. Definition of the stock																								
1.1 Genetic analysis	SRP	12 months+	✓						M															
1.2 Parasite analysis	INP - SRP	12 months+	✓						M															
1.3 Otolith micro-elemental analysis	INP (otolith collection), SRP	12 months+		✓					M															
1.4 Training national technicians	INP - SRP	12 months+		✓					M															
1.5 National mahi workshop (genetics, stock assessment & status, biological characteristics and monitoring)	INP – SRP – WWF	< 12 months		✓	H	H			M															
1.6 International mahi workshop (genetics, stock assessment & status, biological characteristics and monitoring)	INP – SRP – WWF - CPPS	12 months+		✓	H	H			M															
2. Stock status and abundance indices																								
2.1 VPA assessment	INP - SRP	12 months+	✓		H	H				H														
2.2 Develop CPUE series (index of abundance) / status of resource	INP - SRP	12 months+	✓		H	H	Phase 2	Phase 2		H														
2.3 Length-based assessment	SRP - INP	12 months+	✓		H	H	Phase 2	Phase 2		H														
2.4 Egg size assessment	SRP	12 months+	✓		H	H	Phase 2	Phase 2		H														
2.5 Literature review on mahi assessment and management	INP – SRP – Cooperatives/Asoexpebla	< 6 months	✓		H	H			M	H														
3. Monitoring and evaluation																								
3.1 Characterisation of Ecuadorian artisanal Mahi mahi fishery	SRP - INP	< 12 months	✓						M															
3.2 National workshop for observer coordination	SRP - INP	< 12 months		✓							M		M											
3.3 Design mahi observer program	INP - SRP	12 months+		✓							M	M		M										
3.4 Literature review of pelagic ecosystems	INP - Universities - NGOs	< 12 months		✓												M								
3.5 Review ecosystem/ trophic models	INP - SRP - Universities	12 months+		✓											M	M								
4. Turtle bycatch reduction																								
4.1 Determine bycatch levels for fibras fishing with nets (Santa Rosa)	INP - CI	12 months+	✓								M		M											
4.2 Implement and confirm turtle handling procedures	SRP – WWF – ASOEXPEBLA – EPESPO – OFCF - FENACOPEC	12 months+		✓									M											
4.3 Conversion of longline fishery to circle hooks	SRP – OFCF – ASOEXPEBLA – FENACOPEC – WWF – EPESPO	12 months+	✓									M	M	M										
4.4 Eliminate tariffs on circle hooks	SRP - CAE (Ecuadorian Customs)	12 months+		✓								M	M	M										
4.5 Manufacture circle hooks at national level	SRP - Metal industry	12 months+		✓								M	M	M										
4.6 Project 'T' to prevent entanglement of turtles	SRP – OFCF – WWF – ASOEXPEBLA - FENACOPEC	12 months+		✓								M	M	M										
4.7 Long-term monitoring of turtle interactions	WWF - EPESPO - SRP - ASOEXPEBLA - FENACOPEC	12 months+	✓									M		M										
4.8 OFCF research cruise(s)	OFCF – SRP – FENACOPEC – ASOEXPEBLA – WWF	12 months+		✓								M	M	M										
5. Education and outreach																								
5.1 Develop a communications strategy	SRP	< 6 months		✓																		H		
5.2 Program to educate fishermen on resource state, changes in fishery etc	SRP – INP – NGOs (WWF) – Fishing sector (FENACOPEC) – ASOEXPEBLA	< 12 months		✓					M													H		
5.3 Program to educate fishermen to reduce bycatch (training for fishermen)	SRP – INP – NGOs (WWF) – Fishing sector (FENACOPEC) – ASOEXPEBLA	< 12 months		✓							M											H		
5.4 Incorporate new education and outreach initiatives into existing compulsory programs	SRP - INP - Fishing Sector - Ecuadorian Navy	< 12 months		✓														H				H		
6. Management & governance																								
6.1 Develop strategic research plan for mahi	INP - SRP - Universities - Fishing sector	< 6 months		✓																			H	
6.2 Evaluate options to develop international agreement on shared stocks	Min. RREE - SRP - INP	< 6 months	✓	✓														H	H					
6.3 Describe decision-making processes	SRP – INP – Fishing sector (FENACOPEC)	< 6 months		✓																	H			
6.4 Improve co-ordination between monitoring and enforcement	SRP – INP – Fishing sector (FENACOPEC) – Ecuadorian Navy - EPESPO	12 months+		✓																		H		
6.5 Identify new schemes for co-management	SRP – INP – Fishing sector (FENACOPEC) – Ecuadorian Navy	< 12 months		✓																		H		
6.6 Develop and implement Code of Responsible Fishing	SRP - FENACOPEC (Ecuadorian Fishers Union)	< 12 months		✓																		H		
6.7 Revise internal and external review of the management systems	SRP - INP - NGOs	< 12 months		✓																				M
6.8 Develop timelines, budget and indicators in the mahi action plan	SRP – INP – FENACOPEC – NGOs - ASOEXPEBLA	< 12 months		✓																	H	M	M	M
6.9 Incorporate an ecosystem mgt. strategy into mahi national plan	SRP - INP	12 months+		✓											M									M
6.10 Establish National Plan of Action for mahi.	SRP – INP – FENACOPEC – ASOEXPEBLA – NGOs	12 Months+		✓					M				M		M		H	H	H	M	H	H	M	M

Table 2B: Revised outline of 2014 FIP Action Plan for the Ecuador mahi mahi fishery, where M = Medium priority; H = High priority.[1]

TASK	ROLE	ORIGINAL TIMEFRAME	STATUS/ NEW TIMEFRAME	Ongoing	Additional 'NEW' work	1.1.1 Stock Status	1.1.2 Reference Points	1.2.1 Harvest Strategy	1.2.2 Harvest Control Rules and Tools	1.2.3 Information and monitoring	1.2.4 Assessment of Stock Status	2.2 Bycatch Information and Monitoring	2.3.1 EtP Status	2.3.2 EtP Management Strategy	2.3.3 EtP Information and Monitoring	2.5.2 Ecosystem Management Strategy	2.5.3 Ecosystem Information and Monitoring	3.1.1 Legal/Customary Framework	3.1.2 Consultation, Roles and Responsibilities	3.1.3 Long Term Objectives	3.2.1 Fishery Specific Objectives	3.2.2 Decision Making Processes	3.2.3 Compliance and Enforcement	3.2.4 Research Plan	3.2.5 Management Performance Evaluation
1. Definition of the stock			Note: H = high priority, M = Med priority, & L=Low priority from scoping document																						
1.1 Genetic analysis	SRP	12 months+	COMPLETE	✓																					
1.2 Parasite analysis (REMOVED due to low likelihood of success)	INP - SRP	12 months+	None-REMOVED																						
1.3 Otolith micro-elemental analysis	INP (otolith collection), SRP	12 months+	Reconsider Oct 14							M															
1.4 Training national technicians	INP - SRP	12 months+	COMPLETE	✓																					
1.5 National mahi workshop (genetics, stock assessment & status, biological characteristics and monitoring)	INP - SRP – WWF	< 12 months	COMPLETE		✓																					
1.6 International mahi workshop (genetics, stock assessment & status, biological characteristics and monitoring)	INP - SRP – WWF - CPPS	12 months+	14-Oct	✓	✓	H	H			M															
1.7 Define Practical stock unit	INP – SRP – WWF –IATTC	New Task	2014	✓		H	H			H	H														
1.8 Bilateral technical workshop with Peru	SRP - IATTC	New Task	14-Aug	✓	✓	H	H			H	H							H	H	H		H	H		H
2. Stock status and abundance indices																									
2.1 VPA assessment	INP - SRP	12 months+	Inactive/Long-term	✓																					
2.2 Develop CPUE series (index of abundance) / status of resource	INP - SRP	12 months+	COMPLETE	✓																					
2.3 Length-based assessment	SRP - INP	12 months+	Removed	✓																					
2.4 Egg size assessment (REMOVED- not useful to determine stock status)	SRP	12 months+	None-REMOVED																						
2.5 Literature review on mahi assessment and management	INP – SRP – Cooperatives/Asoexpebla- ULEAM	< 6 months	Nov-14	✓		H	H			M	H														
2.6 Ageing	INP - SRP - CICIMAR	New Task	Jun-14	✓		M	M				M														
2.7 5-95 percentile	IATTC – SRP	New Task	Jul-17	✓							H														
2.8 Link 5-95 to Bmsy	IATTC – SRP	New Task	Jul-17	✓		H	H	H	H		H														
3. Monitoring and evaluation																									
3.1 Characterisation of Ecuadorian artisanal Mahi mahi fishery	SRP - INP	< 12 months	COMPLETE	✓																					
3.2 Development and training for observers	SRP - INP	< 12 months	COMPLETE	✓																					
3.3 Design mahi observer program	INP - SRP - Stakeholders	12 months+	14-Dec	✓							M		M		M										
3.4 Literature review of pelagic ecosystems	IATTC - SRP - NGOs	< 12 months	Nov-15	✓												M									
3.5 Review ecosystem/ trophic models (REMOVED but Monitored in the long-term)	INP - SRP - Universities	12 months+	Inactive/Long-term																						
4. Turtle bycatch reduction																									
4.1 Determine bycatch levels for fibras fishing with nets (Santa Rosa) (REMOVED)	INP - CI	12 months+	COMPLETE																						
4.2 Implement and confirm turtle handling procedures	SRP –WWF – ASOEXPEBLA – EPESPO – OFCF - Artisanal Sector	12 months+	IMPLEMENTED	✓																					
4.3 Conversion of longline fishery to circle hooks	SRP – OFCF – ASOEXPEBLA – Artisanal Sector – WWF – CI – EPESPO	12 months+	Partially COMPLETE	✓								M	M	M										
4.4 Eliminate tariffs on circle hooks	SRP - COMEXI	12 months+	COMPLETE	✓																					
4.5 Manufacture circle hooks at national level (REMOVED due to high manufacturing cost)	SRP - Metal industry	12 months+	None-REMOVED																						
4.6 Project 'T' to prevent entanglement of turtles	SRP – OFCF – WWF – ASOEXPEBLA - Artisanal Sector	12 months+	Jun-16	✓								M	M	M										
4.7 Long-term monitoring of turtle interactions	WWF - EPESPO - SRP - ASOEXPEBLA - Artisanal Sector	12 months+	14-Dec	✓								M		M										
4.8 OFCF research cruise(s)	OFCF – SRP – FENACOPEC – ASOEXPEBLA – WWF	12 months+	COMPLETE	✓																					
5. Education and outreach																									
5.1 Develop a communications strategy	SRP	< 6 months	Complete	✓																					
5.2 Program to educate fishermen on resource state, changes in fishery etc	SRP – INP – NGOs (WWF) –Artisanal Sector, CNP Esmeraldas – ASOEXPEBLA	< 12 months	Complete	✓																					
5.3 Program to educate fishermen to reduce bycatch (training for fishermen)	SRP – INP – NGOs (WWF) –Artisanal Sector, CNP Esmeraldas – ASOEXPEBLA	< 12 months	Complete	✓																					
5.4 Incorporate new education and outreach initiatives into existing compulsory programs	SRP - INP - Fishing Sector - Ecuadorian Navy - WWF - EPESPO	< 12 months	Complete	✓																					
6. Management & governance																									
6.1 Develop strategic research plan for mahi	INP - SRP - Artisanal Sector	< 6 months	Update in PAN-Dorado	✓	✓																			M	
6.2 Evaluate options to develop international agreement on shared stocks	Min. RREE - SRP - INP	12 months+	Complete	✓																					
6.3 Decribe decision-making processes	SRP – INP – Artisanal Sector	< 6 months	Jun-14	✓																	M			
6.4 Improve co-ordination between monitoring and enforcement	SRP – INP – Artisanal Sector – Ecuadorian Navy - EPESPO	12 months+	Complete	✓																					
6.5 Identify new schemes for co-management	SRP – INP – Artisanal Sector – Ecuadorian Navy	< 12 months	Combined with 6.3																						
6.6 Develop and implement Code of Responsible Fishing	SRP - Artisanal Sector	< 12 months	Complete																						
6.7 Revise internal and external review of the management systems	SRP - INP - NGOs (WWF, CI)	< 12 months	Complete		✓																				
6.8 Develop timelines, budget and indicators in the mahi action plan	SRP – INP – FENACOPEC - NGOs - ASOEXPEBLA	< 12 months	Complete		✓																				
6.9 Incorporate an ecosystem mgt. strategy into mahi national plan	SRP – INP	12 months+	Update in PAN-Dorado		✓													M						M	
6.10 Establish National Plan of Action for mahi.	SRP – INP – FENACOPEC – ASOEXPEBLA – NGOs	12 months+	Complete	✓																					
6.11 International Management Agreement	SRP – INP – NGOs (WWF CI) – MRAG	12 Months+	New	✓	✓													H	H	H	H	H	H	H	H

[1] All activities for a performance indicator generally have the same priority. However, the aging task is a lower priority pending development of data for age models

The initial assessment used RBF to evaluate and score two performance indicators, stock status and ecosystem status (Table 3). Because both elements of the MSC risk-based framework (RBF) for indicator 1.1.1 scored less than 80, the RBF is not a good long term option. Unless both elements of RBF score $\geq$80, recertification must use the traditional assessment. Therefore, it makes sense to plan for a traditional assessment from the start.

While the RBF for indicator 2.5.1 scored an 80, it seemed that the work required to bring 2.5.2 (ecosystem management) and 2.5.3 (ecosystem information) to scores $\geq$80 could also allow analysis to supplant the RBF and provide for a passing score for ecosystem status.

Table 3: Overview of RBF applicability to Performance Indicators for Principles 1 and 2. PIs for which the RBF may directly be used are indicated in bold. PIs for which special guidance applies when the RBF is used for related PIs are indicated in *italics* (source: FAM ver2.1).

Performance Indicator	RBF applicability
1.1.1 Stock status	**Both SICA and PSA applicable**
1.1.2 Reference points	*If RBF is used for 1.1.1 default score of 80 shall be given to this PI*
1.1.3 Stock rebuilding	*Do not score if RBF is used for 1.1.1*
1.2.1 Harvest strategy	RBF not applicable
1.2.2 Harvest control tools and rules	RBF not applicable
1.2.3 Information/monitoring	RBF not applicable
1.2.4 Assessment of stock status	*If RBF is used for 1.1.1 default score of 80 shall be given to this PI*
2.5.1 Ecosystem outcome	**SICA only, no PSA available**
2.5.2 Ecosystem management strategy	RBF not applicable
2.5.3 Ecosystem information/monitoring	RBF not applicable
Principle 3	RBF not applicable to P3

2 REVIEW OF PROGRESS

Six performance indicators are scored under Principle 1 related to stock status and harvest strategies. The 2009 RBF assessment report indicated that five performance indicators would score below 60 and are therefore high priorities within the FIP.

Fifteen performance indicators are scored under Principle 2 related to ecosystem components. The 2009 RBF assessment indicated no performance indicators would likely score below 60. All the P2 activities are medium priority within the FIP.

Nine performance indicators are scored under Principle 3 related to governance and policy and to fishery specific management. The 2009 RBF indicated that three performance indicators related to international management would score below 60 and two indicators related to fishery specific management would score below 60.

Tasks 1 and 2 address Principle 1; Tasks 3 and 4 primarily address Principle 2 but also Principle 1; and Tasks 5 and 6 primarily address Principle 3 but also Principles 1 and 2. The Review of Progress examines the activities of each task.

This section presents the progress made against each Task based on information received at the 2014 FIP review meeting.

2. 1 TASK 1. DEFINITION OF THE STOCK

To determine the status of the stock, it is necessary to define the distribution and abundance of the stock exploited by the fishery. Within the RBF assessment, the unit of certification indicated that mahi mahi has a wide but currently undefined distribution in the Pacific. Therefore, Task 1 focused on activities to define the stock. Recent genetic analysis indicates that no genetic differences have been found within the greater Pacific Ocean and that mahi mahi in the entire Pacific may constitute a single genetic population. This result suggests that a single Pacific-wide management program may be necessary. However, if subsequent information demonstrates that stocks within the greater population are suitable for management on a smaller scale (e.g., limited exchange across subregions such that exploitation in one subregion would not adversely impact other subregions), then the unit of certification could be limited to a stock within the population.

In 2013, as a result of discussions with several scientists from the Inter-American Tropical Tuna Commission (IATTC), WWF, and MRAG Americas, it appeared that the range of primary fishing activity in the eastern Pacific could serve as a stock unit for management purposes: fishing for mahi mahi occurs primarily by Peru (>75% of the eastern Pacific catch since 2008) and Ecuador (>16%), and limited catch occurs to the north, south, or west (Table 4). Therefore, Ecuador and Peru currently dominate the catch in the eastern Pacific (>93%). On this basis, a consensus developed during the FIP meeting to consider the unit stock as that fished by Peru and Ecuador in the eastern Pacific ocean; if other countries substantially increase participation in the fishery, the unit stock could expand to incorporate that fishing.

Table 4. Reported landings of mahi mahi by Peru and Ecuador, in the eastern Pacific Ocean, and the world.

Año	TONELADAS			
	Perú	Ecuador	EPO	Mundo
2001	28.025	5.266	46.792	75.588
2002	29.787	5.473	46.051	78.496
2003	35.651	4.756	46.191	88.690
2004	31.456	4.838	40.202	84.738
2005	37.078	2.300	43.932	94.106
2006	33.755	3.638	41.778	89.898
2007	35.333	3.865	43.239	85.607
2008	49.473	11.030	64.964	106.571
2009	57.153	12.235	73.899	110.157
2010	53.359	7.226		

Sources:
Perú: Anuario Estadístico 2010 PRODUCE
Ecuador: Fishstat (2001-2007), SRP (2008-2010)
Table compiled by WWF

In 2014, INP presented information that mahi off the west coast of South America are bounded by specific isotherms, and as such, do not cross the equator into the northern hemisphere. The FIP participants agreed to have INP and IATTC conduct further research to see if available evidence would support this concept. This is further addressed below.

2.1.1   Task 1.1 Genetic Analysis

No new genetic information was presented at the 2013 meeting, so the conclusion from Concepto Azul agreed with previous analyses that a single trans-Pacific population exists. The success of the project to conduct genetic analyses generated support for continued research in this area. It is unlikely that further research will identify genetic subunits, so continued genetic research will be useful for information on the species but will not likely contribute further to definition of a unit stock.

Task complete for FIP purposes.

2.1.2   Task 1.2 Parasite Analysis

Removed from task list in 2012.

2.1.3   Task 1.3 Otolith Micro-element Analysis

Now that it is unlikely that genetic analysis will contribute to a definition of a stock unit for management purposes, other alternatives have a higher potential value than previously considered.

Information received after the 2012 FIP meeting determined that a micro element analysis could provide information on stock structure by testing a null hypothesis of a single Pacific-wide stock against an alternate hypothesis of separate stocks. A micro element analysis could be done for about $50,000 to test three regions of the Pacific for similarity and differences[2]. SRP agreed at the 2013 meeting that the methodology has merit and is worth considering further. SRP and INP (Instituto Nacional de Pesca) can consider the potential of this method and determine whether to add this task back into the Action Plan. Sharing the cost among interested agencies (IATTC, SRP-Ecuador, IMARPE-Instituto del Mar del Perú) and stakeholders (WWF, Conservation International (CI), ASOEXPEBLA- the Whitefish Exporters Association) could bring down the cost per participant, and could help start international collaboration.

The 2012 FIP removed this task from further consideration, but the 2014 FIP added a task to prepare a proposal for discussion at an International Workshop (discussed below).

2.1.4   Task 1.4 Training National Technicians

SRP has undertaken a widespread program for training scientists, managers, and technicians. SRP prepared a technical report that described all the training that Ecuadorian scientists and technicians have received on a variety of issues related to biology, ecology, management, bycatch, and other topics for review within this evaluation of this FIP. The report on this training showed comprehensive topics, and indicated that the training will proceed as an ongoing project.

This effectively completes this subtask; training is ongoing.

2.1.5   Task 1.5 National Mahi Mahi Workshop

SRP conducted a workshop in Santa Rosa de Salinas. The meeting invited fishing cooperatives; provided presentations on general description of biology and characteristics of mahi mahi; and included work conducted jointly with IATTC and Centro Interdisciplinario de Ciencias Marinas del Instituto Politécnico Nacional (CICIMAR) of Mexico. The National mahi mahi workshop served mainly to present to the key stakeholders (but mainly to fishers), the results or progress of a series of investigations

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[2] Dr. Yongwen Gao, a scientist at the Makah Tribe in Washington State, is an expert in otolith microelement analysis. He could perform an analysis to test stable isotope ratios of carbon and oxygen from mahi mahi otoliths. The design would consist of 50 otoliths from each of three regions (eastern Pacific south of the equator, eastern Pacific north of the equator, and the western Pacific) tested at the nucleus and the margin. This would determine if the fish caught in a region have consistent spawning areas (from the nucleus) and traveled together (margin), and if the spawning areas and the areas traveled differed among regions. This would include otolith preparation, microsampling, 13C/12C and 18O/16O analyses, interpretation of the isotopic data and drafting a manuscript. He worked for Bob Trumble for several years as a post-doc.

led by the SRP. SRP committed to a series of small workshops on a regular basis to update stakeholders on the status of the management and research.

These activities complete this subtask.

2.1.6   Task 1.6 International Mahi Workshop

SRP has discussed plans for an international workshop with IATTC science staff. At a meeting in 2012 organized by Panalang Group Union, the Center for Sustainable Fishery Development (CeDePesca) and Panama Maritime University on sustainability, the Ecuador mahi mahi work was highlighted. OSPESCA, CPPS, FAO participated, and indicated an interest in developing funds for an international workshop specifically for mahi. All key regional stakeholders should participate in this workshop. Formal communication to these parties should occur in the near future.

Prior to the 2014 FIP meeting, IATTC agreed to organize and sponsor the international workshop during the last quarter of 2014, probably in October. In addition to having an exchange of information concerning mahi mahi, it would be desirable for the workshop to review the proposed southern EPO stock definition, potential research to support or refute the definition, and concepts for international control of the fishery.

Likely topics for the workshop include:

- a stock assessment with reference points based on tracking indicators such as standardized CPUE, average size, and/or average weight;
- linking the reference points to Bmsy;
- evaluating and determining whether data support a southern EPO mahi mahi stock for management purposes;
- levels of data collection that EPO countries could commit to; and
- international control of the fishery.

More topics will likely arise as planning continues.

2.1.7   Task 1.7 Define Practical Stock Unit

The FIP participants discussed information suggesting that a southern stock exists separate from a northern stock. The INP offered to provide documents to the SRP and WWF staff collaborating with the IATTC, which could help support the notion that there is a southern stock of mahi. The better a unit stock can be defined, based on justifiable evidence such as movement of isotherms and circulation of fish, the better for stock definition and assessment. The participants recognized a fall back option of a conservative harvest strategy, similar in concept to the certified Pacific Dungeness crab fishery. This would probably involve a conservative minimum size limit, seasonal closures and CPUE monitoring from Peru and Ecuador, as they dominate landings. INP agreed to provide the available evidence for the southern EPO stock, and to work with IATTC to determine if a southern stock exists in the upcoming publication with the IATTC..

We have identified three alternative approaches for addressing the unit stock: 1) the conservative harvest strategy that would assure biomass at or above the target

reference point would apply regardless of the stock definition; 2) the southern EPO stock currently under evaluation; and 3) a stock structure based on the areas of predominant harvest for the eastern Pacific, in which Peru and Ecuador account for >93% of the harvest. This should be a major topic for consultations with international experts and for discussions with IATTC when mahi mahi come under the IATTC assessment or management. Alternative 1 would serve as an interim process while the evaluation of the southern EPO stock continues. Depending on the results, stock assessment by IATTC would apply to alternative 2 or 3. This work has not been completed and stock status determination has not occurred; technically, this task is not complete. But the likelihood of success has led to a provisional completion in recognition of the progress made.

2.1.8   Task 1.8 Bilateral Technical Workshop with Peru

A cooperation agreement between the INP and IMARPE in Peru could form the basis to organize a bilateral workshop between Ecuador and Peru to demonstrate where we are with science and management of the mahi resource. The workshop could be an opportunity to show the data and management measures that each country has in place, and explore the possibility of a binational management regime, for example on the basis of CPUE. This should occur before the International Workshop. INP agreed to invite representatives from IMARPE to the workshop, and to plan and implement the workshop prior to the international workshop. The technical workshop could allow for discussions of suitability of the southern EPO stock concept; fall back harvest strategy based on such actions as a conservative minimum size limit, seasonal closures, and CPUE monitoring from Peru and Ecuador; and compatible fishery data collection (e.g., CPUE).

2.2   TASK 2. STOCK STATUS AND ABUNDANCE INDICES

The objective of Activity 2 is to use a variety of techniques to conduct assessments that would provide determination of stock status and develop target and limit reference points. A considerable amount of work completed over previous years may allow an effective stock assessment.

2.2. 1   Task 2.1. VPA assessment (or other modeling)

Age-based modeling such as VPA is a good long-term objective, but given the lack of data and recognizing the long time series required, not practical in the short term. This task stays on the action plan list because of the long-term potential, but in an inactive status until sufficient data develop.

2.2. 2   Task 2.2 Develop CPUE series (index of abundance) / status of resource

CPUE is a standard calculation useful in a number of management evaluations, and in the short term will provide a basis for trying some simple assessment models. SRP has maintained a consistent catch record and has begun a standardized collection of data for calculating CPUE. The CPUE series will provide an index for monitoring trends in the fishery, and over time evaluations of the data and the trends may determine if CPUE tracks abundance or reflects environmental effects. SRP and IATTC staff have developed a CPUE index that both parties believe will provide consistent information. The procedure would track standardized CPUE and other parameters, and use bounds

(e.g., 5 to 95 percentile) to set limits for management purposes. The IATTC reports that the Ecuador CPUE and biological data will be sufficient for tracking the fishery, even in the absence of comparable data from Peru: the Ecuador fishing range extends to south of Peru, north to Colombia, and west past the Galapagos, and since 2008 fishery monitoring has resulted in high quality data. SRP and IATTC expect to complete an initial report on Ecuador CPUE by November 2013, and a finalized report by December 2014; they expect a comparison with purse seine data to be completed by June 2014. Data collection will continue.

The progress on this subtask is sufficient to consider it completed. However, the CPUE results will not likely meet the stock assessment requirements. The CPUE series and the series from other parameters alone cannot link to Bmsy or Bmsy proxy. This is further discussed in the new tasks added to this section.

2.2. 3 Task 2.3 Length-based assessment

Changes in the length distribution of a fish stock over time can reflect changes in the abundance of that stock (http://www.fao.org/DOCREP/003/T0535E/T0535E00.htm#TOC. Ecuador has collected five years of length data that can form the basis for a length-based model assessment. The short lifespan and fast growth of mahi mahi is both a drawback and an opportunity in terms of identifying and tracing length signals in the data. Given the short lifespan, five or six years of data should be minimally sufficient to apply the model.

A recently developed assessment that uses length frequencies plus age at maturity to track changes in spawning potential ratio (SPR) will be available for general use in the near future. Use of the SPR model could help provide information to serve as a proxy for Bmsy, and help solve the problem of linking the CPUE index model to Bmsy.

The length-based methods are not currently part of the stock status evaluation, removed from the action plan in favor of the work underway with IATTC. But these methods could provide a fall back analysis in case other methods do not provide sufficient robustness to meet the MSC requirements. The 2014 FIP meeting confirmed removing length-based methods from the FIP projects.

2.2. 4 Task 2.4 Egg size assessment

Removed from task list in 2012.

2.2. 5 Task 2.5 Literature review on mahi assessment and management

This is considered as a straightforward project. INP and SRP recognized the value of this activity and committed to work jointly on producing a report prior to the international workshop. The Universidad Laica Eloy Alfaro de Manabi (ULEAM) has apparently withdrawn from participating in this project. However, IATTC, as part of its help with the CPUE subtask, will work with SRP to provide a report on stock assessment and management by the end of 2014. It would be useful to have the literature review in time for the IATTC-SRP stock assessment report.

2.2. 6 Task 2.6 Ageing

Fish ages are an integral part of age-based analysis, and some determination of ages for mahi mahi has occurred. SRP has established a collaborative project with CICIMAR of Mexico to begin continuing reading of mahi mahi scales. CICIMAR scientists help the SRP in the data analysis, and also train the national staff. Over the past two years, there have been several technical exchanges. After another year or two of age data collections, SRP and Cicimar will evaluate the age reading program to determine to value of establishing it as a permanent program. SRP expects a consultant's report, sponsored by WWF, in the third quarter of 2014.

2.2. 7 Task 2.7 5-95 Percentile analysis

IATTC and SRP have begun application of various stock indices as indicators of stock status, looking at the trend of the indices within or outside of the 5-95 percentile range of the indices. The participants have indicated plans to complete the analysis by the fall of 2015. The project will track standardized CPUE, and evaluate other possible candidate indicators like weight or length. This work is expected to continue through 2015, and then support a stock assessment in 2017.

2.2. 8 Task 2.8 Link 5-95 percentile analysis to Bmsy
The MSC requires a target reference point linked to Bmsy to reach the 80 level: "The target reference point is such that the stock is maintained at a level consistent with BMSY or some measure or surrogate with similar intent or outcome." The 5-95 percentile analysis will not meet this requirement, so some linkage to Bmsy or Bmsy proxy is needed. SRP and IATTC will incorporate this task in the 5-95 percentile task, with work scheduled for completion in the 2017-2018 period.

2.3   TASK 3. MONITORING AND EVALUATION

The objective of Activity 3 is to obtain information on the mahi fishery and on bycatch and the ecosystem. The monitoring has improved over recent years but some gaps remain. The 2013 FIP workshop concluded that gaps in observer coverage have occurred and that more representative coverage would strengthen conclusions drawn from the data. An evaluation of the observer coverage levels needed to reach specified monitoring goals would help assure the most efficient collection of data. An evaluation of what is known about pelagic ecosystems as applied to the region off Ecuador would strengthen the environmental assessment of the fishery.

2.3. 1 Task 3.1 Characterization of Ecuadorian artisanal mahi mahi fishery

The report and this subtask are completed.

2.3. 2 Task 3.2 Development and training of national observers

Ecuador has established a coordinated observer program where several programs previously existed. SRP has conducted a series of trainings to institute consistent

practices for observers. The program has an observer manual with standard forms for data collection. Observer training will continue as an on-going program.

This subtask is complete.

2.3. 3 Task 3.3 Design mahi observer program

The government has placed observers on board mahi mahi and other vessels since 2008 through several disparate programs; at the end of 2011 the various programs consolidated into a single program. Consolidation of the several observer programs into a single program offers an opportunity for prioritizing the needs for observers by different management programs. Observers must meet rigorous selection criteria and have substantial training. The observers collect a variety of data and also teach sea turtle release techniques to fishermen. Currently, SRP states that it employs 17 fishery observers and has a goal of 31 observers.

Observer coverage is currently about 5%, with a target of 12%. It is unclear whether the 12% target was derived to reach statistical goals. An analysis to match coverage levels with statistical goals would reduce the likelihood of collecting data that do not produce the statistical robustness needed for management programs.

SRP has implemented a comprehensive observer program except that no rationale has been provided for the coverage level, and whether the coverage will permit estimates at an acceptable statistical reliability. WWF is developing terms of reference for conducting a statistical analysis of the observer program to provide background for a SRP-INP-stakeholder consultation. To assure that the observer program most efficiently uses its resources, it is recommended that SRP and INP, in consultation with stakeholders:
- prepare overall goals for the observer program based on scientific and management requirements,
- align observer coverage, design, and strategies to achieve the goals, and
- regularly review performance of the program and adjust program design as necessary.

Key questions are: (a) what do you want to know about the fishery, and (b) what resolution do you want?

Important goals or objectives currently identified include providing adequate temporal/spatial coverage to characterize (make quantitative estimates of) catches, discards (bycatch), endangered, threatened, or protected (ETP) species interactions including incidence of sea turtles, and other biological characteristics (e.g. length, maturity etc.). Defining 'adequate' in terms of data precision and timeliness requirements would help assure that subsequent analysis would provide useful results.

This task is essentially complete except that no rationale has been provided for the coverage level, and whether the coverage will permit estimates at an acceptable statistical reliability. As an example of an analysis to complete this task, a consulting statistician could consider:
a) the level of <u>statistical significance</u> desired,
b) the <u>total number or universe of possible observations</u> (i.e. total fishing effort, properly distinguished by primary sampling units),

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c) the "dimension" of the change one hopes to detect (e.g. are we looking to detect a 5% shift in turtle interactions, a 10% shift, a 10/25/50% drop/increase in mahi CPUE, etc.) and

d) the variance associated with the quantity being measured (e.g. turtle CPUE, mahi CPUE).

e) The important strata, e.g. fibras/nodrizas, fishing area, time of year, to reflect important differences in fishing operations and therefore variance.

The output of this analysis would be the number of observations (in the right units) required per stratum to achieve statistically robust results, i.e. the number of trips/sets/fishing days that should be observed in order to draw robust conclusions about turtle interactions, mahi CPUE, etc. The consultant could also use these calculations to set clear, measurable and justified objectives for the observer program, something that is currently lacking.

Such an analysis would bring several potential advantages:

1) A defensible figure for how many trips in total should be observed, to make sure observer resources are adjusted to exactly the right level for the program goals;

2) A guarantee that the observer program will provide statistically robust conclusions when required in an MSC full assessment;

3) An analysis of how observer resources can most efficiently be allocated among different strata (e.g. fleet sectors, fishing areas, times of year), which at the moment doesn't seem to be accounted for in the design of the program;

4) A safeguard against the problem of "pseudo-replication", whereby you think you have more data than you really do because your primary sampling unit (e.g. set) is not independent (e.g. because several sets from one trip on one boat are not independent);

5) A set of clear, measurable goals for the observer program based on justifiable desired outcomes;

6) An example of best practice for other observer programs currently underway or being considered in Ecuador (e.g. pomada shrimp, hake, eel)

7) A chance to train Ecuadorian technicians in this statistical technique so that they can carry out future analyses themselves.

In addition to the statistical robustness project, the 2014 FIP participants agreed to add an estimation of undersized mahi caught and discarded by the fishery and an estimation of the number of sea turtle interactions with the fishery. These projects are due at the end of 2014.

2.3. 4 *Task 3.4 Literature review of pelagic ecosystems*

No specific collection of data or other information has been collected to characterize the pelagic ecosystem in the region of the Ecuador fishery (which includes waters offshore of Peru). A project to collect data for this would be very expensive unless combined with an ongoing project that could add on additional work. Therefore, a literature review of similar pelagic ecosystems would offer a less expensive and a more timely opportunity to understand key aspects of the interactions of the fishery with the ecosystem. Evaluation of ecosystem impacts allows inference from other regions with similar characteristics. The literature review would help identify any issues that need addressing and provide rationale for ecosystem-based management to assure protection of the ecosystem structure and function. SRP and IATTC have discussed preparing a joint

report on ecosystem issues for the mahi mahi fishery, and a report is expected by the end of 2015.

2.3. 5   Task 3.5 Review ecosystem/trophic models

Ecosystem and trophic models are data intensive. Little applicable data exist to populate such models. Such models, while useful, are not practical in the near term for Ecuador. Therefore, this FIP recognizes ecosystem/trophic models have immediate value only as a long-term goal. In planning for the international workshop, INP and SRP will keep the idea of these models in mind and determine if and when application of the models become feasible. Information in Task 3.4 could provide criteria for determining the value of ecosystem modeling. Actual modeling would not likely occur for a number of years if at all.

2.4   TASK 4 TURTLE BYCATCH REDUCTION

2.4. 1   Task 4.1 Determine bycatch levels for fibras fishing with nets (Santa Rosa)

INP has been working with Conservation International to understand the bycatch levels of mahi and other bycatch species from the net fishery in Santa Rosa. This ongoing research will help to reduce the impact of this fishery on mahi and other bycatch species, including turtles. As the mahi mahi FIP will focus on the longline fishery, and because the project is now complete, it is removed from the action plan.

2.4. 2   Task 4.2 Implement and confirm turtle handling procedures

The turtle bycatch reduction program in Ecuador started in Ecuador in late 2003. This currently has a number of activities including: i) hook exchanges, ii) observer program, iii) training of fishermen in the use of instruments and procedures to release hooked or entangled turtles, iv) workshops for fishermen.

Procedures are now in place for implementing best practices for handling of marine turtles caught in the mahi longline gear to reduce the chances of injury and increase the chances of survival. SRP has developed the tools and procedures for safe release of turtles, and has set up a program to educate fishermen on the need for turtle protection and train them in proper techniques. The program is well implemented and will proceed on an ongoing basis. While the education and training program has not reached all fishermen, it is progressing well. SRP will continue to work with additional fishing communities to implement to turtle handling requirements. Outreach workshops by SRP to cover all fishing communities and implementation of the approved turtle handling procedures by fishermen in all communities in advance of starting a full assessment would substantially strengthen the ETP score.

2.4. 3   Task 4.3 Conversions of longline fishery to circle hooks

Ongoing research with institutions and stakeholders has demonstrated the success of using circle hooks to reduce or eliminate the level of turtle bycatch from the mahi longline fishery. C-hook sizes 14 and 15 seem most appropriate but size 16 may be best in some areas or circumstances. Outreach to fishermen is increasing acceptance, but not all fishermen are convinced. The SRP focused its strategy to introduce circle hooks

primarily in Muisne (Esmeraldas Province) because fishermen catch bigger mahi mahi in that province, and bigger fish are more susceptible to circle hooks. Further south in Ecuador, fishers capture smaller mahi mahi (because fishing sites are different), and resistance to the use of circle hooks occurs because circle hooks result in lower catch rates of target species. The short term goal is to convert 40% of the fishermen in Muisne (Esmeraldas Province) to circle hooks. J-hooks have a higher CPUE in numbers, but circle hooks catch bigger fish. Fish caught on J hooks often die before coming on board, while circle hooks allow catch of live fish and higher quality. More workshops and other outreach activities continue in this regard. An emphasis in Santa Marianita and Muisne is showing progress.

Because fish caught in the south are smaller than in the north, and because size 15 circle hooks catch fewer fish than J hooks (lower CPUE in numbers), a smaller sized circle hook (size 13 or 14) may work better in the south to maintain catch rates but still achieve conservation benefits. Experiments with smaller circle hooks would provide information to help determine the tradeoffs.

Until the use of circle hooks increases across the fleet, this task cannot be completed. The FIP meeting participants agreed to add a task for VMAP to develop a plan to extend best practice fishing practices, including the use of circle hooks, to fishing villages, including milestones, timeframes and reasonable objectives.

2.4. 4 Task 4.4 Eliminate tariffs on circular hooks

The government of Ecuador recognizes that the cost of circle hooks is a barrier to extended use of circle hooks. To support planning for increasing the supply of circle hooks, the government jointly with WWF prepared a technical report summarizing socio-economic and ecological impacts of eliminating tariffs; this technical report served as the basis by which Comexi made the decision to eliminate the tariffs on circle hook imports. SRP has made massive purchases of C hooks, and NGOs (WWF and CI) have also supplied circle hooks.

The provisioning of C16 hooks for the tuna-billfish-shark (TBS) fishery will receive the highest initial priority. SRP plans on testing other types of hooks, such as ¨half claw¨ (media garra in Spanish), the mutsubaris, etc. to achieve high catch rates of mahi mahi with low catch rates of sea turtles.

Task completed for FIP.

2.4. 5 Task 4.5 Manufacture of circle hooks at national level

This is impractical given the relatively low demand for hooks and the high cost of tooling up for manufacturing. Removed from list.

2.4. 6 Task 4.6 Project 'T' to prevent entanglement of turtles

Research with local fishermen has recently shown that inserting slightly heavier line in the gear around the buoy float (making a 'T' shape) has significantly reduced the level of turtle interactions and entanglements. This technique also reduces gear loss but the main advantage is that it avoids the incidental catch of sea turtles. The modified gear

has been installed on a number of vessels. SRP provides free floats (about 150 buoys per long line, at $2.50/buoy) to fishermen who wish to try the technique; this is part of a strategy to encourage the artisanal fleet to adopt the method.

This project is now working to have the gear modification adopted fleet-wide to reduce or eliminate turtle entanglements from the mahi fishery. It is anticipated that an education and outreach program will be required as part of a communications strategy (task 5.1) to ensure the innovative design is adopted by the fleet. This task is making progress in acceptance of the gear by fishermen with a pilot program in Muisne. Distribution and posting on the SRP web site of a video showing methods to avoid catch of sea turtles and proper release of those caught, produced by the Overseas Fisheries Cooperation Foundation (OFCF) of Japan, will help inform fishermen on this.

The development of the technique is complete, and the transfer of the technology to communities is continuing. Until the use of the T-connection increases across the fleet, this task cannot be completed. The FIP meeting participants agreed to add a task for VMAP to develop a plan to extend best practice fishing practices, including the use of T-connections, to fishing villages, including milestones, timeframes and reasonable objectives. The plan should have a majority of the fleet using the T-connections by mid-2016.

2.4. 7 Task 4.7 Long-term monitoring of turtle interactions

Ongoing research has been undertaken in an attempt to reduce the level of turtle interactions with mahi longline gear. This includes the development and implementation of new gear (see tasks 4.3 and 4.6 above). While this research has shown very positive results, further monitoring is required to ensure that the benefits of research are effectively implemented across the sector and demonstrate a long-term reduction in bycatch rates. The consolidated observer program will provide ongoing coverage. Evaluation of the consolidated observer program as suggested in Task 3.3 would help assure that coverage produces the information needed for management.

This task is nearing completion, and will be complete when monitoring is demonstrated as providing representative coverage of the fishery and can produce statistically reliable estimates of interactions.

2.4. 8 Task 4.8 OFCF research cruises

A series of research cruise was conducted by OFCF to i) continue to test new types of circle hooks or other (e.g., mutsubaris), ii) continue experimenting with entanglements, and iii) work on the development of educational material (especially videos related to release techniques and the appropriate use of equipment). These cruises resulted in a video that is on the SRP website, distribution of the video to fishermen, and use of the video by observers on nodrizas to show fishermen proper techniques.

This task is complete.

2.5   TASK 5 EDUCATION AND OUTREACH

2.5. 1   *Task 5.1 Develop a communications strategy*

The Social Communications Unit of the Vice Ministry of Aquaculture and Fisheries has designed a communications strategy oriented to the conservation of mahi mahi. The program intends to build awareness of conservation issues for fishermen, to incorporate other stakeholders, and to use the media options that will best carry the message to the intended audiences. The program has a budget of $238,000 and started in May 2012.

The program specifically targets all links in the supply chain: fishermen, dealers and processors, exporters, and consumers. The May start date occurred during the mahi mahi closed season, so that the message would not get lost in the intensity of the fishing season. The campaign focuses on four main components:
1. Monitoring and research
2. Reduction of bycatch
3. Education and outreach to fishermen
4. Control and surveillance
These four components incorporate tasks 5.2, 5.3, and 5.4.

The media includes news releases on the experiments in Santa Rosa and Muisne in 2012, news releases on mahi mahi management plan, news releases on ministerial agreements for regulation and management, update of the VMAP website, brochures, messages on bycatch in a comic format, posters on the fishery closure, TV and radio spots. Roadside sign-posts and some posters have already been put into place. The strategy will have an evaluation and feedback component to help improve the presentation of the message.

This task is completed and ongoing.

2.5. 2   *Task 5.2 Program to educate fishermen on resource state, changes in fishery, etc.*

A number of projects for fishermen education have been implemented, and more are in development. Participation by the fishing sector in the FIP discussions helps consolidate a diversity of information that is discussed in more detail during workshops and meetings. This program enables fishermen to learn and better understand new management measures. The education and outreach program reaches out to local fishing communities to help educate resource users, increases the level of transparency between fishermen and managers, and facilitates increased levels of compliance with regulations. The task involves collaboration from multiple stakeholders including government, NGOs and the local fishing sectors. Feedback is helping scientists and managers better understand the resource and increasing the level of compliance by resource users. The program continues to develop.

This task is completed and ongoing.

2.5. 3 Task 5.3 Program to educate fishermen on bycatch reduction

Bycatch reduction, especially of sea turtles, is one of the primary focus areas for SRP. SRP continues to conduct workshops in coastal communities to emphasize sea turtle protection and use of circle hooks and gear modifications to reduce entanglements, and to distribute the sea turtle video on turtle releases. At the 2013 FIP review meeting, the SRP announced the creation of the Department of Regulation and Exchange of Fishing Gear for the Ecuadorian artisanal fleet. The SRP has conducted a number of activities with fishermen to promote the exchange from J-hooks to circle hooks. The communications strategy formalizes these activities and adds a number of presentations to better distribute the message. The communications strategy addresses the issue that some fishermen are not interested in the workshops or in the message; the communications strategy could include activities to have dealers and processors encourage fishermen to participate in the workshops. SRP is developing mobile training teams to specifically target communities in the south of Ecuador, since there is much less awareness and experience in reducing bycatch there, as SRP has mainly focused its training efforts in northern and central Ecuador. Scheduling workshops during the closed season and during moon phases with poor fishing conditions would increase workshop attendance.

This task is complete and ongoing.

2.5. 4 Task 5.4 Incorporate new education and outreach initiatives into existing compulsory programs

This activity was not explicitly discussed, but is inherent in monitoring/research and control/surveillance components of the communications strategy. This work in ongoing.

2.6 MANAGEMENT AND GOVERNANCE

2.6. 1 Task 6.1 Develop strategic research plan for mahi

While it was acknowledged that considerable research has been undertaken within the past few years, it was not clear how each component contributed towards a strategic plan for mahi. As such, it is proposed that a review of key information gaps to answer science and management questions about the fishery be undertaken and a review of all current and proposed research be undertaken to document how they address the information gaps. The FIP action plan for mahi mahi is a good start in this. A strategic research plan will require contributions from several research agencies, including INP, SRP, Universities, and the fishing sector. We recommend a specific research plan with fairly detailed operations plan for each item, so that we know the results will be credible. Before certification assessment begins, we recommend a review of the gaps remaining at that time and updating a research plan.

The text of the 2013 updated PAN-Dorado did not describe the strategic plan . The FIP participants agreed that a text description of the strategic plan should be part of the next update of PAN Dorado.

2.6. 2 Task 6.2 Evaluate options to develop international agreement on shared stocks

The decision by member countries of the IATTC to ratify the Antigua Convention provides an opportunity to develop coordinated management for the eastern Pacific mahi mahi. The Antigua Convention allows the IATTC to consider, as necessary, associated or dependent species in addition to the primary fish stocks covered by the Convention. This would allow international management of mahi mahi in a manner similar to the tunas and billfish currently under auspices of IATTC. However, implementation of the Convention for mahi mahi could languish without pressure from member countries to move this forward. Ecuador has undertaken high level discussions with Peru concerning management of the mahi mahi resource. While Peru participated in the initial 2007 workshop on the mahi mahi fishery and its management, it has not participated in subsequent Ecuadorian FIP activities. The Ecuador-Peru discussions offer an opportunity for Peru to engage in this process. The INP has a signed research agreement with the Peruvian Institute of the Sea (IMARPE). Ecuador is to be commended for its diplomacy in this regard. Central American countries have jointly asked the IATTC to carry out a stock assessment for mahi mahi in the Eastern Pacific Ocean; support of this request by Ecuador strengthens the request. The Ecuador National Plan of Action for the Conservation and Management of Mahi Mahi (PAN-Dorado) is a model for other countries interested in the internal management of this international resource. The IATTC has begun analysis for mahi mahi, and is coordinating development of the stock assessment with all interested parties. Alex Da Silva, IATTC staff, is in charge of organizing the scientists' work in the countries that want to participate, as well as the collection of the data. The IATTC has not yet implemented coordinated management for the eastern Pacific mahi mahi, but plans to do so as a next step following the international stock assessment work. Until either a bilateral agreement with Peru or multilateral arrangement under the IATTC is reached, the international control of the fishery is incomplete.

Evaluation of options complete

2.6. 3 Task 6.3 Describe decision-making processes

Ecuador has made substantial improvements toward a transparent and participative decision making process through development of the Consejo Consultivo Recurso Dorado. The Consultative Council consists of a variety of stakeholders who have an opportunity to receive information of the needs and rationale for management actions and to participate in the decisions. The Consultative Council incorporates the communities into the decision making, resulting in co-management of the resource (Task 6.5). The Consultative Council resulted from discussions at the FIP workshop and subsequent development of the PAN-Dorado, showing responsiveness to suggestions for best practices. The Consultative Council has not yet met, but consultation with stakeholders occurs as needed to support decisions by VMAP; this was demonstrated by the wide-ranging consultation that occurred prior to the decision in 2011 to implement the current closed season for mahi mahi. To assure that the decision-making process complies with the MSC SG80 performance indicator *3.2.2(a) [There are **established** decision-making processes that result in measures and strategies to achieve the fishery-specific objectives*] requires documentation of the process. A clear explanation of the role of the Consultative Council and meetings with individual actors in decision-making,

or a documented procedure for stakeholder consultations leading to a decision (as occurred for the 2011 mahi mahi seasonal closure), is required to assure a score of 80. The 2014 FIP participants agreed to a report on decision making and the Consultative Council by mid 2014.

No decision making body exists for international decisions. A bilateral management forum consisting of key officials from Ecuador and Peru could support the decision making for the substantial portion of the harvest taken by Ecuador and Peru. This could develop through Task 6.2. Alternately, a multilateral agreement through IATTC could include the necessary international decision making.

2.6. 4 Task 6.4 Improve co-ordination between monitoring and enforcement

The Veda del Dorado (annual mahi mahi fishery closure) formalizes monitoring and surveillance with enforcement. This is an excellent start, but documentation of effective implementation of the SRP's plan for monitoring, surveillance and enforcement is required. Public reporting of a summary of actions taken, cases made, and sanctions applied would demonstrate implementation of the plan. The SRP presented a memo "MEMORANDO No. **DCRP-** 559-2012" that documented mahi enforcement activities in 2012, specifically monitoring sites in fishing communities, monitoring of fishing companies, amounts of mahi mahi seized for various infractions, and inspections of mahi in cold storage prior to exportation. Updated information documents that the inspectors have increased to 84 distributed across the fishing landing sites, that monitoring of motherships occurs at 100% of landings and about 30-40% of fibras. Some inspectors operate primarily from main landing sites and others roam outside the primary landings sites. An emphasis on outreach and prevention has reduced the number of citations for undersized fish, emphasized the compliance with the closed season, and prevention of shark finning. Sanctions include fines up to 10-30 times average wages for infractions, and $17,500 for illegal transshipments. VMS requirement for motherships allow continuous monitoring. The Ecuadorian Navy has an agreement with SRP for monitoring and enforcement.

This task is ongoing.

2.6. 5 Task 6.5 Identify new schemes for co-management

Combined with Task 6.3.

2.6. 6 Task 6.6 Code of Responsible fishing

Moved to Task 5.1. No longer a separate task.

2.6. 7 Task 6.7 Revise internal and external review of the management

Ecuador has implemented a process called Governance by Results (GBR), in which each governmental element must present the achievements expected on an annual basis, and then undergo a review of the progress against the expected results. The mahi mahi fishery will undergo this review. This is a process and has not yet been implemented. Once the GBR starts, with the results of the reviews presented publically, the mahi mahi fishery should have a comprehensive internal and external review. SRP

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provided a spreadsheet of GBR results that listed a series of indicators with target and achieved metrics. This is a useful first step in conducting performance reviews.

Section A.2.2 and Section A.2.3 of the PAN-Dorado provide a detailed list of general objectives and responsibilities of the legal framework of fishery management of Ecuador. Section D.1 provides general and specific objectives for the mahi mahi fishery, which are discussed in further detail in Section D.2. Internal and external review of the overall management system and of the mahi mahi fishery as specified in these sections would substantially improve likely scores for MSC certification. SRP presented the GBR process and results at the 2014 FIP meeting, which essentially completes this task.

2.6. 8 Task 6.8 Develop timelines, budget and indicators in the mahi action plan

A coordinated approach to indicators, timelines, and budgets is in development. SRP updated the PAN-Dorado which contains budgets for completion of the FIP action plan. SRP presented a proposed budget of $2.857 million for this work.

This task was completed with the publication of the updated PAN-Dorado in 2013.

2.6. 9 Task 6.9 Incorporate an ecosystem management strategy into mahi National Plan

SRP has developed an ecosystem management strategy (see 2013 PAN-Dorado). The strategy will be revised as necessarty on the basis of the on-going pelagic ecosystem literature review to determine the necessity of additional ecosystem management and will be reported in the next PAN Dorado update. This task should be completed with the publication of the next updated PAN-Dorado.

2.6. 10 Task 6.10 Establish National Plan of Action for mahi mahi

Ecuador has completed a comprehensive National Plan of Action (PAN-Dorado). The Plan will undergo regular updates. An update was completed in 2013. A subsequent update will occur but no date has yet been set.

2.6. 11 Task 6.11 International Management Agreement

Ecuador has developed a strong internal management system, but cannot unilaterally control the harvest on the stock. Development of some internationally agreed control is necessary to achieve certification.

Working group	SRP – INP – NGOs (WWF CI) – MRAG
Priority	High
Status	New
Timeframe	Ongoing until complete
MSC Performance Indicator(s)	3.1.1 Legal/ customary Framework 3.1.2 Consultation, roles and responsibilities 3.1.3 Long term objectives 3.2.1 Fishery specific objectives 3.2.2 Decision making processes 3.2.3 Compliance and enforcement 3.2.4 Research plan 3.2.5 Management performance evaluation

Milestones for Activity 6.11 are shown below.

	Commencing	Ending
Milestone 1: Bilateral workshop, Peru	Quarter 1 2014	Quarter 3 2014
Milestone 2: Discussion at International Workshop	Quarter 1 2014	Quarter 4 2014
Milestone 3: Evaluate level of international agreement needed (e.g., EU mackerel fishery)	Quarter 1 2014	Quarter 2 2014
Milestone 4: International agreement	Quarter 1 2014	

3   REVIEW OF PROGRESS AGAINST MSC PRINCIPLES

The progress reported in Section 2 has improved the likely scores for many, but not all, of the MSC performance indicators for a mahi mahi assessment. Substantial improvements have occurred for P1 and P3 (Table 5).

Table 5. Projected change in scores based on progress through the 2014 FIP meeting.

Performance Indicator	2009	2014
Principle 1 Stock Status		
1.1.1 Stock Status	High	Medium*
1.1.2 Reference Points	High	Medium*
1.2.1 Performance of Harvest Strategy	High	High
1.2.2 Harvest Control Rules and Tools	High	High
1.2.3 Information/ Monitoring	Medium	Medium*
1.2.4 Stock Assessment	High	Medium*
Principle 2 Ecosystem		
2.1.1 Retained Status	Low	Low
2.1.2 Retained Management Strategy	Low	Low
2.1.3 Retained Information Monitoring	Low	Low
2.2.1 Bycatch Status	Low	Low
2.2.2 Bycatch Management Strategy	Low	Low
2.2.3 Bycatch Information Monitoring	Medium	Low
2.3.1 ETP Status	Medium	Low
2.3.2 ETP Management Strategy	Medium	Low
2.3.3 ETP Information Monitoring	Medium	Medium

Performance Indicator	2009	2014	
2.4.1 Habitat Status	Low	Low	
2.4.2 Habitat Management Strategy	Low	Low	
2.4.3 Habitat Information Monitoring	Low	Low	
2.5.1 Ecosystem Status	Low	Low	
2.5.2 Ecosystem Management Strategy	Medium	Medium	
2.5.3 Ecosystem Information Monitoring	Medium	Medium	
Principle 3 Management System			
3.1.1 Legal/Customary Framework	High	L**	M***
3.1.2 Consultation, Rules & Responsibilities	High	L**	M***
3.1.3 Long Term Objectives	High	Low	
3.1.4 Incentives for Sustainable Fishing	Medium	Low	
3.2.1 Fishery-specific Objectives	Medium	L**	M***
3.2.2 Decision-making Processes	High	M**	H***
3.2.3 Compliance & Enforcement	High	L**	H***
3.2.4 Research Plan	Medium	Medium	
3.2.5 Management Performance Evaluation	Medium	L	H***

*INP has information to support a southern hemisphere stock. If this information is accepted at the international workshop, it will form the basis for stock assessment and harvest strategy. The IATTC/SRP have nearly completed a stock assessment and reference points. As this info is not yet ready, these indicators are technically red, but we presume that the completed work will satisfy the indicators and perhaps reach green. As a fallback position, a precautionary harvest strategy consisting of conservative size limit and closed season would suffice. But the minimum size limit would need justification based on assuring high spawning potential. The 'performance of the harvest strategy' remains red because the work leading to the strategy hasn't been completed, so we don't have evidence yet that it works.
**Score for Ecuador management
***Score for international management

3.1   PRINCIPLE 1 STOCK STATUS AND HARVEST STRATEGY

As a result of the progress through the 2014 FIP meeting, the P1 performance indicators are on the verge of completion for FIP purposes, assuming a conservative harvest strategy will be implemented, and further work between the SRP, INP and IATTC will help to refine the stock definition over time. As an interim step, the biology of mahi mahi offers a composite means of achieving the requirements for P1, using a conservative harvest strategy. Mahi mahi grow fast and reproduce at a young age, starting spawning at around 9 months. The Ecuador and Peru minimum size limits exceed the mean size

at maturity. Ecuador has, and Peru is considering, a closed period prior to the main mahi mahi season to minimize catch of sublegal fish. If the minimum size limit is set high enough that sufficient spawning occurs to maintain population size highly likely to fluctuate around Bmsy or Bmsy proxy, regardless of exploitation on the legal size, then the strategy could meet the P1 requirements. This would require an analysis to determine the appropriate minimum size and to identify and monitor indicators (such as standardized CPUE) to assure that the abundance doesn't drop to unsafe levels. The minimum size analysis could fulfill the stock assessment requirement and the identification of indicators to track could fulfill the reference point requirement. From this parties could establish harvest control rules to respond as appropriate to the indicators falling below a target and toward a limit reference point.

IATTC and SRP are completing an analysis of stock indicators that could apply to the Southern EPO stock (if confirmed through ongoing research as part of this FIP). The 5-95 percentile analysis would define bands of normal fluctuation for key indicators such as standardized CPUE, average length, or average weight. However, historical patterns do not explicitly relate to target reference points related to Bmsy or Bmsy proxy, as required by MSC. The IATTC-SRP analysis will evaluate linking the indicators to Bmsy. Subsequently, IATTC will conduct a management strategy evaluation to determine the appropriate reference points for the fishery. If successful, as anticipated, this will provide for stock status and reference point determination (P1.1) and harvest strategy, harvest control rules, and stock assessment (P1.2). Together with the fishery information collected by Ecuador, this should provide sufficient robustness to conditionally pass P1.

Because this work is not yet completed, the performance indicators do not technically pass at this time. However, the level of commitment by IATTC and SRP provide confidence that the scores for the performance indicators will improve as indicated in Table 1. As this work for P1 is the heart of the FIP, continuous progress must occur in achieving the milestones presented in the 2014 Ecuador FIP Action Plan.

3.1.1 PI 1.1.1. Stock status

The current status of the mahi mahi stock remains unknown in relation to limit reference points or proxy values. To date, the geographic distribution of the mahi population is not fully understood, although it is believed to encompass a wide area within the Eastern Pacific Ocean, extending south of the equator through both Ecuador and Peru. The same population is targeted in the High Seas and Peruvian EEZ. Mahi mahi are also retained as an important by-catch within the Pacific purse seine tuna and billfish fisheries reported within IATTC, which retained 1291, 1805, and 1448 mt in 2011, 2012, and 2013, respectively and discarded 386, 401, and 491 mt in those years. Within these tuna fisheries, the direct impacts of using FADs on the distribution and abundance of mahi mahi remain unknown. Experiments underway by the IATTC and the SRP show promising results for releasing small mahi mahi (<60cm) from purse seines that use a large mesh sorting grid.

The RBF is not a good solution for Ecuador in assessing P1. The 2009 assessment demonstrated that the fishery would score a conditional pass for P1.1.1, and therefore could not be used for recertification. The 5-95 percentile analysis with link to Bmsy as applied to the southern EPO stock shows promise in meeting the requirement to determine the status of the stock relative to reference points.

The genetic information available shows no genetic subpopulations discernible for the greater Pacific Ocean. The biology of the organism suggests a possibility that some stock structure suitable for management (i.e., such that mis-management in one area would not adversely affect other areas) may exist. Mahi mahi live only a few years, and most are out of the fishery by age 4 or 5. The short life span may not allow the fish to make regular long-range migrations. The fish may migrate regularly within a smaller range, but with enough straying to keep the gene pool mixed.

We have identified three alternative approaches for addressing the unit stock: 1) the conservative harvest strategy that would assure biomass at or above the target reference point would apply regardless of the stock definition; 2) the southern EPO stock currently under evaluation; and 3) a stock structure based on the areas of predominant harvest for the eastern Pacific, in which Peru and Ecuador account for >93% of the harvest. This should be a major topic for consultations with international experts and for discussions with IATTC when mahi mahi come under the IATTC assessment or management. Alternative 1 would serve as an interim process while the evaluation of the southern EPO stock continues. Depending on the results, stock assessment by IATTC would apply to alternative 2 or 3. This work has not been completed and stock status determination has not occurred; technically, this performance indicator would not pass. But the likelihood of success has led to a provisional yellow score in recognition of the progress made.

Likely score: Conditional pass under RBF
                Conditional pass under traditional assessment

3.1.2   PI 1.1.2. Reference points

Reference points will be determined by the 5-95 percentile analysis and management strategy evaluation, but this assessment is not yet completed. Because the P 1.1.1 (stock status) was scored under the risk based framework, scoring of performance indicator 1.1.2 (reference points) was automatically assigned a score of 80 in the 2009 RBF assessment, in accordance with MSC CR. However, the MSC CR precludes use of RBF for re-certification (see P1.1.1). Therefore, a stock assessment is required. The CPUE index and the 5 to 95 percentile bounds under development by SRP and IATTC (see Tasks 2.7 and 2.8) will likely meet the requirements of the MSC, if the CPUE series and the series from other parameters link to Bmsy or Bmsy proxy. While not technically passing, this indicator scored a conditional pass on the basis of the work underway.

Likely score: Pass under RBF
                Conditional pass under traditional assessment

3.1.3   PI 1.1.3. Rebuilding.

Not applicable

3.1.4   PI 1.2.1. Harvest Strategy

Ecuador has now implemented a formal harvest strategy for the mahi fishery. The management system has implemented a number of programs, including a minimum size larger than L_{50}, seasonal closure to minimize undersized fish, VMS, voluntary logbooks

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(with plans for a mandatory logbook), routine port sampling, a consolidated at-sea observer program, outreach to fishermen on the importance of adhering to minimum size limits, and a policy to change from J-hooks to circle hooks. Scientific information now helps to demonstrate that the minimum landing size (80 cm TL) is above L_{50} and, if appropriately enforced, may be effective in controlling exploitation. Peru has adopted a minimum size limit of 70 cm FL, which is similar to the 80 cm TL limit of Ecuador. The minimum size and closed season could form the basis of a management strategy, and if properly enforced it could be expected to help reduce the risk of recruitment overfishing on the population. However, the harvest strategy does not reflect the target and limit reference points, as these reference points have not yet been determined, and does not reflect the state of the stock as that has not yet been determined. Also, Peru (other than minimum size) and other countries that harvest mahi mahi do not have a strategy comparable to that of Ecuador. Under the MSC scoring guidelines, since there is no harvest strategy in place for the entire stock, the fishery would have to score below 60.

Likely score: Fail

3.1.5   P1.2.2 Harvest control rule.

This management performance indicator assesses the control rules and actions that management takes in response to changes in the fishery and/or changes in abundance status in relation to reference points. At present, there are no reference points and no harvest strategy for the Ecuadorian or international mahi fishery with which to design harvest control rules. Since this is not an outcome performance indicator, the risk based framework is not available for scoring.

While it is recognized that the minimum landing size in Ecuador and Peru may be appropriate to reduce the risk of recruitment overfishing, there are no clear guidelines on the rules or actions that would need to be taken if the status of the stock was shown to be reduced toward a limiting abundance (e.g., reduce fishing season length, reduce number of vessels, TAC etc.).

Because of the dependence of control rules on stock assessment and international management, the FIP action plan put measures to address P1.2.2 into a Phase 2 pending actions on stock assessment and international management.

Likely score: Fail

3.1.6   PI 1.2.3 Information and monitoring

New information continues to be collected in Ecuador on the biological characteristics and fishing operations of the Ecuador fleet, as demonstrated by the presentations and reports from the 2013 FIP review meeting. The most serious scientific information gap is the geographic distribution and stock structure of the mahi population, although it is believed to encompass a wide area within the Eastern Pacific Ocean, extending south of the equator through both Ecuador and Peru. Scientific information is now being collected to help understand the stock productivity, and preliminary results are available on seasonal length frequencies, maturity, growth, natural mortality, sex ratio and fecundity, for example (Martinez-Ortiz and Zuniga-Flores 2012). The current vessel licensing scheme is capable of providing information on the Ecuador mahi fleet composition while a complete census of all fishers' catch has been implemented since October 2008 in

several key landing ports in Ecuador (Esmeraldas, Manta and Santa Rosa-Anconcito). This monitors approximately 80% of all removals from the mahi fishery. Further information on discards and by-catch may soon be available through adaptation of the current shark documentation scheme. There are very few mahi-mahi discards (other than undersized), and all legal sizes are utilized.

The MSC Certification Requirements identifies six components for evaluating information:

1. **Stock structure:** the stock is known to range over a wide area, but it is not known how to define a unit stock. The RBF evaluated the fishery over the eastern tropical Pacific, but acknowledged the uncertainty. For practical purposes, we recommend using the area of dominant catch, in this case Peru and Ecuador, expandable to adjacent regions as the catch expands.

2. **Stock productivity:** mahi mahi are known to be highly productive, to mature at 6-9 months, have high fecundity, to have a high natural mortality, and an expectation that a spawner-recruit relationship is driven more by environmental factors than fishing at normal abundance levels.

3. **Fleet composition:** Fleet composition of the Ecuador fishery is well known, and some information exists for fleet composition of adjacent countries; little information exists for the longline fleets, other than for Ecuador,that target mahi mahi. The purse seine fleet that harvests mahi mahi incidentally in the eastern tropical Pacific is known by the IATTC.

4. **Stock abundance**: Ecuador has added effort data to the fishery data collection program such that CPUE can be calculated. On-going analyses with IATTC will determine if CPUE will serve as an index of abundance. However, it will be necessary to also develop a way to estimate Bmsy or Bmsy proxy.

5. **Fishery removals**: Monitoring improvements made by SRP provide information describing the level, size, age, and sex of directed landings. Incidental landings from the purse seine fleet are known through IATTC. Recreational and customary use does not occur for the stock and incidental mortality of the target stock varies by location and method of capture. Bycatch of mahi mahi occurs primarily in tuna purse seine fisheries, and is monitored by the IATTC. Stock structure is not known, nor are illegal, unreported, unregulated catches.

6. **Other data**: Mahi mahi are known to respond to El Niño and La Niña, for which considerable information exists.

Once the stock structure is identified, other countries exploiting the stock will need to collect data comparable to that collected by Ecuador. In the short term, the data collected by Ecuador are considered as representative of the harvest, because the Ecuador fleet fishes throughout the primary range of the harvest.

Likely score: Conditional pass

3.1.7   PI 1.2.4 Stock assessment

Under the RBF, the stock assessment would score a default 80. The use of the RBF could provide the fishery a conditional pass, but could not be used for recertification. Therefore, a more traditional assessment would provide a stronger basis for certification.

Lack of age data precludes use of age-based models and the FIP participants chose not to pursue length-based models as an alternative. A formal stock assessment would not be necessary if the management system chose a conservative harvest strategy based on a minimum size limit that would highly likely assure sufficient spawning for the stock size to fluctuate at or above the target reference point. The minimum size limit is already above the L_{50} so completing this approach would require determining if the current minimum size achieves the target stock size. Using standardized CPUE and other possible indicators as target and limit reference points would complete the interim assessment. Completion of the 5-95 percentile analysis with linkage to Bmsy could provide a more robust assessment. While not technically passing, this indicator scored a conditional pass on the basis of the work underway.

Likely score: Fail under traditional assessment
                Conditional Pass under RBF

With the information currently available, indicators 1.2.1 and 1.2.2 cannot score above 60 and none of the indicators score at or above 80. To get them all at 80 or above will require substantial amount of international cooperation. Any score above 60 but below 80 will require other scores above 80 sufficient to average ≥ 80 for the Principle. Table 6 demonstrates this. Clearly, efforts must continue to ensure the highest possible score for each performance indicator to help ensure Principle 1 reaches the MSC Standard.

Table 6: An example of alternative scoring is shown for different scenarios A, B, and C. Shaded boxes show changes that have occurred in scores between performance indicators.

Performance Indicator		A	B	C
1.1.1	Stock Status	<60	80	80
1.1.2	Reference Points	<60	80	80
1.2.1	Performance of Harvest Strategy	<60	70	80
1.2.2	Harvest Control Rules and Tools	<60	70	80
1.2.3	Information / Monitoring	70	80	90
1.2.4	Stock Assessment	<60	80	90
	Average score	Fail	77.5	82.5

3.2   PRINCIPLE 2: ECOLOGICAL AND ENVIRONMENTAL IMPACTS

Fifteen Performance Indicators are scored under Principle 2 related to the ecological and environmental impacts of the fishery. The 2009 RBF assessment report indicated that nine PIs would score 80 or above and are therefore a low priority within the FIP. The remaining six Performance Indicators would score less than 80 but greater than or equal to 60, so were deemed as medium priority.

It should also be noted here that in cases where the RBF is used to score outcome PIs in Principle 2, the scoring guideposts shall be revised such that the fishery need not be required to meet those scoring issues relating to its assessment relative to biologically based limits (MSC Certification Requirements). This exception is allowed since the information required to meet these scoring issues would not be expected to be available in the data-limited situations applicable to the RBF. The scoring issues covered by this exception are identified by brackets in the information/monitoring scoring guideposts for PIs 2.1.3 (Retained species), and 2.2.3 (Bycatch species).

Relevant to developing appropriate management strategies for each Component (e.g., retained, bycatch etc.), the MSC provides the following guidance under relevant paragraphs of the FAM ver2.1:

7.1.25. The term 'if necessary' is used in the management strategy PIs at SG60 and SG80 for the retained species, bycatch species, habitats and ecosystems Components. This term is applicable to those fisheries that have no impact on the relevant Component and where no management strategy is required. For example, if there are no 'main' retained species then a management strategy would not be required at SG60 or SG80.

7.1.26. If it has been shown that a fishery has no impact on a particular Component and has therefore scored 100 under the Outcome PI, it shall still be scored under the Management Strategy PI. But to meet the requirement at SG100 this may simply comprise a statement of intent about continuing to have no impact and ongoing monitoring to ensure that no impact occurs.

Under the current MSC CR, P2 is scored only considering the impacts of the fishery under assessment. However, the MSC is currently evaluating whether to include cumulative effects of other fisheries or other non-fishing activities in the evaluation of P2. It is not clear what form the cumulative impacts would take, and if the cumulative impacts would include non-fishing impacts. The evaluations below are based on the current CR, which does not consider cumulative impacts. Cumulative impacts would be most worrisome for sea turtles, which experience mortalities from a wide range of sources unrelated to the Ecuador mahi mahi fishery.

3. 2.1 *Retained Species*

Catch data show that no main retained species occur in the mahi mahi species, as the fishery catches 98.9% mahi mahi (by numbers). A wide diversity of species, 18 species of bony fish and 14 species of cartilaginous fish, are caught and retained but at very low numbers for each species. The most commonly caught fish, sharks, are managed under a National Plan of Action for Sharks.

Likely score: Pass

3. 1.3 Bycatch Species

PIs 2.2.1 and 2.2.2. Observer data show that virtually no discarded species occur in the mahi mahi fishery, so there are no main bycatch species. The National Plan of Action for mahi mahi (PAN-Dorado) identifies bycatch as an issue, but the Plan focuses on ETP species as the discards of non-ETP species is so low.

Likely score: Pass

PI 2.2.3

The 2009 RBF assessment noted that observer coverage had declined over the period 2004-2008, and that gaps in the coverage area existed. The consolidated national observer program has the potential to target observer coverage at the highest priorities. The current observer has a target of 12%, according to presentations at the 2013 FIP review workshop. Increasing coverage to 12% will certainly improve the situation, but it is not yet clear if 12% coverage will allow for sufficient data precision and accuracy. It is recommended that managers of the observer program align the observer coverage with the observer program goals by considering what needs to be estimated from the data and what resolution in time and space is needed:
Estimates for the following types of objectives would require different designs:
  • Landed catch
  • Discarded catch
  • Rare events (ETP)
  • Biological Information
A program designed for one type of objective may not provide sufficient statistical robustness for other objectives.

Resolution at the following types of objectives would require different designs:
  • Fishery wide
  • Fleet/sectors
  • Season/area
  • Individual vessel
A program designed for one type of objective may not provide sufficient statistical robustness for other objectives.

Given the low levels of incidental catch in the fishery, the current observer data may be sufficient to determine the quantities and impact from the mahi mahi fishery. However, defining the data needs and data resolution, and matching coverage to goals will improve the scores for this (and other) information indicators.

Likely score: Pass

3. 2.3 Endangered, Threatened and Protected (ETP) Species

PI 2.3.1. Outcome

Seabirds: Ecuador is a member of the Agreement on the Conservation of Albatrosses and Petrels (ACAP), which includes an Action Plan with a number of conservation measures to be implemented by Parties. Conservation measures to be implemented include research and monitoring, and reducing incidental mortality in fisheries. Even

though several sea birds are threatened or endangered, observer data show that bird bycatch approaches zero; the Ecuador mahi mahi fishery is in compliance with ACAP, and does not hinder the recovery of the species.

Marine mammals: there are no reports of interactions with marine mammals.

Sea turtles: Interactions with sea turtles can be of two types: entanglements and hookings. In both cases, the vast majority of the turtles encountered in the mahi mahi fishery are encountered alive, and the fishers have the opportunity to release them alive. Although the fishery may encounter thousands of sea turtles, hooked or entangled turtles have a high survival potential, indicating that the mahi mahi fishery does not jeopardize the turtle populations. This conclusion is based on assumptions about fishers: (a) not retaining the turtles for consumption or other purposes, (b) not killing the turtles to recover their hooks

As a signatory to the Inter-American Convention for the Protection and Conservation of Sea Turtles, Ecuador promotes and implements measures for the protection, conservation, and recovery of sea turtles through regulation prohibiting killing or injuring turtles, through research to reduce encounters and increase survival, and through education of the fishermen for the need for turtle conservation. Ecuador complies with the CITES requirements through a total ban on retention. Ecuador complies with the requirements of the Inter-American Convention for the Conservation of Sea Turtles, and with the requirements of the Inter-American Tropical Tuna Commission. SRP has undertaken a number of measures to set requirements for protection of sea turtles and has expended substantial effort to implement the measures: gear development to reduce entanglement (Project T) and providing gear to fishermen; encouraging a shift in the fishery from J-hooks to circle-hooks; research cruises to test and demonstrate careful release techniques for sea turtles; production of a video showing proper release techniques; and workshops with fishing communities for education and outreach on the need for sea turtle protection.

The evidence demonstrates that Ecuador complies with international requirements, has set national requirements, and that the effects of the fishery are highly likely to be within limits of national and international requirements for protection of ETP species.

Likely score: Pass

PI 2.3.2 Management strategy

The National Plan of Action (PAN-Dorado) has made sea turtle conservation a major component of the nation's conservation program. The strategy consists of prohibiting retention, minimizing interactions, maximizing survival, and education and outreach to the fishermen to ensure implementation of the plan. The research conducted on interactions and survival and implementation of these best practices indicates that the government takes this very seriously. It may take time for all fishermen to switch to the best practice techniques, but progress in well underway. Thus, there is a strategy in place with confidence that it will work. Some resistance to adopting circle hooks because of lower catch rates of mahi mahi suggests some benefits from experiments testing smaller hooks (C13 and C14) to determine if catch rates would increase (catch more smaller-sized fish) while maintaining the lower catch of sea turtles. Scoring at 80 or above will require evidence that can show that the strategy has been implemented, i.e.,

that the fishermen have adopted the best practices management measures. To date, the implementation may not reach this level, but the progress made in recent years suggests that sufficient implementation will occur before other high priority tasks are complete.

Likely score: Pass

PI 2.3.3 Information

Overall, the likely impacts of the fishery on sea turtles, the primary ETP species of concern, is likely small because government actions are decreasing interactions and increasing survival. However, the government has not estimated the impact of the fishery on sea turtle morality nor set actions in place should the impact reach or exceed some impact limit. This could cause an assessment team to determine that the first scoring issue of SG80 is not met: "Sufficient data are available to allow fishery related mortality and the impact of fishing to be <u>quantitatively</u> estimated for ETP species." With CPUE of turtles and the amount of effort in the fishery, SRP could calculate the number of interactions that occur. The US National Marine Fisheries Service Office of Protected Resources has produced a substantial amount of information on this concept of estimating takes and setting limits at <u>http://www.nmfs.noaa.gov/pr/species/turtles/</u>, which may provide a starting point. Taking this additional step of quantitatively estimating the impact of fishing on sea turtles would increase the likelihood of passing and of scoring 80 or higher. Additionally, information on whether smaller hooks increase catch rates of mahi mahi while maintaining low interactions with sea turtles would benefit the management strategy.

As with performance indicator 2.2.3 (bycatch information), the low levels of mortality currently observed for sea turtles in the fishery, may be sufficient to determine the quantities and impact from the mahi mahi fishery. However, defining the data needs and data resolution, and matching coverage to goals will improve the scores for this (and other) information indicators. The fishery does not at this point provide quantitative estimates of sea turtle interactions and sea turtle mortality, which could prevent a full pass.

Likely score: Conditional pass

3.1.8   Habitat

The pelagic longline gear does not interact with the bottom, and has no direct impact while fishing. Lost gear occurs rarely, as fishermen stay close to the line, so indirect impacts from lost gear on the bottom are negligible.

Likely score: pass

3.1.9   Ecosystem

PI 2.5.1 Outcome

The Outcome indicator passed using the SICA of RBF. As additional information is required for PIs 2.5.2 and 2.5.3 to move from conditional pass to full pass, using the additional information to re-assess the outcome would make this a stronger conclusion.

Likely score: pass

PI 2.5.2 Management strategy

The fishery has implicit management for assuring no long-term, adverse impacts to the structure and function to the ecosystem. Making ecosystem-based management explicit in the mahi mahi National Plan of Action (PAN-Dorado), such that there is at least a partial strategy that restrains impacts of the fishery on the ecosystem so as to achieve the Ecosystem Outcome 80 level of performance, would provide the best mechanism to move the scoring to $\geq$80. This is expected in the updated PAN-Dorado due for release in 2013.

Likely score: conditional pass

PI 2.5.3 Information

Sufficient information exists to identify the main functions of the components of the ecosystem, but not for the key elements (trophic structure and function, community composition, productivity pattern and biodiversity). As a result, a SICA was conducted to provide information about the ecosystem. From the SICA we can broadly understand the key elements and infer impacts. Based on available information, sea turtles seem the most vulnerable component of the ecosystem, and the overall status of these highly migratory species depends largely on actions far removed from the Ecuador mahi mahi fishery. Information on the status comes mostly from nest counts; nesting from all species except green sea turtle does not occur in Ecuador.

The commitment of SRP and IATTC to conduct a literature review of pelagic ecosystems will provide a basis for understanding the structure and function of the ecosystem in the region where the Ecuador fleet fishes, and allow inference on the impacts of the fishery on the ecosystem to determine the outcome and support the management strategy.

Likely score: conditional pass

P2 will likely score at or above 80, given the improvements made and reported at the 2014 FIP review meeting (Table 5). Addressing observer coverage levels to assure that analyses can provide statistical results with predetermined levels of precision would assure pushing the scores for Performance Indicators s 2.2.3 and 2.3.3 to or above 80. Explicitly laying out a management strategy for ecosystem structure and function and summarizing key ecosystem issues for pelagic longline fisheries in general and the mahi mahi fishery in particular would push the scores for 2.5.2 and 2.5.3 to or above 80. Any score above 60 but below 80 will require other scores above 80 sufficient to average $\geq$80 for the Principle. Table 8 demonstrates that only a few scores below 80 in P2 can lead to an average below 80 unless some indicators score sufficiently high to bring up the average.

Table 8: An example of alternative scoring scenarios under Principle 2. Shaded boxes show differences between performance indicator scores.

Performance Indicator			A	B	C
Retained	2.1.1	Status	80	80	85
	2.1.2	Management Strategy	80	80	80
	2.1.3	Information / Monitoring	80	80	80
Bycatch	2.2.1	Status	80	80	85
	2.2.2	Management Strategy	80	80	80
	2.2.3	Information / Monitoring	70	70	80
ETP	2.3.1	Status	70	80	90
	2.3.2	Management Strategy	70	80	80
	2.3.3	Information / Monitoring	70	70	80
Habitat	2.4.1	Status	90	90	90
	2.4.2	Management Strategy	90	90	90
	2.4.3	Information / Monitoring	90	90	90
Ecosystem	2.5.1	Status	80	80	80
	2.5.2	Management Strategy	70	70	80
	2.5.3	Information / Monitoring	70	70	80
		Average	78	79	84

3.3 PRINCIPLE 3: MANAGEMENT AND GOVERNANCE

Nine Performance Indicators are scored under Principle 3 (P3) related to the management and governance of the fishery. The 2009 RBF assessment report indicated that five Performance Indicators would score below 60 and was therefore a high priority within the FIP. Three of these indicators scored less than 60 for the international aspects of the fishery, but would have passed with consideration limited to only Ecuador. The remaining four Performance Indicators were deemed as medium priority. It should be noted here that the MSC RBF cannot be used for any Performance Indicator within P3, since these do not include Outcome PIs (CR v1.3).

Substantial progress has been made since the previous FIP workshop, which is due partly to a range of other projects initiated by the FIP. These are described under the following Performance Indicators.

3.3. 1 PI 3.1.1 Legal/ Customary framework

A fishery management system's legal and/or customary framework is considered to be the underlying supporting structure, be it formal or informal, that incorporates all the formal and informal practices, procedures and instruments that control, or have an impact on, a fishery (paragraph 8.2.2 FAM ver2.1). Specifically, the fishery is required to pass three issues to reach the SG80 standard (MSC CR ver1.3):

- There is an effective national legal system <u>and a framework for cooperation with other parties</u>, where necessary, to deliver management outcomes consistent with MSC Principles 1 and 2.

- The management system incorporates or is subject by law to a <u>transparent mechanism</u> for the resolution of legal disputes which is <u>considered to be effective</u> in dealing with most issues and that is appropriate to the context of the fishery.

- The management system has a mechanism to <u>observe</u> the legal rights created explicitly or established by custom of people dependent on fishing for food or livelihood in a manner consistent with the objectives of MSC Principles 1 and 2.

The 2009 RBF analysis scored the internal legal and customary framework as a likely pass for the domestic fishery. However, international management has not occurred. The adoption of the Antigua Convention by the IATTC now establishes an international governance framework that covers the basic requirements, and would now likely score greater than 60 but less than 80. Once fully implemented for managing mahi mahi, this should score at least 80, as eastern Pacific albacore tuna have already passed this indicator for an MSC assessment. An agreement with Peru to jointly manage mahi mahi would offer an alternative to IATTC full implementation of the Antigua Convention to mahi mahi.

Likely score: National - pass; International - conditional pass

3.3. 2 PI 3.1.2 Consultation, rules and responsibilities

The management system has to demonstrate effective consultation processes that are open to interested and affected parties. In addition, the roles and responsibilities of organisations and individuals who are involved in the management process should be clear and understood by all relevant parties. Consideration of the roles and responsibilities of the fishers in relation to their cooperation with the collection of relevant information and data, where relevant and/or necessary, may be considered under this performance indicator. The fishery is required to pass the following three issues to meet the SG80 level (MSC CR):

- Organisations and individuals involved in the management process have been identified. Functions, roles and responsibilities are <u>explicitly defined and well understood</u> for <u>key areas</u> of responsibility and interaction.

- The management system includes consultation processes that <u>regularly seek and accept</u> relevant information, including local knowledge. The management system demonstrates consideration of the information obtained.

- The consultation process <u>provides opportunity</u> for all interested and affected parties to be involved.

The 2009 RBF analysis scored consultation, rules, and responsibilities as a likely pass for the domestic fishery. However, international consultation did not occur. The adoption of the Antigua Convention by the IATTC could establish a consultative framework to cover the basic requirements; however, the decision not to fully implement the Antigua Convention for mahi mahi means that the functions, roles, and responsibilities are not yet clear and that the IATTC is not obtaining all relevant information. Once full management of mahi mahi occurs under the Antigua Convention, this should score at least 80, as eastern Pacific albacore tuna have already passed this indicator for an MSC assessment. An agreement with Peru to jointly manage mahi mahi would offer an alternative means of developing consultation, rules, and responsibilities.

Likely score: National - pass; International - conditional pass

3.3. 3   PI 3.1.3 Long term objectives

In order for the fishery to meet the MSC Standard at SG80, it must have '<u>clear</u> long-term objectives that guide decision-making, consistent with MSC Principles and Criteria and the precautionary approach, which are <u>explicit</u> within management policy' (MSC CR).

Management policy in the context of this performance indicator means outside the specific fishery under assessment (i.e., at a higher level or within a broader context than the fishery-specific management system). Furthermore, the intention under this PI is that scoring focuses on the consistency of any long term objectives within overarching management policy with the notions of being cautious when information is uncertain and taking action even when information is inadequate. It is not intended that this PI require a prescriptive list of what must appear in the management policy.

The National Plans of Action for Shark and Mahi Mahi provide long-term objectives for the domestic management system. No comparable long-terms objectives are available for fishing in international waters. Peru, whose fishermen overlap in international waters with Ecuadorian fishermen, has not undertaken development of long-term objectives. Incorporation of mahi mahi under the IATTC management responsibility has the potential to offer a substantial improvement, if agreements to do so are reached. The adoption of the Antigua Convention by the IATTC now brings the possibility of long term objectives of the IATTC in to place for other species, which could cover the basic requirements. Although the IATTC has not fully incorporated mahi mahi into the Antigua Convention, the decision to plan and implement an international mahi mahi conference and to have its staff work on a mahi mahi stock assessment shows clear agreement to objectives for management. This suggests that long-term objectives of the Commission apply for mahi mahi management. However, this will remain a borderline pass until other countries implement these objectives.

Likely score: Borderline of conditional pass and pass

3.3. 4 PI 3.1.4 Incentives for sustainable fishing

In order for the fishery to meet the MSC Standard at SG80, it must be demonstrated that the 'management system provides for incentives that are consistent with achieving the outcomes expressed by MSC Principles 1 and 2, and seeks to ensure that perverse incentives do not arise' (MSC FAM ver 2.1). To reach SG100, it must be demonstrated that the 'management system provides for incentives that are consistent with achieving the outcomes expressed by MSC Principles 1 and 2, and <u>explicitly considers</u> incentives in a <u>regular review</u> of management policy or procedures to ensure that they do not contribute to unsustainable fishing practices.

The MSC Certification Requirements indicates that when considering whether the fishery management system *provides for incentives* that are consistent with achieving the outcomes expressed by MSC Principles 1 and 2 (SG60 and SG80), the key issue is to score the system with reference to whether it 'opens the door' for the possibility for positive incentives (paragraph 8.2.28, FAM ver2.1). At SG100, the 'theoretically perfect' fishery, the expectation is that the management system actively and explicitly considers and reviews management policies and procedures with particular attention paid to the issue of incentives to make sure they are not contributing to unsustainable fishing practices (paragraph 8.2.30, FAM ver2.1).

The Ecuador government provides fuel for fishing vessels at lower than market prices, but does not provide negative incentives that would contribute to unsustainable fishing. Fishing companies will sometimes upgrade existing fishing vessels or provide new ones. The government seeks to replace old, polluting fishing vessels with more efficient vessels.

The government works with industry to provide information about resources and management requirements, and has substantially increased these efforts since the 2009 FIP workshop. The government and private sector (through the operation of the Foundation School of Fisheries of the Eastern Pacific – EPESPO), have projects underway to build capacities of fishermen and fishing leaders. Communications with industry generally occur through fishing association leaders. These efforts help keep the industry informed and reduce information gaps. The government has responded to industry requests for changes to management changes and has brought industry into research activities, often through charter of vessels.

It is not clear what policies exist in Peru or other countries to avoid perverse incentives or to provide for positive incentives. This will need some review for a full assessment.

Likely score: pass

3.3. 5 PI 3.2.1 Fishery-specific objectives

To meet the MSC Standard at the SG80 level, the fishery is required to 'demonstrate <u>short and long term objectives</u>, which are consistent with achieving the outcomes expressed by MSC's Principles 1 and 2, are <u>explicit</u> within the fishery's management system' (MSC CR).

The National Plan of Action for Mahi Mahi (PAN-Dorado) provides explicit short and long term objectives, which meet the requirements. The lack of consensus for IATTC to fully

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bring mahi mahi under the Commission management means that the fishery does not have explicit international objectives.

Likely score: National - pass; International - conditional pass

3.3. 6 PI 3.2.2 Decision-making processes

The fishery-specific management system should include effective decision-making processes that result in measures and strategies to achieve the objectives. In order for the fishery to meet the MSC Standard at the SG80 level, it must be demonstrated that the following scoring issues are satisfied:

- There are <u>established</u> decision-making processes that result in measures and strategies to achieve the fishery-specific objectives.

- Decision-making processes respond to <u>serious and other important issues</u> identified in relevant research, monitoring, evaluation and consultation, in a transparent, timely and adaptive manner and take account of the wider implications of decisions.

- Decision-making processes use the precautionary approach and are based on best available information.

- Information on fishery performance and management action is available on request, and explanations are provided for any actions or lack of action associated with findings and relevant recommendations emerging from research, monitoring evaluation and review activity.
- The management system or fishery is attempting to comply in a timely fashion with judicial decisions arising from any legal challenges.

Here it is important to determine whether the decision-making processes actually produce measures and strategies, and is not the quality of the decisions themselves. Under the CR v1.3, the decision making must include international aspects if necessary. As the assessment has considered the possible roles of IATTC or a Peru-Ecuador bilateral agreement in the management of the stock, the decision making of these groups will affect the score of this performance indicator. As the harvest by Peru is substantially larger than the Ecuador harvest, decision making by IATTC or a bilateral agreement has the potential to impact directly on the delivery of P1 outcomes.

The 2009 RBF assessment pointed out a tendency for politically, rather than scientifically-based decisions – in part because scientific background and advice was inadequate. Ecuador typically used a top-down approach in which the minister made decisions. Industry often became involved through protests. Since the 2009 FIP workshop, Ecuador has established the Consejo Consultivo Recurso Dorado, which has responsibility for making decisions. The council could allow the fishery to meet the national portion of this performance indicator. The council has membership consisting of a variety of stakeholders, including the industry, and allows non-members of the council to participate. This system actively seeks information for use in the decision making. The Consultative Council has not yet met, but consultation with stakeholders occurs as needed to support decisions by VMAP; this was demonstrated by the wide-ranging consultation that occurred prior to the decision in 2011 to implement the current closed season for mahi mahi. To assure that the decision-making process complies with the

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MSC SG80 performance indicator *3.2.2(a) [There are **established** decision-making processes that result in measures and strategies to achieve the fishery-specific objectives*] requires documentation of the process. A clear explanation of the role of the Consultative Council and meetings with individual actors in decision-making, or a documented procedure for stakeholder consultations leading to a decision (as occurred for the 2011 mahi mahi seasonal closure), is required to assure a score of 80. The 2014 FIP participants agreed to a report on decision making and the Consultative Council by mid 2014.The international aspect does not yet occur, but could with either full management of mahi mahi under the Antigua Convention or an effective bilateral agreement with Peru.

Likely score: National - conditional pass; International - fail

3.3. 7 PI 3.2.3 Compliance and enforcement

The fishery should ensure that monitoring, control and surveillance mechanisms ensure the fishery's management measures are enforced and complied with. To meet the MSC Standard at the SG80 level, the fishery is required meet the following issues (FAM ver2.1):

- A monitoring, control and surveillance <u>system</u> has been implemented in the fishery under assessment and has demonstrated an ability to enforce relevant management measures, strategies and/or rules.

- Sanctions to deal with non-compliance exist, <u>are consistently applied</u> and thought to provide effective deterrence.

- <u>Some evidence</u> exists to demonstrate fishers comply with the management system under assessment, including, when required, providing information of importance to the effective management of the fishery.

- There is no evidence of systematic non-compliance.

The 2009 RBF assessment report pointed out that the number of enforcement agents was low but increasing; that actual enforcement is conducted by the Navy, which plays a small role in the fishery; that sanctions are inconsistently applied; and that the minimum size is inconsistently enforced. The effective components of MCS included the VMS system for motherships and enforcement of the requirements for fishing vessels to have permits. Observer coverage was limited. As the assessment has considered the possible roles of IATTC or a Peru-Ecuador bilateral agreement in the management of the stock, the compliance and enforcement capacity of these groups will affect the score of this performance indicator.

Since the 2009 FIP workshop, the number of enforcement agents (SRP Inspectors) has increased to 85 in 21 provinces, and enforcement has extended nationwide. Agents monitor offloading from vessels, including retention allowances during the closed season and minimum size measurements; make roadside checks; inspect distribution centers; and follow up on complaints. Sanctions seem highly effective. SRP has provided a document with enforcement activities that demonstrate a cohesive plan. The increased level of observer coverage provides a higher level of monitoring. The national activities largely meet the requirements for an 80 score. The international aspect does not yet

occur but could with either full management of mahi mahi under the Antigua Convention or an effective bilateral agreement with Peru.

Likely score: National - pass; International – conditional pass

3.3. 8 PI 3.2.4 Research plan

The fishery should have a research plan that addresses the information needs of management. To meet the MSC Standard at the SG80 level, the fishery is required meet two scoring issues (MSC CR):

- A <u>research plan</u> provides the management system with a strategic approach to research and <u>reliable and timely information</u> sufficient to achieve the objectives consistent with MSC's Principles 1 and 2.
- Research results are <u>disseminated</u> to all interested parties in a <u>timely</u> fashion.

In the 2009 RBF assessment, it was pointed out that INP and SRP did not coordinate to assure effective research. Since the 2009 FIP workshop, the two agencies have increased consultation, and held a national workshop for mahi mahi. The workshop reviewed and summarized existing information rather than looking at gaps and developing a strategy for ongoing research.

Considerable research has been undertaken within the past several years, but it was not clear how each component contributed towards a strategic plan for mahi. As such, it is proposed that a review of key information gaps to answer science and management questions about the fishery be undertaken and a review of all current and proposed research be undertaken to document how they address the information gaps. The action plan for mahi mahi is a good start in this. A strategic research plan should fill the requirements for scoring >80. The updated PAN-Dorado is expected to contain a research plan. Utilization of research results from Ecuador by IATTC and research activities by IATTC confirm that research activities address issues important to MSC principles 1 and 2.

Likely score: conditional pass

3.3. 9 PI 3.2.5 Management performance evaluation

An assessment of the fishery requires that there is a system for monitoring and evaluating the performance of the fishery-specific management system against its objectives and that there is effective and timely review of the fishery-specific management system. To meet the MSC Standard at the SG80 level, the fishery must have in place mechanisms to evaluate <u>key</u> parts of the management system and is subject to <u>regular internal</u> and <u>occasional external review</u> (CR v1.3):

In the 2009 RBF assessment, evidence showed that SRP had undertaken a review of the management system to identify ways to improve sustainability of the mahi mahi fishery. The evaluation was internal and *ad hoc*, but an improvement over previous administrations. Plans to put in place new fishery regulations, the improvements in fishery monitoring, and the research MOU demonstrated that internal review had taken place and resulted in management changes. Completion of the mahi mahi management

plan (PAN Dorado) provides a basis for evaluation whether the management system achieves the goals of the plan. Ecuador has implemented a process called Governance by Results (GBR), in which each governmental element must present the achievements expected on an annual basis, and then undergo a review of the progress against the expected results. The mahi mahi fishery has undergone this review. SRP provided a spreadsheet of GBR results that listed a series of indicators with target and achieved metrics. This is a useful first step in conducting performance reviews.

Section A.2.2 and Section A.2.3 of the PAN Dorado provide a detailed list of general objectives and responsibilities of the legal framework of fishery management of Ecuador. Section D.1 provides general and specific objectives for the mahi mahi fishery, which are discussed in further detail in Section D.2. These goals and objectives are considered the key parts of the management system. Internal and external review of the overall management system and of the mahi mahi fishery as specified in these sections would move the likely scores for MSC certification from less than 80 to 80 or higher.

Note that the international management, either through IATTC or a bilateral agreement with Peru, would also need management system review when implemented.

Likely score: National - pass; International - conditional pass

3.1.10 Summary of progress under P3

Based on the results generated so far from the range of FIP and related projects, including other sources of scientific literature, the current proposed status of the mahi mahi fishery towards the MSC Standard has been assessed against the original RBF assessment in the table below.

The 2009 RBF assessment report highlighted five PIs as a high priority and the remaining four PIs as a medium priority. Following a review of progress within the FIP Action Plan, the five high priority PIs have moved to a medium priority, two medium priority PIs moved to low, and two medium priorities remained unchanged. The current medium priorities for decision making, research plan, and management evaluation have clear plans in place that should move them to low priority over the next year. Three medium priority PIs, legal and customary framework, consultation, and long term objectives, will require actions by IATTC to move to low priority.

To help gauge the impact of the latest results from the FIP and related projects on the likely scoring of Principle 3, a range of alternative scenarios are shown in Table 4. This makes a number of important assumptions about the scoring of each performance indicator. Scenario A shows the likely progress has been made so far. Although four performance indicators have shown improvements over the past 12 months, it is important to note that this alone is not sufficient to pass the fishery (average score of 73).

Clearly, similar to P1 and P2, efforts must continue to ensure the highest possible score for each performance indicator to help ensure Principle 3 reaches the MSC Standard.

Table 7: Example of alternative scoring scenarios for Principle 3. Shaded boxes show differences in Performance Indicator scores between each scenario.

Performance Indicator			A	B	C
Governance and Policy	3.1.1	Legal/ Customary framework	≤60	70	80
	3.1.2	Consultation, rules and responsibilities	≤60	70	80
	3.1.3	Long term objectives	≤60	70	90
	3.1.4	Incentives for sustainable fishing	70	80	80
Fishery Specific Management System	3.2.1	Fishery specific objectives	70	80	90
	3.2.2	Decision making processes	≤60	70	85
	3.2.3	Compliance and enforcement	≤60	70	80
	3.2.4	Research plan	70	75	80
	3.2.5	Management performance evaluation	70	75	80
		Average	Fail	76	83

4 NEXT STEPS

To date, almost all fisheries that have successfully progressed to an MSC full assessment have been recommended for certification but with conditions set for continuing certification. These conditions may relate to operational and management functions. The client is then responsible for ensuring that these conditions are met within the required timescale. The client should therefore have authority, or have secured agreement with the relevant organizations, to enact potential conditions should certification be successful. This is important with an industry client, as the client would need confirmation of participation by the government agencies in the action plan. If the government (e.g., SRP) is the client, the participation comes standard.

Ecuador has achieved nearly all of the action steps over which it has control. Ongoing improvements as planned by SRP will help to increase some scores. Several steps would benefit from increased analysis or reporting, but the base of management and information is clearly there. The factors that prevent the mahi fishery from passing an MSC assessment fall in the international management arena. Although implementing international control lies beyond Ecuador's direct control, Ecuador has taken a positive position in dealing with Peru on a bilateral agreement, and with members of the IATTC to encourage further implementation of the Antigua Convention. The role of IATTC in putting on an international workshop and its stock assessment activities have shown that Ecuador has made important strides in fostering international management. Ecuador should continue an emphasis on establishing international control of the mahi mahi fishery.

Specific comments follow for the results needed for achieving passing scores of performance indicators with failing and conditional pass scores, or where stronger performance would provide a higher likelihood of passing:

1.1.1 Stock Status Stock status determination has not yet occurred, but the research on stock determination and plan for stock assessment put this indicator on the verge of completion. An interim step of using a conservative harvest strategy could satisfy the stock status requirement while the stock assessment occurs. Ecuador has collected data to allow determination of stock status. Application of the data using IATTC-recommended methods (e.g., 5-95 percentile) will make a good start but full pass requires a link to Bmsy (e.g., spawning potential ratio or length based methods).

1.1.2 Reference Points Reference points have not yet been determined, but the plan for assessment and management strategy evaluation (MSE) put this indicator on the verge of completion. Ecuador has collected data to allow determination of reference points. Application of the data using IATTC-recommended methods (e.g., 5-95 percentile) will make a good start but full pass requires a link to Bmsy (e.g., spawning potential ratio or length based methods).

1.2.1 Harvest Strategy Ecuador's harvest strategy has most of the elements needed, but does not reflect the state of the stock and cannot demonstrate effectiveness. This should occur along with the stock assessment and MSE.

1.2.2 Harvest control rules Harvest control rules that establish a decreasing exploitation rate as the limit reference point is approached requires stock assessment and reference points and should occur along with the stock assessment and MSE.

1.2.3 Information and Monitoring Ecuador provides good information, but other harvesting nations need to provide quality information.

1.2.4 Stock Assessment Several stock assessment methodologies designed for data deficient situations are available, but must link to Bmsy and allow calculation of target and limit reference points. An international workshop on mahi mahi discussed as an action item in the FIP would allow discussion of these methods and their application to reference points, harvest strategy, and control rules.

2.3.3 ETP Information and Monitoring Current information shows low interaction rates with sea turtles, but calculation of quantitative estimates must occur. Making these calculations would provide useful information on the confidence intervals of the estimates and the statistical power to determine differences. Information on whether smaller hooks increase catch rates of mahi mahi while maintaining low interactions with sea turtles would benefit the management strategy.

2.5.2 Ecosystem Management Strategy Ecuador has not presented a strategy designed to restrain impacts of the fishery on the ecosystem. Because the impacts on ecosystem structure and function seem small with the available information, this performance indicator should not require a complex strategy.

2.5.3 Ecosystem Information and Monitoring Information received during the RBF suggest low impacts on the ecosystem. SRP has collected substantial trophic data in recent years. A literature review combined with available data and the results of the RBF should provide adequate information.

3.1.1 Legal and Customary Framework Ecuador has demonstrated an effective framework for internal fisheries. An international mechanism to control the fishery is required. The Antigua Convention offers a framework, but mahi mahi has not come fully under IATTC management. Alternatively, an agreement with Peru could develop the framework. Discussions of this topic at an international meeting could advance the progress on international management.

3.1.2 Consultations, Rules, and Responsibilities Ecuador has demonstrated an effective consultation for internal fisheries. An international mechanism to the control the fishery is required. The Antigua Convention offers an opportunity for consultations, rules, and responsibilities, but mahi mahi has not come fully under IATTC management. Alternatively, an agreement with Peru could develop the framework.

3.1.3 Long Term Objectives The National Plans of Action for Shark and Mahi Mahi provide long-term objectives for the domestic management system. No comparable long-terms objectives are available for fishing in international waters. The Antigua Convention offers an opportunity for setting objectives, but mahi mahi has not come fully under IATTC management. Alternatively, an agreement with Peru could develop the objectives.

3.1.4 Incentives for Sustainable Fishing Ecuador has undertaken several steps to provide incentives for sustainable fishing. It is not clear what policies exist in Peru or other countries to avoid perverse incentives or to provide for positive incentives. This will need some review for a full assessment.

3.2.2 Decision-making Process The national decision-making occurs through the Consejo Consultivo Recurso Dorado, which has responsibility for making decisions. But this indicator would not score 80 or above until the council has met and demonstrated its effectiveness and until some demonstration that international decision-making occurs. The international aspect could occur with either full management of mahi mahi under the Antigua Convention or an effective bilateral agreement with Peru.

3.2.3 Compliance and Enforcement The national activities largely meet the requirements for an 80 score. The international aspect should occur with either full management of mahi mahi under the Antigua Convention or an effective bilateral agreement with Peru.

3.2.4 Research Plan A substantial amount of research has occurred in Ecuador. A strategic research plan needs documentation, as planned for the next update of PAN Dorado. Utilization of this management (or comparable) by IATTC under the Antigua Convention or through a bilateral Peru-Ecuador agreement would increase scores.

3.2.5 Management Performance Evaluation Governance by Results (GBR) requires each governmental element to present the achievements expected on an annual basis, and then undergo a review of the progress against the expected results. The mahi mahi fishery has undergone this review. SRP provided a spreadsheet of GBR results that listed a series of indicators with target and achieved metrics. PAN Dorado provides a

detailed list of general objectives and responsibilities of the legal framework of fishery management of Ecuador. These goals and objectives are considered the <u>key</u> parts of the national management system. The international aspect should occur with either full management of mahi mahi under the Antigua Convention or an effective bilateral agreement with Peru.

5   APPENDIX 1: LIST OF PARTICIPANTS
Delegate

NAME	INSTITUTION
JIMMY MARTINEZ (JM)	WWF
MOLKE MENDOZA AVILA	VMAP/SRP
PABLO GUERRERO (PG)	WWF
MANUEL DIAZ (MD)	INP
BOB TRUMBLE (BT)	MRAG Americas
VICTOR ALCIVAR ROSADO	VMAP/SRP
RAMÓN MONTAÑO C	VMAP/SRP
MIGUEL EDUARDO MACIAS	FENACOPEC
MARIUXY GARCÍA (MG)	VMAP/SRP
ADRIANA CEVALLOS (AC)	VMAP/SRP
GABRIELA ZAVALA	VMAP/SRP
CAROLINA SIERRA	VMAP/SRP
MANUEL PARRALES (MP)	VMAP/SRP
FRED SONDHEIMER	WWF
OSWALDO VELEZ	VMAP/SRP

6 APPENDIX 2: MEETING AGENDA

Fishery Improvement Project (FIP) Evaluation Workshop, of the Mahi Mahi Fishery of Ecuador.
Manta Host Hotel, 26th and 27th of March of 2014, in Manta, Ecuador.

Agenda
Vice Ministry of Aquaculture and Fishing Building
Avenida 4 entre calle 12 y 13
PBX +593 5 2611410
Manta, Ecuador
Wednesday 26th March 2014

8.45am – 8.55am	Welcoming Address from Ing. Ramón Montaño, Subsecretary of Fishing Resources
8.55am – 9.00am	Introductions of Attendees
9.00am – 9.15am	General FIP Mahi Introduction, Bob Trumble
9.15am – 9.45am	FIP Mahi Principle 1 MSC: Status of the Stock, Bob Trumble
9.45am – 10.00am	Stock Unit proposed for Certification, Mariuxy Garcia
10.00am – 10.15am	Break
10.15am – 11.30am	Progress and Workplan for Stock Assessment, Decision Rules and Determination of Management Reference Points, Jimmy Martinez
11.30am – 12.00pm	Reproductive and Growth Aspect, Jimmy Martinez
12.00pm – 13.00pm	Discussion of Principle 1
13.00pm – 14.00pm	Lunch
14.00pm – 14.30pm	Discussion of Principle 1
14.30pm – 15.00pm	FIP Mahi Principle 2 MSC: Ecosystem Aspects, Bob Trumble
15.00pm – 15.30pm	Design and Coverage of Observer and Inspector Programs, Adriana Cevallos
15.30pm – 15.45pm	Break
15.45pm – 16.30pm	Progress on Sea Turtle Bycatch Reduction: Circle Hooks, Ruben Caiche Floats, Equipment and Fishing Gear used by the Fishing Sector, Carolina Sierra
16.30pm – 17.00pm	Discussion of Principle 2
17.00pm	End of Day 1

Thursday 26th March 2014

8.30am – 9.00am	Progress Review
9.00am – 9.30am	FIP Mahi Principle 3 MSC: Management and Governance, Bob Trumble
9.30am – 10.15am	Progress and Options for International Collaboration in Mahi Science and Management, VMAP
10.15am – 10.45am	Mahi Fishery Control, Molke Mendoza, SRP
10.45am – 11.00am	Break
11.00am – 11.30am	PAN Dorado 2013: Decision-Making Processes and Internal and External Management Review, VMAP
11.30am – 13.00pm	Discussion of Principle 3
13.00pm – 14.00pm	Lunch
14.00pm – 15.30pm	Work-Plan Review, Bob Trumble
15.30pm	End of Workshop

<u>Invitees</u>
Vice Ministry of Aquaculture and Fishing
- Ing. Guillermo Morán Velásquez, Vice Minister of Aquaculture and Fishing
- Ing. Ramón Montaño Cruz, Subsecretary of Fishing Resources
- Biólogo Molke Mendoza, Director of Fishing Control
- Bióloga Mariuxy García Dominguez, Coordinator of PAN Dorado
- Ingeniera Gladys Cedeño Marcillo, Directorate of Artisanal Fishing
- Biólogo Victor Alcivar Rosado, Directorate of Policies and Fishery Management

National Fishing Institute
- Blgo Edwin Moncayo, INP Director

WWF
- MSc. Pablo Guerrero, Regional Fisheries Coordinator, WWF Ecuador
- Biólogo Jimmy Martínez, Fisheries Coordinator, WWF Ecuador
- Wendy Goyert, WWF US
- Fred Sondheimer, Marine Official, WWF Ecuador

MRAG Americas
- Dr. Bob Trumble

ASOEXPEBLA
- Juan Benincasa Azua