UNITED NATIONS UNIVERSITY

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IW:Science

Enhancing the use of Science in International Waters projects to improve project results

SYNOPSIS REPORT

LAKES

A global Synopsis of **Lakes** science and transboundary management

UNEP

GLOBAL ENVIRONMENT FACILITY 20 YEARS INVESTING IN OUR PLANET

GEF IW:Science Project

Synopsis Report of the Lakes Working Group

IW: Science, or *Enhancing the Use of Science in International Waters Projects to Improve Project Results* is a medium-sized project of the Global Environment Facility (GEF) International Waters (IW) focal area, implemented by the United Nations Environment Program (UNEP) and executed by the United Nations University Institute for Water, Environment and Health (UNU-INWEH). GEF ID Number: 3343.

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Synopsis Report of the Lakes Working Group

March 2012

This report is written as part of the IW:Science series of reports comprising a synopsis and analysis for each of five classes of global transboundary water system: River Basin, Lake, Groundwater, Land-based Pollution Sources, and Large Marine Ecosystems and Open Oceans. The findings and content of the Synopsis and Analysis Reports are then integrated into two IW:Science Synthesis Reports to provide a global water view with regard to *Emerging Science Issues and Research Needs for Targeted Intervention in the IW Focal Area*, and *Application of Science for Adaptive Management & Development and use of Indicators to support IW Projects*. All reports can be found on the IW:Science, UNU-INWEH, IW:LEARN and GEF websites.

This report was prepared under the responsibility of the IW:Science Core Partner and Lead Institution of the Lakes Working Group:

UNITED NATIONS UNIVERSITY
UNU-INWEH
Institute for Water, Environment and Health

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Cover photo: Floating islands of the Uru people on Lake Titicaca, located on the border of Peru and Bolivia it is the world's highest commercially navigable lake / *A. Dansie*

List of Acronyms and Abbreviations

ACRONYM	MEANING
ACP	AFRICAN, CARIBBEAN, AND PACIFIC
ACZM	ALEXANDRIA COASTAL ZONE MANAGEMENT PROJECT
BMP	BEST MANAGEMENT PRACTICES
CEP	CASPIAN ENVIRONMENT PROGRAM
DPSIR	DRIVING FORCES-PRESSURES-STATE-IMPACTS-RESPONSES FRAMEWORK
EU	EUROPEAN UNION
FREPLATA	ENVIRONMENTAL PROTECTION OF THE RIO DE LA PLATA AND ITS MARITIME FRONT: POLLUTION PREVENTION AND CONTROL AND HABITAT RESTORATION
FYR	FORMER YUGOSLAV REPUBLIC
GEF	GLOBAL ENVIRONMENT FACILITY
GIWA	GLOBAL INTERNATIONAL WATERS ASSESSMENT
GOGLME	GULF OF GUINEA LARGE MARINE ECOSYSTEM
ICLARM	INTERNATIONAL CENTER FOR LIVING AQUATIC RESOURCES MANAGEMENT
IW	INTERNATIONAL WATERS
LME	LARGE MARINE ECOSYSTEM
LTBP	LAKE TANGANYIKA BIODIVERSITY PROJECT
MRC	MEKONG RIVER COMMISSION
NAPS	NATIONAL ACTION PLANS
NBSAPS	NATIONAL BIODIVERSITY STRATEGIC ACTION PLANS
NGOS	NON-GOVERNMENT ORGANIZATION

ACRONYM	MEANING
NOWPAP	NORTHWEST PACIFIC ACTION PLAN
PEMSEA	PARTNERSHIPS FOR ENVIRONMENTAL MANAGEMENT FOR THE SEA OF EAST ASIA
PTS	PERSISTENT TOXIC SUBSTANCES
QA/QC	QUALITY ASSURANCE/QUALITY CONTROL
RENDR	REDUCTION OF ENTERPRISE NUTRIENT DISCHARGES PROJECT
SAP	STRATEGIC ACTION PLAN
SCS	SOUTH CHINA SEA
SEA START RC	SOUTHEAST ASIA START REGIONAL CENTER
SEAFDEC	SOUTH ASIAN FISHERIES DEVELOPMENT CENTER
SEAS	SPECIALIZED EXECUTING AGENCIES
SESS	SOCIO-ECONOMIC SPECIAL STUDY
SIDRP	STRATEGIC INFRASTRUCTURE AND DEVELOPMENT REFORM PROGRAM
SIDS	SMALL ISLAND DEVELOPING STATES
START	SYSTEM FOR ANALYSIS, RESEARCH, AND TRAINING
TDA	TRANSBOUNDARY DIAGNOSTIC ANALYSIS
UNDP	UNITED NATIONS DEVELOPMENT PROGRAMME
UNEP	UNITED NATIONS ENVIRONMENT PROGRAMME
UNU-INWEH	UNITED NATIONS INSTITUTE FOR WATER, ENVIRONMENT AND HEALTH
WB (IBDR)	WORLD BANK (INTERNATIONAL BANK FOR RECONSTRUCTION AND DEVELOPMENT)

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Appendix C	Thematic Reviews

CHAPTER ONE

Introduction: background, purpose, approach and limitations of this Synopsis Report

Enhancing the Use of Science in International Waters Projects to Improve Project Results is a GEF IW:Science project launched in 2009 covering the five main areas in the GEF International Waters portfolio: surface water; lakes; groundwater; large marine ecosystems; and deep oceans. A working group was formed to address each of these areas.

The project's objective is to enhance - through knowledge integration and information-sharing tools - the use of science in the GEF IW focal area to strengthen priority setting, knowledge sharing, and results-based, adaptive management in current and future projects. The project has three components:

1. Understanding and documenting, for future analysis and reference, the scientific experience and scientific best practices from the IW project portfolio.

2. Undertaking and reporting a comparative, cross-sectoral assessment of IW:Science, identifying intended users and impacts, contemporary scientific challenges, research and science-policy gaps, emerging issues, and global-scale impacts.

3. Creating an IW scientific learning network for information sharing and mutual learning among IW projects and with the wider water science community.

The first component consists of three main activities: (i) development of a project document database (by UNU-INWEH); (ii) review of the documents of relevant projects, with particular emphasis on extracting science; and (iii) analysis of the reviewed projects on the basis of a number of predefined core questions.

This Synopsis Report is the outcome of the second activity of the first component, as carried out by the Lakes Working Group. Its purpose is to provide a clear review of relevant transboundary projects dealing with lakes in the GEF portfolio as a basis for further analysis, thus contributing to the objective of the IW:Science project. Standardized templates were developed and used to conduct the reviews in a uniform way, allowing easy integration of information, both inside the set of projects and across the five water system types. The projects were assigned to reviewers (generally three to four projects per group member), and information was extracted to skeleton templates for the synopsis and analysis reports. The Synopsis Report relies on project documents contained in the IW:Science project documents database and additional information acquired by individual reviewers. Together, these sources form the basis of the report; however, an important limitation to note is the fact that for most projects it proved impossible to collect a reasonably complete set of reports. Another limitation resulted from uneven participation in the process. Reviews were much more thorough when people involved with the project actively participated in the process, but many people were not very active in their participation. This combined with the poor state of documents in some projects and the absence of science-based data in many types of reporting made a complete analysis impossible to achieve.

Detailed project reviews are presented in Appendix A.

1.1 Membership

Table 1 Summary of Lakes Working Group members

NATIONALITY/NAME	PROFESSIONAL TITLE & ADDRESS
KELLY MUNKITTRICK	CANADIAN RIVERS INSTITUTE, UNIVERSITY OF NEW BRUNSWICK, SAINT JOHN, NB, CANADA
GHEORGHE CONSTANTIN	ROMANIAN MINISTRY OF ENVIRONMENT, CLINCENI, ILFOV, ROMANIA
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ERIC ODADA	DEPARTMENT OF GEOLOGY, UNIVERSITY OF NAIROBI, NAIROBI, KENYA
OSCAR PARRA	UNIVERSIDAD DE CONCEPCIÓN, CONCEPCIÓN, CHILE
GEOFFREY PHILLIPS	MARSH HOUSE, ROTTEN MARSH, ACLE, NORWICH, UK
ROBERTO URRUTIA	UNIVERSIDAD DE CONCEPCIÓN, CONCEPCIÓN, CHILE
SERGEI RYANZHIN	INSTITUTE OF LIMNOLOGY, RUSSIAN ACADEMY OF SCIENCES, ST. PETERSBURG, RUSSIA
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Additional assistance with some reviews was provided by Philip Micklin (Western Michigan University, USA), Dietmar Keyser (Hamburg University, Germany), Lauri Arvola (University of Helsinki, Finland) and Walter Rast (Texas State University, USA), as well as several participants who had to withdraw from the activity.

CHAPTER TWO

Reviewed projects and available documentation

2.1 Summary of Projects

The Lakes Working Group was assigned a total of 58 projects, 88 per cent of which overlapped with the Rivers Working Group (Table 2): only four focused solely on lake environments. There was minimal communication to compare or discuss the overlap; those discussions will occur in the synthesis phase of the project. Appropriately at this stage, reviewers focused on the lake aspects of the reports. Table 3 provides a synopsis of reports, along with some of the documentation issues.

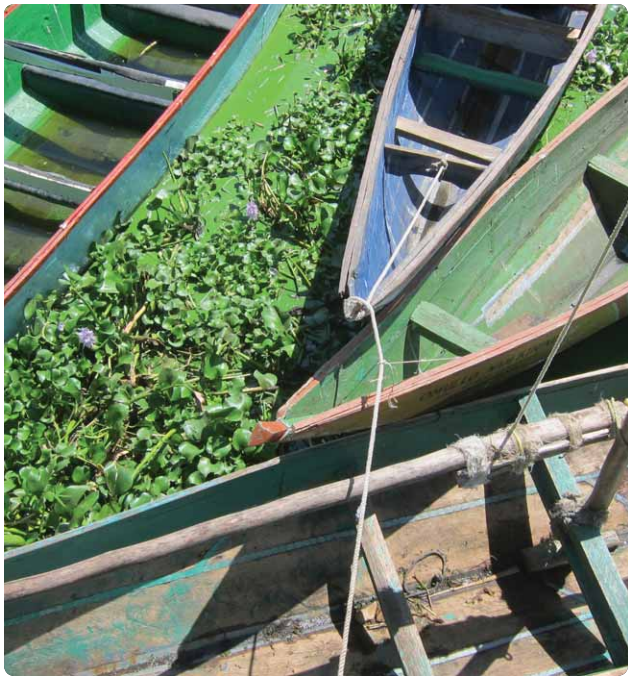
Table 2 Summary of projects assigned to the Lakes Working Group

WORKING GROUPS THAT PROJECT WAS ASSIGNED TO	NUMBER OF PROJECTS ASSIGNED
LAKES	4
LAKES, LBPS,	1
LAKES, LBPS, LME & OO	1
LAKES, LME & OO	1
LAKES, RIVERS	18
LAKES, RIVERS, LBPS	23
LAKES, RIVERS, LBPS, GW	1
LAKES, RIVERS, LBPS, LME &OO	5
LAKES, RIVERS, LBPS, LME & OO, GW	2
LAKES, RIVERS, GW	2

LBPS = Land-based Pollution Sources Working Group, LME & OO = Large Marine Ecosystems and the Open Ocean Working Group, GW = Groundwater Working Group, Rivers = River Basin Working Group, Lakes = Lakes Working Group

2.2 Distribution of projects – geographical and themes

The majority of the projects focused on Europe and Africa (Figure 1), with the most common themes related to eutrophication and nutrients (38 projects), management (37 projects), biodiversity (33), governance (30) and contaminants (28) (Figure 2). On average, each project dealt with at least six major themes, with most identified in the Mekong River (Project 615; 14 themes), Lake Manzala (Project 395; 12 themes), Dnipro Basin (Project 2544; 12 themes), Prespa Lakes (Project 1537; 11 themes), and the South China Sea (Project 885; 10 themes). A detailed breakdown of themes is shown in Table 4.



Eutrophication and increased nutrients in Lake Victoria cause algae blooms and encourage proliferation of the invasive water hyacinth, Kenya / *A. Dansie*

Table 3 Synopsis Survey (Project Review) and Documentation Issues

GEF #	PROJECT TITLE	AGENCY	STATUS	DOCUMENTS	ORIGINALLY RESPONSIBLE	GEOG REGION	CROSS-LINKAGES
88	Lake Victoria Environmental Management	IBRD	Poor summary available	>4000	Odada	Lake Victoria	Rivers
113	Lake Ohrid Management	IBRD	Complete	5	Phillips	Albania- Ohrid	Rivers
393	Water Pollution Control and Biodiversity Conservation in the Gulf of Guinea Large Marine Ecosystem (GOGLME)	UNDP	Relevant?	106		Gulf Guinea	Rivers LBPS LME Open
395	Lake Manzala Engineered Wetland Project	UNDP	Project completion or project closure	6	Rast	Egypt	
398	Pollution Control and Other Measures to Protect Biodiversity of Lake Tanganyika (LTBP)	UNDP	Ok	65	Ntakimazi	Burundi	
461	Determination of Priority Actions for the Further Elaboration and Implementation of the Strategic Action Programme for the Mediterranean Sea	UNEP	Removed	33	Phillips	Mediterranean	Rivers LBPS LME Open
583	Integrated Watershed Management of the Pantanal and Upper Paraguay River Basin (GEF Pantanal/Upper Paraguay Project)	UNEP	Project completion	14	Azevedeo	Paraguay	Rivers
584	Global International Waters Assessment (GIWA)	UNEP	Complete	102	Rast	International	Rivers LBPS LME Open GW
596	Addressing Transboundary Environmental Issues in the Caspian Environment Programme (CEP)	UNDP	Project Completion	87 documents;	Aladin + Rast	Caspian	Rivers

GEF #	PROJECT TITLE	AGENCY	STATUS	DOCUMENTS	ORIGINALLY RESPONSIBLE	GEOG REGION	CROSS-LINKAGES
613	Environmental protection of the Rio de la Plata and its Maritime Front: Pollution Prevention and Control and Habitat Restoration (FREPLATA)	UNDP	Removed	9, incl, SAP, TDA, TER	Azevedeo	Plata	Rivers LBPS LME Open
615	Mekong River Basin Water Utilization Project	IBRD	Complete	66	Navy	Mekong	Rivers LBPS LME
767	Reversal of Land and Water Degradation Trends in the Lake Chad Basin Ecosystem	UNDP	Under implementation or project completion	31	Ntakimazi	Chad	Rivers
806	Building Environmental Citizenship to Support Transboundary Pollution Reduction in the Danube: A Pilot Project in Hungary and Slovenia	UNDP	Ok	10	Constantin	Danube	Rivers
842	Environmental Protection and Sustainable Management of the Okavango River Basin	UNDP	Ok	76	Odada	Okavango	Rivers
885	Reversing Environmental Degradation Trends in the South China Sea and Gulf of Thailand (SCS)	UNEP	Complete	128	Choowaew	South China Sea	Rivers
1017	Partnership Interventions for the Implementation of the Strategic Action Programme (SAP) for Lake Tanganyika	UNDP	Ok	14	Ntakimazi	Tanganyika	
1074	Anatolia Watershed Rehabilitation Project - under WB-GEF Strategic Partnership for Nutrient Reduction in the Danube River and Black Sea	IBRD	Ok	8	Constantin	Danube	Rivers
1094	Nile Transboundary Environmental Action Project, Tranche 1	IBRD	Ok	36	Odada	Nile	Rivers
1123	Wetland Restoration and Pollution Reduction Project - under WB-GEF Strategic Partnership for Nutrient Reduction in the Danube River and Black Sea	IBRD	Ok	95	Constantin	Bulgaria	Rivers LBPS
1159	Agricultural Pollution Control Project - under WB-GEF Strategic Partnership for Nutrient Reduction in the Danube River and Black Sea	IBRD	Ok	84	Constantin	Danube	Rivers LBPS

GEF #	PROJECT TITLE	AGENCY	STATUS	DOCUMENTS	ORIGINALLY RESPONSIBLE	GEOG REGION	CROSS-LINKAGES
1351	Reduction of Nutrient Discharges - under WB-GEF Strategic Partnership for Nutrient Reduction in the Danube River and Black Sea	IBRD	Ok	16	Constantin	Hungary	Rivers LBPS
1353	Nature Conservation and Flood Control in the Yangtze River Basin	UNEP	Under Implementation	3	Jin	Yangtze	Rivers
1355	Agricultural Pollution Control Project - under WB-GEF Strategic Partnership for Nutrient Reduction in the Danube River and Black Sea	IBRD	OK	21	Constantin	Moldova	Rivers LBPS
1375	Reducing Transboundary Degradation in the Kura-Aras Basin	UNDP	Cancelled	14	Rast+Aladin	Aral	Rivers
1444	Development and Implementation of the Lake Peipsi/Chudskoe Basin Management Plan	UNDP	Project Completion	16, SAP not available	Aladin	Baltic	Rivers
1537	Integrated Ecosystem Management in the Prespa Lakes Basin of Albania, FYR-Macedonia and Greece		Complete	25	Phillips	Albania	Rivers
1580	Control of Eutrophication, Hazardous Substances and Related Measures for Rehabilitating the BLACK SEA Ecosystem: Phase 1	UNDP	Complete	13	Ryanzin	Black Sea	Rivers LBPS LME
1665	Towards a Lake Basin Management Initiative and a Contribution to the Third World Water Forum: Sharing Experiences and Early Lessons in GEF and non-GEF Lake Basin Management Projects	IBRD	TBD	31	Aladin	Aral	Rivers
2095	Sustainable Management of the Water Resources of the la Plata Basin with Respect to the Effects of Climate Variability and Change		Complete	3	Servos	Plata	Rivers
2098	Western Indian Ocean Marine Highway Development and Coastal and Marine Contamination Prevention Project		Removed	17	Ntakimazi		LME
2130	Restoration, Protection and Sustainable Use of the Sistan Basin	UNDP	Complete	5	Kidd	Sistan	Rivers LBPS GW

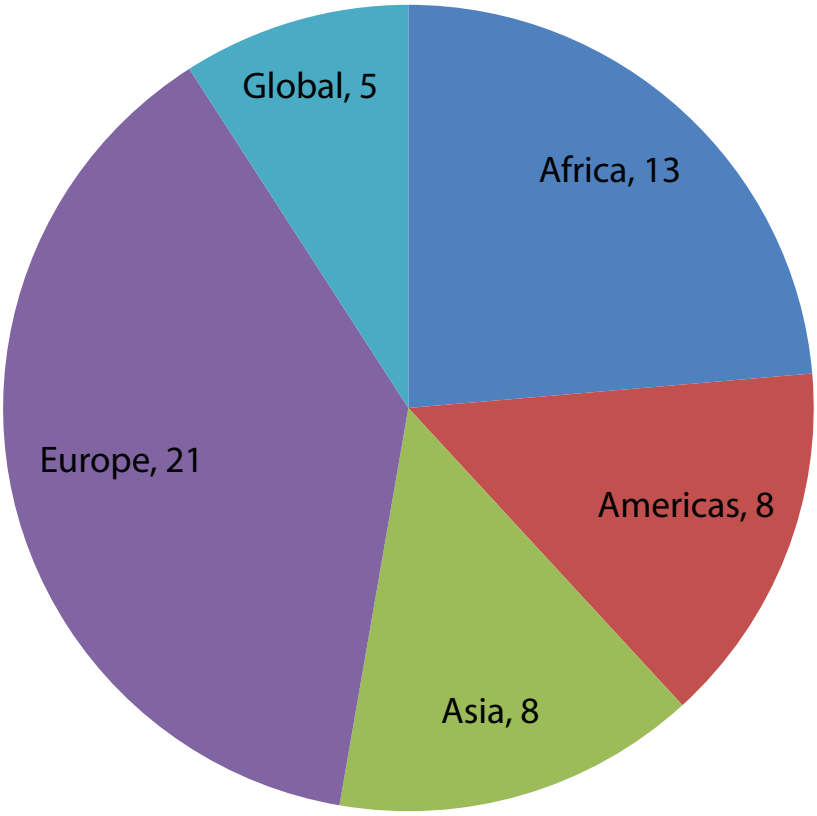
GEF #	PROJECT TITLE	AGENCY	STATUS	DOCUMENTS	ORIGINALLY RESPONSIBLE	GEOG REGION	CROSS-LINKAGES
2132	Bosnia: Integrated Ecosystem Management of the Neretva and Trebisjnica River Basin - under Investment Fund for the Mediterranean Sea LME Partnership		OK	18	Constantin	Danube	Rivers LBPS
2133	Lake Skader-Shkoder Integrated Ecosystem Management	IBRD	Complete	20	Phillips	Albania-Skadar	
2136	Igarape 40 Cleanup, Manaus *InterAmerican Development Bank; Interna-tional Bank for Reconstruction and Development (WB) Executing Agency Mexico National Water Commission	*	Dropped by GEF	1	Azevedeo	Manaus	Rivers
2141	Serbia: Reduction of Enterprise Nutrient Discharges Project (RENDR) (under the WB-GEF Investment Fund for Nutrient Reduction in the Black Sea/ Danube Basin)	IBRD	Complete	14	Kidd	Serbia	Rivers
2143	Water Quality Protection Project - under WB-GEF Strategic Partnership for Nutrient Reduction in the Danube River and Black Sea	IBRD	OK	21	Constantin	Danube	Rivers LBPS
2364	Integrated and Sustainable Management of Transboundary Water Resources in the Amazon River Basin Considering Climate Variability and Change	UNEP	Council Approved	27	Azevedeo	Amazon	Rivers LBPS
2405	Transboundary Diagnostic Analysis and Strategic Action Program Development for the Lake Victoria Basin	IBRD	Complete	9	Servos	L Victoria	Rivers
2540	Water Resources Management Project II - IWRM in the Lerma-Chapala-Santiago River Basin		Complete	2	Servos	Chile	Rivers
2544	Implementation of The Dnipro Basin Strategic Action Program for the reduction of persistent toxics pollution	UNDP	Complete	26	Ryanzin	Dnipro	Rivers LBPS
2584	Nile Transboundary Environmental Action Project, Tranche 2	UNDP	OK	28	Odada	Nile	Rivers
2602	Alexandria Coastal Zone Management Project (ACZM)		Removed	18			Rivers LBPS

GEF #	PROJECT TITLE	AGENCY	STATUS	DOCUMENTS	ORIGINALLY RESPONSIBLE	GEOG REGION	CROSS-LINKAGES
2722	Fostering a Global Dialogue on Oceans, Coasts, and SIDS, and on Freshwater-Coastal-Marine Interlinkages		Removed	59			Rivers LBPS LME Ocean
2760	East Asia Land-Based Pollution Reduction Investment Fund: The East Java Strategic Infrastructure and Development Reform Program (SIDRP)	IBRD	Not adequate	1 document (project description)	Choowaew	Java	Rivers LBPS
2961	Addressing Land-based Activities that Affect the Marine and Coastal Environment of the Northwest Pacific Region (NOWPAP)	IBRD	Ok	36	Nakayama	NW Pacific	Rivers LBPS
2970	Romania: Integrated Nutrient Pollution Control Project-under the WB-GEF Investment Fund for Nutrient Reduction in the Danube River and Black Sea	IBRD	Ok	9	Constantin	Romania	Rivers LBPS
3025	World Bank/GEF Partnership Investment Fund for Pollution Reduction in the Large Marine Ecosystems of East Asia (Tranche 1, Installment 2)	IBRD	Ok	11	Navy	E Asian Sea	Rivers LBPS
3128	Integrated Water Resources Management of the Sao Francisco River Basin and Its Coastal Zone (GEF São Francisco)	UNDP	CEO Approved	28	Azevedeo	Sao Francisco	Rivers LBPS
3148	Croatia: Agricultural Pollution Control Project - under the Strategic Partnership Investment Fund for Nutrient Reduction in the Danube River and Black Sea	UNDP World Bank	CEO endorsed or Project completion	38	Constantin	Croatia	Rivers LBPS
3181	Pollution Reduction through Improved Municipal Wastewater Management in Coastal Cities in ACP Countries with a Focus on SIDS	UNDP	CEO Approved	28	Navy	Pacific islands	Rivers LBPS
3309	Participatory Planning and Implementation in the Management of Shantou Intertidal Wetland	UNEP	Under Implementation	3	Jin	Shantou	Rivers LBPS
3341	Regional Dialogue and Twinning to Improve Transboundary Water Resources Governance in Africa	UNDP	CEO Approved	6	Rast	Africa	Riverss GW

GEF #	PROJECT TITLE	AGENCY	STATUS	DOCUMENTS	ORIGINALLY RESPONSIBLE	GEOG REGION	CROSS-LINKAGES
3342	Development of Methodologies for GEF Transboundary Waters Assessment	UNEP	PPG Approved	3	Rast		Rivers LBPS LME GW
3519	Reducing and Preventing Land-based Pollution in the Rio de la Plata/Maritime Front through Implementation of the FrePlata Strategic Action Programme		Removed	4			LBPS LME GW
3521	Joint Actions to Reduce PTS and Nutrients Pollution in Lake Baikal through Integrated Basin Management	UNDP	Council Approved	3	rumiantzev	Baikal	Rivers

* Inter-American Development Bank; International Bank for Reconstruction and Development (WB) Executing Agency Mexico National Water Commission

Figure 1 Distribution of projects referred to the Lakes Working group by geographic region



2.3 DPSIR framework

This report employs categories of activities consistent with the DPSIR framework:

- Driving forces of environmental change
  - Industrial production, urban development, agriculture
- Pressures on the environment
  - Discharges of waste water, fertilizer application
- State of the environment
  - Water quality in rivers, quality of eelgrass in estuaries
- Impacts on population, economy, and ecosystems
  - Loss of fishery, cultural activity, species, habitat
- Response of the society
  - Regulation, policies, BMP, integrated management.

Figure 2 Distribution of themes in the IW Lakes projects

Table 4 Fields of science and scientific themes covered by the reviewed projects

NAME	GEF #	BIODIVERSITY	CLIMATE CHANGE	CONTAMINANTS
		1	2	3
Lake Victoria Environmental Management	88	Y		
Lake Ohrid Management	113	Y		
Water Pollution Control and Biodiversity Conservation in the Gulf of Guinea Large Marine Ecosystem (GOGLME)	393	Y		Y
Lake Manzala Engineered Wetland Project	395	Y	Y	Y
Pollution Control and Other Measures to Protect Biodiversity of Lake Tanganyika (LTBP)	398	Y		Y
Determination of Priority Actions for the Further Elaboration and Implementation of the Strategic Action Programme for the Mediterranean Sea	461	Y		Y
Integrated Watershed Management of the Pantanal and Upper Paraguay River Basin (GEF Pantanal/ Upper Paraguay Project)	583	Y		Y
Global International Waters Assessment (GIWA)	584	Y	Y	Y
Addressing Transboundary Environmental Issues in the Caspian Environment Programme (CEP)	596	Y		Y
Environmental protection of the Rio de la Plata and its Maritime Front: Pollution Prevention and Control and Habitat Restoration (FREPLATA)	613	Y		
Mekong River Basin Water Utilization Project	615	Y	Y	Y
Reversal of Land and Water Degradation Trends in the Lake Chad Basin Ecosystem	767	Y		Y
Building Environmental Citizenship to Support Transboundary Pollution Reduction in the Danube: A Pilot Project in Hungary and Slovenia	806			Y
Environmental Protection and Sustainable Management of the Okavango River Basin	842			
Reversing Environmental Degradation Trends in the South China Sea and Gulf of Thailand (SCS)				

	CYANOTOXINS/ PHYTOPLANKTON	DAMS	DIVERSIONS	DREDGING	ECONOMICS	EUTROPHICATION/ NUTRIENTS	FISHERIES	FOOD WEBS	GOVERNANCE	HYDROLOGY/ WATER BALANCE	INVASIVE SPECIES	LAKE RESTORATION	MANAGEMENT	SOCIAL IMPACTS	WETLANDS
	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18
	Y					Y	Y				Y		Y		
						Y	Y		Y	Y					
						Y	Y						Y		
			Y		Y	Y	Y	Y				Y	Y	Y	Y
						Y	Y								
				Y		Y	Y			Y	Y				
						Y				Y			Y		Y
	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
							Y			Y			Y	Y	Y
					Y		Y						Y		
		Y		Y	Y	Y	Y	Y	Y	Y		Y	Y	Y	
					Y		Y		Y	Y	Y				Y
						Y			Y						
					Y				Y	Y					

NAME	GEF #	BIODIVERSITY	CLIMATE CHANGE	CONTAMINANTS
		1	2	3
	885	Y	Y	Y
Partnership Interventions for the Implementation of the Strategic Action Programme (SAP) for Lake Tanganyika	1017	Y		
Anatolia Watershed Rehabilitation Project - under WB-GEF Strategic Partnership for Nutrient Reduction in the Danube River and Black Sea	1074		Y	
Nile Transboundary Environmental Action Project, Tranche 1	1094			
Wetland Restoration and Pollution Reduction Project - under WB-GEF Strategic Partnership for Nutrient Reduction in the Danube River and Black Sea	1123	Y		Y
Agricultural Pollution Control Project - under WB-GEF Strategic Partnership for Nutrient Reduction in the Danube River and Black Sea	1159			Y
Reduction of Nutrient Discharges - under WB-GEF Strategic Partnership for Nutrient Reduction in the Danube River and Black Sea	1351	Y		
Nature Conservation and Flood Control in the Yangtze River Basin	1353	Y	Y	
Agricultural Pollution Control Project - under WB-GEF Strategic Partnership for Nutrient Reduction in the Danube River and Black Sea	1355			Y
Reducing Transboundary Degradation in the Kura-Aras Basin	1375	Y	Y	Y
Development and Implementation of the Lake Peipsi/Chudskoe Basin Management Plan	1444			
Integrated Ecosystem Management in the Prespa Lakes Basin of Albania, FYR-Macedonia and Greece	1537	Y		Y
Control of Eutrophication, Hazardous Substances and Related Measures for Rehabilitating the BLACK SEA Ecosystem: Phase 1	1580	Y		Y
Towards a Lake Basin Management Initiative and a Contribution to the Third World Water Forum: Sharing Experiences and Early Lessons in GEF and non-GEF Lake Basin Management Projects	1665			
Sustainable Management of the Water Resources of the la Plata Basin with Respect to the Effects of Climate Variability and Change	2095	Y	Y	
Western Indian Ocean Marine Highway Development and Coastal and Marine Contamination Prevention Project	2098			Y

	CYANOTOXINS/ PHYTOPLANKTON	DAMS	DIVERSIONS	DREDGING	ECONOMICS	EUTROPHICATION/ NUTRIENTS	FISHERIES	FOOD WEBS	GOVERNANCE	HYDROLOGY/ WATER BALANCE	INVASIVE SPECIES	LAKE RESTORATION	MANAGEMENT	SOCIAL IMPACTS	WETLANDS
	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18
					Y		Y	Y	Y	Y		Y	Y		
						Y			Y						
						Y				Y			Y	Y	
						Y			Y	Y	Y		Y	Y	Y
						Y				Y		Y			
						Y			Y				Y	Y	
				Y		Y									Y
		Y			Y					Y					
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	Y					Y	Y		Y	Y	Y		Y	Y	Y
						Y	Y		Y		Y		Y		Y
		Y			Y	Y				Y					Y
					Y		Y						Y		

NAME	GEF #	BIODIVERSITY	CLIMATE CHANGE	CONTAMINANTS
		1	2	3
Restoration, Protection and Sustainable Use of the Sistan Basin	2130			
Bosnia: Integrated Ecosystem Management of the Neretva and Trebisjnica River Basin - under Investment Fund for the Mediterranean Sea LME Partnership	2132			Y
Lake Skader-Shkoder Integrated Ecosystem Management	2133	Y		Y
Igarape 40 Cleanup, Manaus	2136			Y
Serbia: Reduction of Enterprise Nutrient Discharges Project (RENDR) (under the WB-GEF Investment Fund for Nutrient Reduction in the Black Sea/Danube Basin)	2141			
Water Quality Protection Project - under WB-GEF Strategic Partnership for Nutrient Reduction in the Danube River and Black Sea	2143			
Control of Eutrophication, Hazardous Substances and Related Measures for Rehabilitating the Black Sea Ecosystem: Tranche 2	2263			
Integrated and Sustainable Management of Transboundary Water Resources in the Amazon River Basin Considering Climate Variability and Change	2364	Y	Y	
Transboundary Diagnostic Analysis and Strategic Action Program Development for the Lake Victoria Basin	2405	Y		Y
Water Resources Management Project II - IWRM in the Lerma-Chapala-Santiago River Basin	2540	Y		Y
Implementation of The Dnipro Basin Strategic Action Program for the reduction of persistent toxics pollution	2544	Y		Y
Nile Transboundary Environmental Action Project, Tranche 2	2584	Y		Y
Alexandria Coastal Zone Management Project (ACZM)	2602	Y		Y
Fostering a Global Dialogue on Oceans, Coasts, and SIDS, and on Freshwater-Coastal-Marine Interlinkages	2722			
East Asia Land-Based Pollution Reduction Investment Fund: The East Java Strategic Infrastructure and Development Reform Program (SIDRP)	2760	Y		Y
Addressing Land-based Activities that Affect the Marine and Coastal Environment of the Northwest Pacific Region (NOWPAP)	2961			

	CYANOTOXINS/ PHYTOPLANKTON	DAMS	DIVERSIONS	DREDGING	ECONOMICS	EUTROPHICATION/ NUTRIENTS	FISHERIES	FOOD WEBS	GOVERNANCE	HYDROLOGY/ WATER BALANCE	INVASIVE SPECIES	LAKE RESTORATION	MANAGEMENT	SOCIAL IMPACTS	WETLANDS
	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18
			Y		Y		Y		Y					Y	Y
		Y			Y	Y	Y						Y		Y
		Y					Y			Y					
						Y			Y				Y	Y	
						Y			Y				Y	Y	
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				Y	Y	Y			Y	Y			Y	Y	Y
									Y				Y		

NAME	GEF #	BIODIVERSITY	CLIMATE CHANGE	CONTAMINANTS
		1	2	3
Romania: Integrated Nutrient Pollution Control Project-under the WB-GEF Investment Fund for Nutrient Reduction in the Danube River and Black Sea	2970			
World Bank/GEF Partnership Investment Fund for Pollution Reduction in the Large Marine Ecosystems of East Asia (Tranche 1, Installment 2)	3025			
Integrated Water Resources Management of the Sao Francisco River Basin and Its Coastal Zone (GEF São Francisco)	3128	Y		
Croatia: Agricultural Pollution Control Project - under the Strategic Partnership Investment Fund for Nutrient Reduction in the Danube River and Black Sea	3148			Y
Pollution Reduction through Improved Municipal Wastewater Management in Coastal Cities in ACP Countries with a Focus on SIDS	3181			
Participatory Planning and Implementation in the Management of Shantou Intertidal Wetland	3309			
Regional Dialogue and Twinning to Improve Transboundary Water Resources Governance in Africa	3341	Y	Y	
Development of Methodologies for GEF Transboundary Waters Assessment	3342			
Reducing and Preventing Land-based Pollution in the Rio de la Plata/Maritime Front through Implementation of the FrePlata Strategic Action Programme	3519	Y		
Joint Actions to Reduce PTS and Nutrients Pollution in Lake Baikal through Integrated Basin Management	3521	Y		Y
Lake Victoria Environmental Management	88	Y		
Lake Ohrid Management	113	Y		
Water Pollution Control and Biodiversity Conservation in the Gulf of Guinea Large Marine Ecosystem (GOGLME)	393	Y		Y

	CYANOTOXINS/ PHYTOPLANKTON	DAMS	DIVERSIONS	DREDGING	ECONOMICS	EUTROPHICATION/ NUTRIENTS	FISHERIES	FOOD WEBS	GOVERNANCE	HYDROLOGY/ WATER BALANCE	INVASIVE SPECIES	LAKE RESTORATION	MANAGEMENT	SOCIAL IMPACTS	WETLANDS
	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18
						Y			Y				Y	Y	
						Y	Y		Y				Y		Y
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						Y	Y						Y		

CHAPTER THREE

Selected issues across the set of reviewed projects

3.1 Projects that have demonstrated significant and successful scientific components

Reviews revealed many science-driven lessons and experiences (e.g. Lake Victoria, Project 88), but in many cases the definition of "science" is fairly relaxed or is focused on monitoring rather than management. Several factors contribute to completion of significant and successful scientific components, including clarity of the issue. Project 596 focused on environmentally sustainable development and management of the Caspian environment, including living resources and water quality, so as to obtain the greatest long-term benefits for human populations of the region, while protecting human health, ecological integrity, economic and environmental sustainability for future generations.

Clarity of the target was important. The objective of Project 1355 was to significantly increase use of environmentally friendly agricultural practices by farmers and agro-industry in Moldova, so as to reduce nutrient discharges from agricultural sources to the Danube River and Black Sea. Project 806 included an objective to ensure public access to environmental information and encourage public participation to support reduction of transboundary pollution from discharge of nutrients and toxics into the Danube River.

Completion of a comprehensive TDA that adequately collected and synthesized existing information was an important component, as were certain aspects of project design, including use of appropriate replicates, baseline, and temporal and spatial representation. Projects were more successful if they focused on basin-level scientific analyses, reviews and assessments, set achievable and measureable targets, and separated the technical and political influences on scientific design. Sometimes this required that sites were selected and limited to focus investment (Project 2113). It was important that these external processes of political influence took place in a parallel process with eventual interface; also, that the scientific design not be unduly influenced by the politics, but remain objective.

Other typical components of study design were important, especially consistency in sites and in measurements and analytical methods. Complicating factors that influenced site selection included an uneven distribution of biodiversity associated with existing stressors; fragmented approaches that lacked coordination and consistency; and failure to consider appropriate timeframes for detecting changes, potential recovery, or influence of mitigation. Lake location within the watershed also influenced study design; for instance, it was important to consider whether the lake was positioned terminal versus headwater versus mid-basin.

The role of science in project design is considerable and significant, particularly in such spheres as estimation of current environmental, geographic, and socio-economic situations in the Dnipro River Basin (Project 2544). Many scientific issues are involved in project design. The most important are cleaner production methodologies, including pollution hot spots methodology; and transboundary monitoring issues, including chemical pollution, modification of ecosystems or ecotones, decreased viability of biological resources due to contamination and diseases, modification of the hydrological regime, eutrophication, and pollution by radio nuclides. Studies that incorporated a pilot-scale experiment had an increased chance of success, as did those with a rigorous scientific peer review process, regular meetings, and workshops to build proposals. In some cases, problems could be quite complex. In Projects 2405 and 88 (Lake Victoria) for example, results showed that the problem in the lake was associated with activities in the catchment, and with atmospheric deposition; moreover, intro-

duction of Nile perch was an ecological disaster, leading to an ecological cascade with implications on economy and society.

The peer-review process benefited from competition and evaluation of ideas and scientific thoughts during development of the project, a representative balance between local and international scientists, and a commitment to regular review and peer scientific review during data collection. In many studies, there was a goal of equilibrium and balanced participation among governmental, scientific and NGO influences. Projects benefited from involvement of public stakeholders in monitoring and implementation, and a process that included a commitment to public engagement, acceptance and uptake of recommendations.

The likelihood of project success was increased by the presence of trained staff with adequate equipment and analytical capabilities, engagement of a mix of international and local scientists as needed, use of competitive science processes, commitment to best available approaches, and completion of data analysis, made widely accessibility within a reasonable time frame.

Projects were considered successful if they achieved goals, transferred training and technology successfully to local agencies, incorporated social and economic factors and analysis in design, ensured public communication, reports and scientific review, and influenced policies and decision- making (national and regional strategic action plans).

Projects were generally too focused on understanding natural systems at the expense of social systems, and there was inadequate discussion or consideration of trade-offs. Several good approaches to understand/assess the coupling of social and ecological systems were apparent: for instance, Projects 2405 and 88 (Lake Victoria)

Socio-economic aspects are part of GEF interventions on the African Great Lakes, firewood collection, Kenya / *A. Dansie*

conducted sociological studies on impacts of livelihoods (such as erosion linked to firewood collection) and found that there was an influence of global trade on health outcomes. Lake Tanganyika studies (Project 398) conducted a Socio-Economic Special Study (SESS) focused on livelihood strategies that are complex and dynamic and lead to vast differences between poor and wealthy populations. Subsistence farming and fishing communities are some of the poorest communities in some of the world's poorest countries. SESS believes that unsustainable fishing efforts and agricultural practices are the result of poverty, underdevelopment and a lack of alternatives

among people living around the lake; also, that a self-perpetuating circle persists wherein poverty leads to continuing environmental degradation, the degraded natural resource base is then less able to support life, which, in turn, perpetuates poverty.

Examples of influences that outlived the projects include spinoff impacts on basin development planning, training to improve management (Project 3185), ongoing monitoring, and establishment of basin-wide databases. Some projects worked hard to establish national databases (Project 885 established seven national databases for four habitats, mangroves, coral reefs, seagrass, and wetlands, plus one on the important issue of land-based pollution), and performed national-level scientific analyses, reviews, and assessment of supportive and assimilative capacity of sensitive ecosystems and transboundary movements of contaminants (as within the South China Sea, Project 885).

Lessons learned from case studies around the world and from previous course deliveries, and building on the work of projects such as the Partnerships for Environmental Management for the Sea of East Asia, (PEMSEA) were used to design the new training program (Project 3181).

3.2 Significant natural and social science findings

A number of common issues in terms of strengths and weaknesses of GEF projects relate to natural and social science findings. A great number of publications and technical papers have been produced, presenting significant natural and social science findings, and these can be used as baseline data and information for comparison and trends analysis, for policies formation, and for development planning. Significant natural and social science findings are included in Project 615 (Mekong River Basin Water Utilization) that concern water quality assessment in the Lower Mekong Basin: for example, biomonitoring of the Lower Mekong River and selected tributaries from 2004 to 2007; impacts of introductions and stocking of exotic species in the Mekong Basin and policies for their control; fish migration of the Lower Mekong River Basin; financial analysis and risk assessment of selected aquaculture and fishery activities in the Mekong Basin; and freshwater aquaculture in the Lower Mekong Basin. Project 885 (South China Sea and Gulf of Thailand) is an excellent example providing substantive natural scientific and social science findings, information, and outputs on various aspects of key important coastal habitats of the South China Sea and the Gulf of Thailand. Results of socio-economic, ecological and sectoral root cause analysis, in conjunction with an evaluation of the extent to which problems are transboundary in either origin or effects, have been used as a basis for designing sustainable fisheries practices.

Management of the Mekong requires significant social and natural science understandings / *A. Dansie*

Project 1159 (Agricultural Pollution Control in the Danube River and Black Sea) was aimed at increasing significant use of environmentally-friendly agricultural practices in the project area, thereby reducing nutrients from agricultural sources in Romania to the Danube River and Black Sea. Social surveys carried out during the project indicated that most households would not be able to afford individual bunkers and therefore government grants were necessary for uptake. Results of surveys conducted along the Caspian Sea to determine stakeholders' attitudes to environmental initiatives and their own requirements (Project 596 – Transboundary Environmental Issues in the Caspian Environment) have been used to guide priorities of the Caspian Environmental Programme (CEP). The project also made several predictions about why particular events

were occurring in the Caspian Sea, such as the decline in fish stocks and the increasing rate of desertification in the surrounding land. These predictions might easily be translated into hypotheses that could direct efforts toward environmental improvement.

A number of GEF projects (for example, Project 615 – Mekong River Basin Water Utilization and Project 885 – South China Sea and Gulf of Thailand) work on a multidisciplinary basis with close integration of related issues and components: i.e., strong links among important wetland ecosystems, fisheries, socio-economics, land uses (forest covers and agricultural uses), land-based pollution, legal issues, water quality, environment, human health, nutrition, hydropower, and many others. A variety of projects addressed the impacts of competition for resource uses; for example, how water abstraction for economic activities, particularly irrigated farming, has become unsustainable and now exceeds the carrying capacity of the region's ecosystems. Project 584 – Global International Waters Assessment (GIWA) considers impacts of freshwater shortage, pollution, and habitat modification in the Aral Sea within the Amudarya and Syrdarya basin and also considers impacts of global change, including modification of stream flow, pollution of water supplies, changes in the water table, pollution, changes to the Aral Sea ecosystem, changes to the wetland ecosystem, and changes in the hydrological cycle. There were also cases where recent rates of sediment deposition entering the lake have increased dramatically over historical rates of input (such as Project 398 – Pollution Control and Other Measures to Protect Biodiversity of Lake Tanganyika), as result of deforestation and agricultural practices in the catchment, resulting in increases of nutrient and organic matter input to the lake.

Many GEF projects, however, still need more linkages between natural science (e.g. changes in land uses, increases of sedimentation rates, resource uses conflicts especially competition between water needs and between water management and agricultural practices), and social science (e.g. changes in rates of employment), and increased focus on regional issues in order to use key findings to develop good monitoring systems for specific issues. Multiple stressors were often used as examples of stresses to ecosystems, but only in reference to the incremental impacts on societal development/poverty alleviation and the linkages of continued environmental degradation to poverty (Project 1094 – Nile Transboundary Environmental Action and Project 398 – Pollution Control and Other Measures to Protect Biodiversity of Lake Tanganyika). Often, it is the poor who are most directly dependent on natural resources and who are also most often unable to manage these resources over the long term because of their need to meet urgent short-term needs. Even when there is a good understanding of the long-term benefits, the poor usually cannot afford to sacrifice short-term benefits. However, multiple stressors are not always explicitly recognized, including linkages to land issues, or potential impacts of dams on responses of river to siltation from deforestation. The major issues that prevented recognition of multiple stressors included lack of adequate knowledge and expertise in different stressors, lack of baseline data to identify stressors, inability to focus on long range or long term stressors (e.g. transboundary issues, climate change, atmospheric deposition, better water management and agricultural practices that could increase food production in one area while preserving important ecological features downstream, such as in Project 1094 – Nile Transboundary Environment Action), lack of coordination across sectors, funding limitations, time constraints, social and cultural constraints, jurisdictional issues, infrastructure limitations, conflicts of interests between different political sectors or the participating agencies, and inertia or reluctance to change.

Successful projects often included demonstration projects and incorporated training programs for stakeholders and monitoring personnel, as well as education programs for decision-makers. In the most successful projects, science outputs helped provide the foundation for guidelines, objectives, and standards and were incorporated into basin development planning processes.

3.3 Unique research, monitoring and assessment issues

There were several issues common to a number of IW projects when it came to conducting effective research, monitoring and assessment. They include an absence of baseline data on the system; a lack of pristine areas for study and comparison; a need for more rigorous study designs and regular effective evaluation of project deliverables; and ongoing challenges related to a lack of regional infrastructure. In addition, there were some project-specific issues that hindered the success of IW activities, including long-range transport and deposition

and effects on water quality, unique system characteristics that make affecting short term change difficult, and challenges with the political will in the region.

Some IW projects were less effective than they could have been because of the absence of baseline data or appropriate reference sites. Without historical baseline data, it was not possible to examine trends in water quality and inappropriate endpoints were sometimes included. For example, for the Lake Skadar/Shkoder (Project 2133) project, there was a lack of scientific rigour in the project because of severely limited baseline data. It was not possible to substantiate the project claim that the data seemed to show no decline in lake water quality since the 1980s, nor the recommendation for further analysis of the phytoplankton community. The latter may not be necessary (or appropriate) under the circumstances given that eutrophication does not seem to be an issue for this system. Similarly, pristine areas or ecosystems may not be available to include in these studies. These unimpacted areas would provide a picture of the natural status of ecosystems in the region and substantiate water quality targets for impacted systems.

Rigorous study designs are critical to the overall success of IW projects and careful consideration of sampling locations is very important. For example, Project 398 conducted extensive biodiversity studies on Lake Tanganyika. Although some species were widespread throughout the lake, others had very localized distributions and would have been missed with a less intensive study design. Some a priori knowledge of the distribution and interconnectedness of habitats is critical to the success of biodiversity projects. Similarly, it is critical to consider threatened or endangered species in the design of IW projects. In some projects, hypotheses were developed initially but never rigorously tested (e.g. Project 398 – Lake Tanganyika, examining how human activities are affecting biodiversity).

An issue common to several IW projects was a lack of local infrastructure (equipment, institutions, legal framework) to support the project and continue the baseline monitoring after it ends. As a result, long-term sustainability of the IW initiatives was not possible. It was emphasized that there is a need to consider post-project phases in infrastructure development and ensure that training is targeted towards what will be needed after the IW project is over. As an example, for Lake Tanganyika (Project 398) it was strongly recommended that training of national experts not be limited to the "immediate needs of the special studies". The need for expertise, and the number of experts needed, in the post-project phase should also be considered. Similarly, investments in equipment should be made with the post-project needs in mind, and not solely to meet the objectives of the project. Finally, there were issues with the operation and maintenance of websites and databases (e.g. South China Sea, Project 885) to facilitate knowledge exchange and communication between participants and stakeholders. For Project 398, the lack of data sharing made it difficult for decision makers to exploit the findings.

There are also unique, site-specific issues to be taken into account. In some projects, (i.e., Lake Victoria Project 88 and South China Sea Project 885) there were significant influences affecting the systems that were outside the scope of the projects. As a result, key drivers related to declines in water quality were not examined. More specifically, atmospheric deposition was a main driver of changes to water quality of Lake Victoria but this was not addressed. Similarly, regional priorities in the South China Sea did not deal with transboundary water-related problems and concerns. However, some projects were very effective at identifying drivers of change. For example, in Lake Tanganyika (Project 398), drivers of change were largely within the boundaries of the lake's watershed; the drivers were immediate and examined via the expected changes in the lake from increasing human use, including increased sediment loads from runoff and discharge of industrial and municipal waste. The value of ecosystems because of the services they provide (maintaining diversity, improving water quality) is difficult to assess and communicate. Also, the history of a region is critical to take into consideration during an IW project. For example, future plans for the Aral and Caspian Seas must consider the historical context of the region.

Another unique set of challenges relates to the characteristics of the systems under study. Lake Victoria (Projects 2405 and 88) has a long water residence (renewal) time. There were concerns, therefore, that mitigation measures may take a considerable amount of time to have an effect and allow the lake to recover. There were also concerns that some research results were not analyzed and, with the exception of fisheries, not effectively fed back into management. Similarly, there was some feedback from the project that the science was not targeted at management issues and was not translated into a form of use to the management community.

The political climate of a region also affects the success of IW projects and implementation of their recommendations. Achieving improvement in water quality of lakes requires governments to enforce new practices and monitor progress. In these instances, a lack of political will reduces the effectiveness of implementing, monitoring and regulating changes in practices, as well as limiting any coordination across government sectors. In the project on the Nile (Project 1094), regional cooperation in achieving goals and maintaining a sustainable ecological state was critical. There can also be inconsistencies or a lack of congruence between scientific needs and those of the political community, and between different governments in the IW project region. Security within areas of the IW project can also affect the ability to collect data. Indeed, some areas were dangerous for sampling and, as a result, no data were collected in those locations of Lake Tanganyika (Project 398, near Burundi). A similar situation occurred with Lake Okavango (Project 842). In some IW projects, there were problems right at the beginning with project start-up, negotiation and administration (Projects 2405 and 88 – Lake Victoria). For Lake Tanganyika (Project 398), initial project contracts and documents were not rigorously developed nor were the contents of these documents widely shared among participating institutions. This led to a lack of common understanding and focus and an inability to monitor progress. Challenges can also arise because a transfer of responsibility is needed after the IW project is over. For example, for Lake Tanganyika (Project 398) the institutions responsible for future monitoring were not those that were involved in the project. For this reason, a plan should have been prepared and implemented to involve future custodians of monitoring earlier in the process. Similarly, the progress report from this project recommended that "*some of the present mandates should be modified (for technical, economic or practical reasons or for specific reasons in relation to the needs of the management of the Lake), there should be taken initiatives to make the necessary institutional (and statutory) changes.*" Finally, industrial development in a region and its economic benefits can override the benefits obtained or affect local decisions made about implementing recommendations from IW projects.

3.4 Lakes are susceptible to ecological external drivers that may not be recognized

There are external drivers affecting the lacustrine watershed that have not been routinely considered. Some of the factors that should be included in this type of study are long-range transport of nutrients, contaminants, climate change, land use changes, and the potential influences of population growth. Examples of these were included in Project 398 – Tanganyika. Sediment input into Lake Tanganyika is a real threat to the lake's biodiversity and the sustainability of livelihoods that depend on the production of the lake. Plans for interbasin transfers and diversions, including catastrophic anthropogenic plans for irrigation, can have a profound influence on lake environments.

Natural disasters (earthquake, hurricanes, floods, etc.), climate, and invasive species are a few of the other factors to be considered; for instance, in Project 596 climatic variation was mentioned repeatedly as a factor that contributes to water levels. It is also very important to consider economic state, changes in commercial demands for products, changing markets, etc., as well as political changes and security, and how they may influence the development of projects.

Fishermen at work on Lake Buyo, Côte d'Ivoire / *UN Photo, K. Chung*

CHAPTER FOUR

Role of science within projects

4.1 Project aims and objectives

Broadly, the diversity of project aims and objectives can be categorized as follows: increasing and sharing knowledge, providing planning tools and capacity development, and catalyzing management. Knowledge-oriented studies were used to provide a baseline on the water environment, to share or provide tools for monitoring and assessment (such as in Project 398 - Lake Tanganyika), to identify critical aspects for conservation, or to provide the scientific background for long term monitoring and assessment. In more developed studies, attempts were made to generate models to predict change, or to provide innovative solutions (pilot projects), or to evaluate alternative development scenarios. Capacity-building initiatives focused on developing infrastructure or training programmes to enhance national capacities for participating in transboundary groups (Project 1537- Lake Prespa); educating local stakeholders in relevant issues; and creating an environmentally-friendly thinking of local decision-makers.

Management needs were addressed through development of transboundary science and political networks (such as in Project 885 – South China Sea), or monitoring programs (Project 2544 – Dnieper River); enhancing the capacity of the participating governments to integrate environmental considerations into national development planning; increasing the understanding of the ecological system to help guide future development for the area; developing best management practices; and improving forecasting of the impacts of different development options. Project 615 – Mekong River assisted the Mekong River Commission to establish mechanisms to promote and improve coordinated and sustainable water management in the Mekong Basin. These mechanisms included reasonable and equitable water utilization and water quality management by the countries of the basin; and protection of sensitive ecological systems including wetlands, flooded forests and the estuary system that support globally significant biodiversity. There were also projects that focused on transboundary cooperation to conserve and protect natural resources and biodiversity (e.g. Project 615 – Lake Ohrid).

The better projects evaluated and developed some understanding of economic and social consequences of decisions, sought to balance local, national and international benefits, and underlined connections between causes and problems.

4.2 Science outputs

High quality science is essential to the credibility of all GEF projects. Past GEF projects have produced a wide variety of science outputs, including new knowledge, technological innovation, database development, governance models, and increased scientific capacity. A key output is development of a local and regional scientific capacity that will allow sustainability of the GEF investment. Science networks and partnerships established by GEF projects will be important to future development and application of science outputs.

In many cases, science outputs were integrated and incorporated into National Action Plans (NAPs) for habitat sub-components, as well as into the National Biodiversity Strategic Action Plans (NBSAPs). Demonstration projects were a powerful tool to communicate and disseminate results from the projects.

Results have been applied in a variety of ways, such as in basin development planning processes (e.g. Project 615). The Coral Sea Project established seven national databases for four key habitats (mangroves, coral reefs, seagrass, and wetlands) and one on the important issue of land-based pollution. Outputs were disseminated

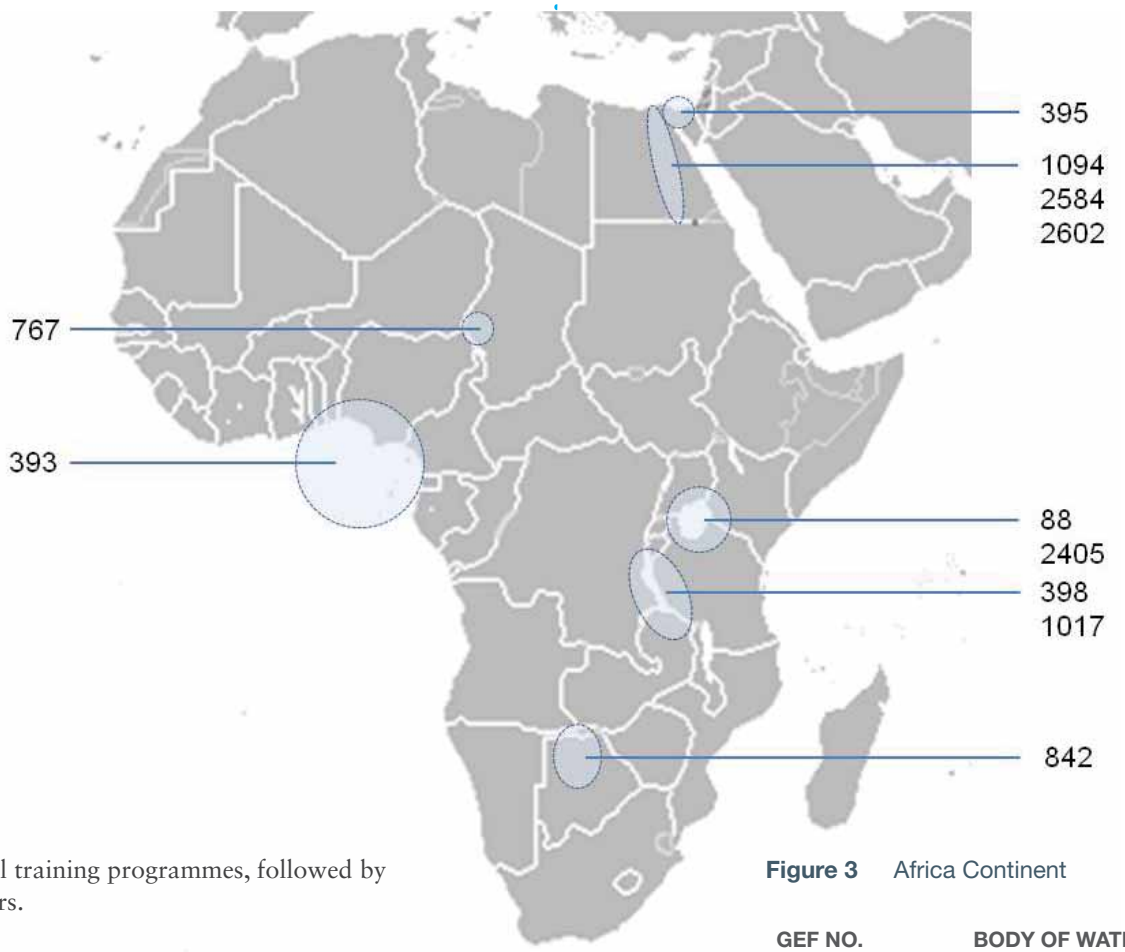


Figure 3 Africa Continent

GEF NO.	BODY OF WATER
88, 2405	Lake Victoria
393	Gulf of Guinea
395	Lake Manzala
398,1017	Lake Tanganyika
767	Lake Chad
842	Okavango River
1094, 2584, 2602	Nile River

through regional training programmes, followed by national seminars.

Dissemination of science output is very important and should include a variety of approaches targeted at the specific audience that can best enable the desired outcomes. The Aral Sea Project (Project 584), for example, had extensive scientific publications of all kinds, designed to target specific audiences, including local stakeholders, and made available in hard copy and electronic (web) formats. Overall, it might be said that while science outputs are very important, dissemination of them to achieve GEF project goals is critical.

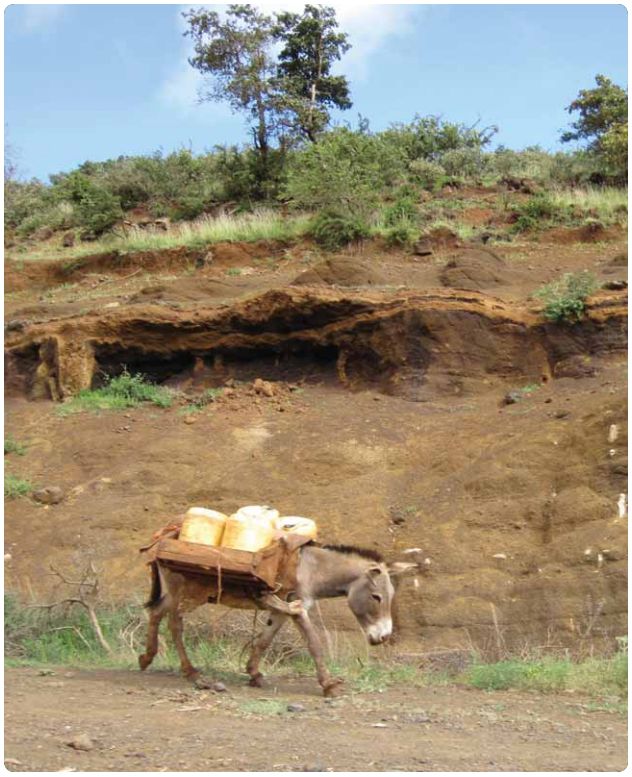
CHAPTER FIVE

Critical science gaps

A number of critical science gaps were identified. Projects sometimes failed to use the best available and up-to-date science components, and were often challenged by absence of various kinds of data, (e.g. land use, climate, social and economic) and a failure to replicate or use adequate statistical designs. Many projects failed to explicitly develop or follow QA/QC guidelines for the available data, and some failed to collect adequate data prior to initiating changes so that the potential benefits of improvements could be judged against status before remediation.

Other serious gaps included failure to consider a variety of issues such as sediments, lake-specific processes, atmospheric transfer across boundaries, interactions of multiple stressors, data from contributing drainages, spatial or temporal variations, and social and economic linkages. Many projects were hampered by the absence of solid conceptual frameworks, especially when they failed to consider lake-specific processes and considered the lake as part of the river system, or failed to consider the past history of lakes.

There was a lack of relevant examples of innovative science approaches in lakes that have been considered and more extensive modelling activities are needed. Often, projects used inappropriate models and were hampered by a shortage of reliable data for modelling and analysis, and a lack of verification and calibration of models. Gaps in considering or integrating approaches with traditional ecological knowledge were often evident.



Collection and transport of surface water for domestic use / *A. Dansie*

CHAPTER SIX

Definition of best practices

The following is a list of best practices developed from the documents:

A. Engage appropriate partners:

- Local stakeholder involvement
- Balance of local and external expertise
- Science-based development of design, free from political and industrial interference (unbiased).

B. Linking questions to development of joint management strategies:

C. Appropriate rigorous multidisciplinary and cross-sectoral scientific design:

- Ecosystem approach
- Appropriate frequency and number of sites
- Consideration of statistical power
- Include biological, physical and chemical variables
- Consideration of socio-economic elements
- Consideration of catchment scale processes
- Real and tangible measureable outputs and outcomes.

D. Coordinated consistent efforts:

E. Real-time feedback and monitoring capability:

F. Development of predictive and scenario forecasting

- Linked to several potential scenarios
- Linked to several levels of economic potential.

G. Replicable and extendable to other areas:

H. Systematic data and information collection, harmonization and compilation:

- Sustainable.

I. Demonstration of activities and pilot projects:

J. Targeted education component to identified outcomes:

- Capacity building of local staff to carry on
- Development of environmental sensitivity of political process
- Sharing and disseminating relevant information.

K. Affordable and long-lasting technology.

CHAPTER SEVEN

Design and use of (local) science networks and scientific advisory bodies

Successful uses of science in GEF projects have involved all levels of scientific expertise in a variety of forms. Considerations include the role of stakeholders and the design and purpose of project steering committees and science advisory boards. Guidance is available from Project 885 (South China Sea and the Gulf of Thailand), which is a big regional project involving seven countries bordering the South China Sea aimed at reversing the environmental degradation of the South China Sea and the Gulf of Thailand. The project makes most use of science, having local science networks at the grassroots level and many scientific advisory bodies at the national and regional levels. At the national level, national coordinators or focal points for each of the major ecosystem components (including mangroves, coral reefs, seagrasses, and wetlands) and two major human activity components (fisheries and land-based pollution) are responsible for convening regular meetings of a national committee or sub-committee, with memberships drawn from government and national level stakeholder groups having interests in, or national level responsibilities for, habitats or issues. Besides the seven focal ministries, a total of 31 government-designated organizations serve as Specialized Executing Agencies (SEAs) for the project. A number of these SEAs have established institutional sub-contracts with other organizations, so that the network of institutions directly linked to the project has expanded to more than 100, while the number of institutions indirectly linked through individual participation on the National Committees and Sub-committees exceeds 400. These linkages include involvement by local and national NGOs and provincial and local governments.

Partnerships at the regional and national level have been initiated in specific areas to meet the direct needs of the project and project execution, including SEA START RC, SEAFDEC, and ICLARM. At the regional level, the project management structure includes five Regional Working Groups (on mangroves, coral reefs, seagrass, wetlands, and land-based pollution) and two Regional Task Forces (on economic valuation and legal matters) that reflect the primary components and sub-components of the project, with significant scientific and technical contributions by many regional expert members on specific issues without remuneration. The project management structure also includes the Regional Scientific and Technical Committee, to ensure that results of each regional working group are mutually supportive and that recommendations and activities do not overlap or conflict but rather provide sound scientific and technical advice to the Project Steering Committee.

Lessons learned from Project 885 (South China Sea and the Gulf of Thailand) relate to design and uses of local science networks and scientific advisory bodies, including best practices for stakeholders involvement with clearly defined roles. A simplified governance model that considers representation of stakeholders, government, scientists, users, public and NGOs is needed. Science networks, either at site-specific levels (local, national, regional, international) or theme-specific levels (e.g. regional working groups on different issues), or outcome-specific levels (e.g. management-oriented) are needed with options for management clearly described at the early stage.

Good characteristics of an efficient local science network, involving grassroots, community-based organizations and NGOs, include balanced representation with full consideration of gender issues; balanced power; early engagement and participation in the project design and development; local initiatives; meaningful collaborative roles; integration of traditional ecological knowledge systems; adequacy and accessibility of legislative and financial support; and efficient communication and management at the site level. At the project steering committee level, it is important to keep the balance of roles between governance, science and NGOs. It is very important for the project to develop a multidisciplinary scientific approach with balanced representation, international representation and cooperation at a watershed level; an adequate framework and conceptual

model; shared vision and objectives; meaningful decision-making targets; adequately qualified scientific expertise related to the project; democratic recruitment with equal rotation of power and ability to work together in a team environment with shared decision-making capabilities; and adaptive management capacity and roles, taking into account the ongoing need for long-term monitoring and a mechanism for influencing policy change.

The Scientific Advisory Bodies established among countries participating in Project 885 (South China Sea and the Gulf of Thailand), not only provided scientific technical advice, but also acted as a bridge between the project steering committee (which represents the political interest) and the regional working groups (which represent the technical aspects). Some were meant to provide objective arms-length advice.

Factors influencing the success of the scientific advisory bodies included clearly defined roles and objectives; balanced representations from local, national and regional areas; creation and integration of multi-stakeholder and multi-disciplinary bodies; full support from participating nations, including adequate financial and logistical support, especially for meetings; efficient dissemination, sharing and exchange mechanisms for communicating scientific information among targeted stakeholders, decision makers, resource users, and the general public; the role of regional and national scientific communities and societies (e.g. wetland expert groups) and their working links with local representatives; participatory contribution of scientific communities to the success of policy development and implementation; and performance review and evaluation.

Other examples of how local science has been used include Project 1159 (Black Sea) in which many baseline studies were conducted and results used for identifying better management practices. The role of local science networks has been explicitly shown in Project 2143 (Neretva and Bosna Rivers, parts of the Adriatic and Black Sea basins). A user/stakeholder committee at the local level was formed under neighbourhood councils in order to participate in the review of any local issues and advise on design of the community score cards to be used for monitoring user satisfaction. These cards were periodically scored by the stakeholders, with the facilitation of the NGO, to show change over time. The NGO also linked with the local educational and health facilities at the municipal level and, where relevant, was included as a stakeholder on the committee. As a result of these activities, the relationship between agencies and the councils/committees was improved. The social and economic importance of the benefits of good environmental management by the beneficiaries as well as by local administrators was better understood. Such actions could be subsequently used for replication at the national level. Project 1094 (Nile) used national consultations and stakeholder workshops to ensure incorporation of local and national concerns and priorities within the project design. As well as the national exercises, regional priority setting exercises were undertaken to identify common transboundary environmental issues and priorities.

Project 3181 (pollution reduction in ACP countries) also depended on effective involvement of existing networks of capable local stakeholders, institutions and municipalities in implementing training components. Project 113 (Lake Ohrid) focused on creation of the Watershed Management Committee with representatives from local stakeholder groups and NGOs. Project 1537 (Prespa Lake Basin of Albania, FYR-Macedonia and Greece) also involved local users and NGOs and established the management body, but with limited funding and without legislative backing.

CHAPTER EIGHT

Targeting users

Users to target are project-specific, but should include implementation agencies and local users. Involvement of all relevant stakeholders is essential, but the identity of those stakeholders and the degree to which they were involved is project-specific. Clear identification of users at the ecosystem, watershed or catchment level is an important step at beginning of the project. At the local level, the main audience should be the direct stakeholders of the project: local and county officials, farmers, community groups and NGOs. Efforts at the national level would concentrate on institutions and groups (government agencies, national, environmental or professional associations, academia, NGOs, etc.) and the population at large. The aim would be to familiarize the population with the project and its benefits, and thereby raise the interest of potential future clients. All projects do not need to include stakeholders at all levels for every project, but all should be explicitly considered.

Lake Tanganyika provides a resource for fishing, livestock and domestic water use / *S. Marijnissen*

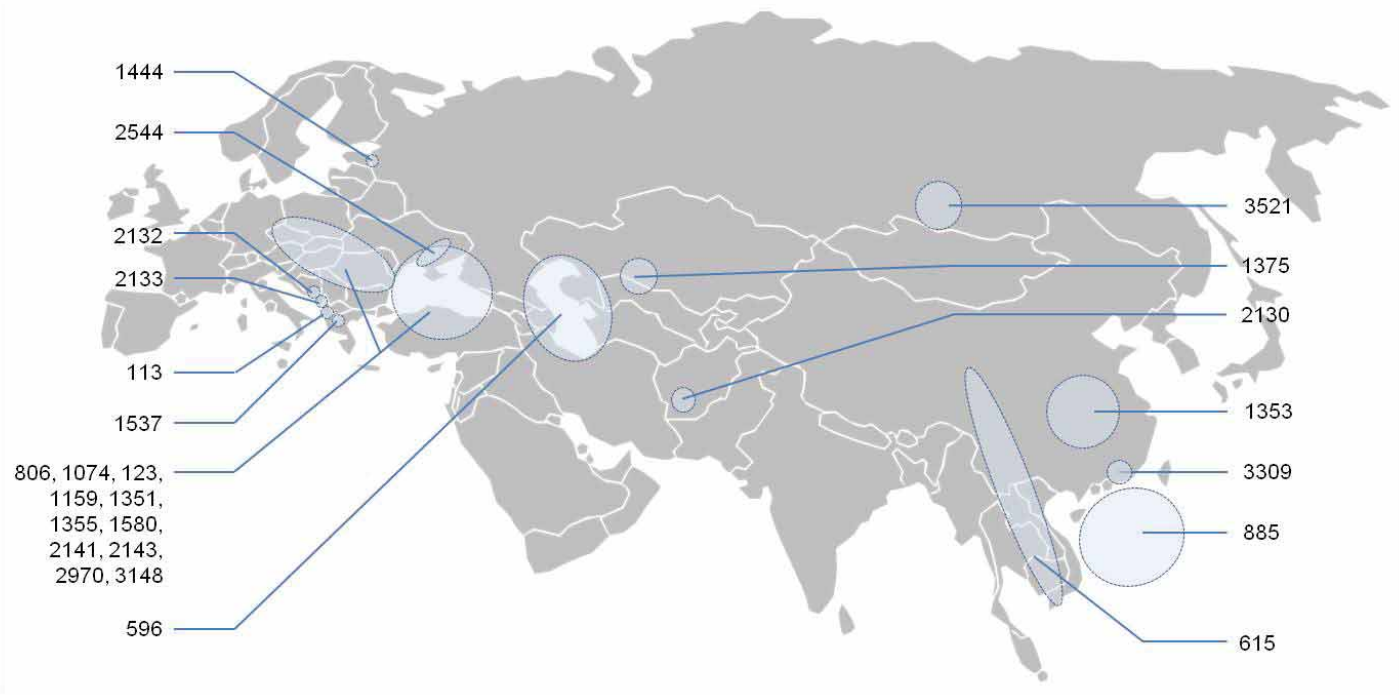


Figure 4 Eurasia Continent

GEF NO.	BODY OF WATER
113	Lake Ohrid
596	Caspain Sea
615	Mekong River
885	South China Sea
1353	Yangtze River
1375	Aral Sea
1444	Lake Peipsi
1537	Prespa Lakes

GEF NO.	BODY OF WATER
2130	Sistan River
2132	Trebisjica River
2133	Lake Skader-Shkoder
2544	Dnipro River
3309	Shantou River
3521	Lake Baikal
806, 1074, 1123, 1159, 1351, 1355, 1580, 2141, 2143, 2970, 3148	Danube River and Black Sea

CHAPTER NINE

Management implications for outcomes

How science is applied in GEF projects to achieve a lasting impact is strongly related to how well science-management linkages are developed and managed before, during and after the projects. It is very important that root causes of the environmental issue are analysed, identified and prioritized in the project (environmental, social and economic). This is not always straightforward and may need to evolve as the project develops and adapts to new knowledge and understanding. It is not enough to simply have science community support. Early in the project development there must be communication to understand and gain public and political support for change. The Aral Sea Project (584) is an example in which scientific research results were used to support decisions of regional policymakers.

The project must focus on building or strengthening 1) capacity, 2) regional cooperation, 3) involvement (participation). This needs to be across local to national and international levels. Success of implementation requires establishing monitoring and evaluation systems that will allow demonstration of the changes, benefits for the environment, and social and economic outcomes, allowing:

- Development and prioritization of management activities;
- Development criteria and conduct analysis (e.g. cluster analysis) at appropriate demonstration sites;
- Development of criteria, indicators and milestones for project evaluation;
- Understanding to address implementation barriers;
- Development of evaluation procedures for transfer of change across levels of implementation;
- Development of processes or frameworks for expanding influence beyond pilot sites.

The Neretva and Bosna Rivers Project (Project 2143) as parts of the Adriatic and Black Sea basins supported design of training modules on integrated wastewater treatment processing, training in environmental policy for law enforcement agents on wastewater management (e.g. municipalities, municipal and regional inspectorates, environment authorities and the private sector), and coordination/organization of conferences on wastewater management for regional information transfer. With these diverse activities, the project supported establishment of links and partnerships among the cities of the region on comprehensive wastewater management issues and also provided a model to enable implementation of the new processes. Using compelling examples and modelling the changes after other successful activities is effective. For example, the project on integrated ecosystem management in the Prespa Lakes basin of Albania (Project 1537) is developing a new monitoring programme designed to meet the European Water Framework Directive.

Implementation of change through GEF projects often requires institutional change.This is usually very difficult to achieve but is important to the full implementation of project goals and outcomes. Institutional barriers can be subtle and if not addressed can make implementation of even the scientifically based recommendations ineffective. This is usually a gradual transition as the institutions adapt and understand the benefits and advantages. Considerations for institutional change include:

- Development of an institutional and legal framework;
- Consideration of private, industrial and public rights;
- Harmonization of policy at different levels;
- Implementation at a watershed scale; and
- Flexibility and consideration of adaptive management.

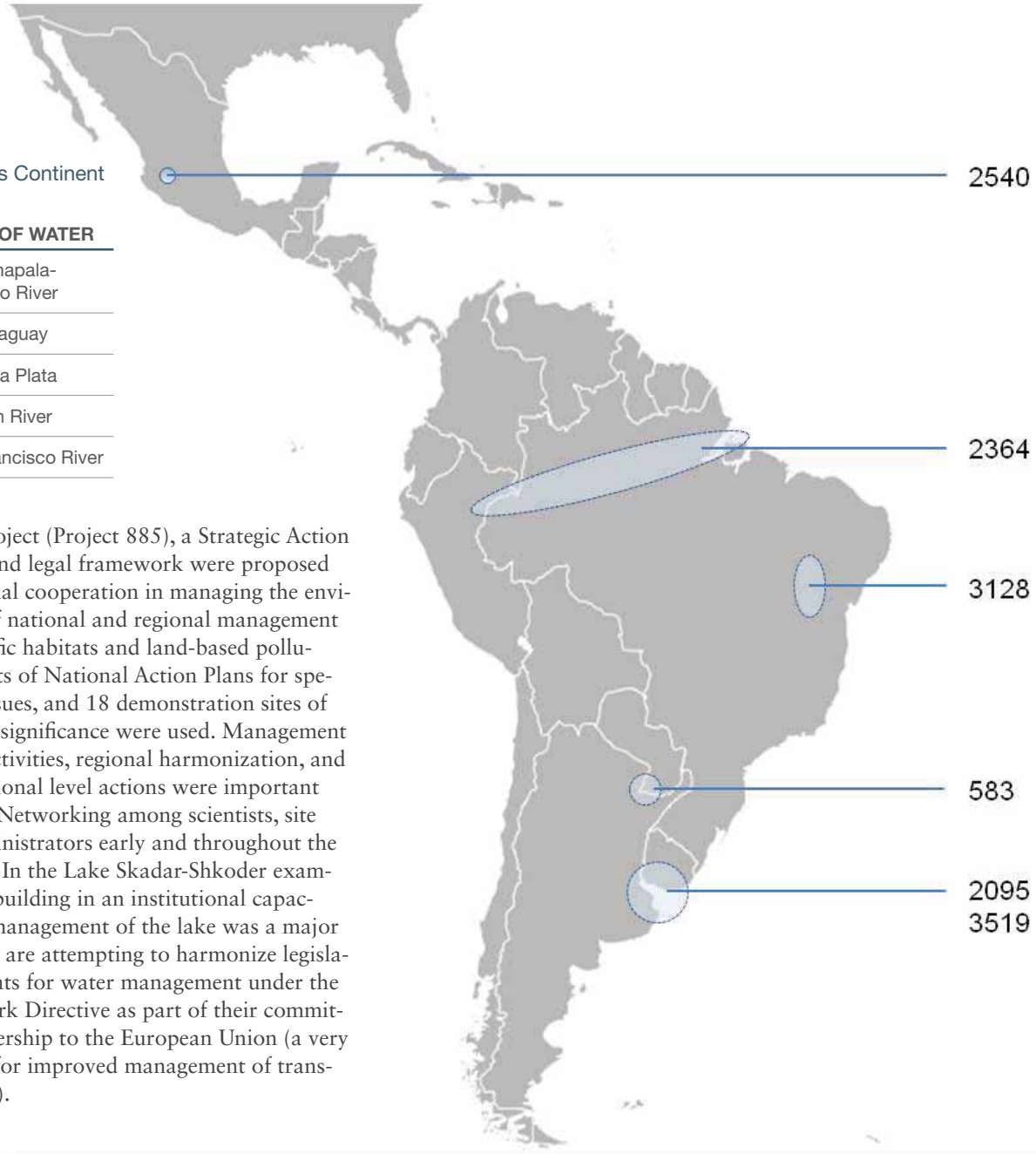


Figure 5 Americas Continent

GEF NO.	BODY OF WATER
2540	Lera-Chapala-Santiago River
583	Rio Paraguay
2095, 3519	Rio de la Plata
2364	Amazon River
3128	Sao Francisco River

In the China Sea project (Project 885), a Strategic Action Programme (SAP) and legal framework were proposed for improved regional cooperation in managing the environment. A series of national and regional management plans for four specific habitats and land-based pollution issues, seven sets of National Action Plans for specific habitats and issues, and 18 demonstration sites of regional and global significance were used. Management of demonstration activities, regional harmonization, and coordination of national level actions were important for project success. Networking among scientists, site managers, and administrators early and throughout the project was critical. In the Lake Skadar-Shkoder example (Project 2133), building in an institutional capacity responsible for management of the lake was a major objective. Countries are attempting to harmonize legislation and requirements for water management under the EU Water Framework Directive as part of their commitment to gain membership to the European Union (a very powerful incentive for improved management of transboundary resources).

CHAPTER TEN

Conclusions

The Lakes Working Group reviewed 58 projects, 88 per cent of which overlapped with those of the Rivers Working Group; only four focused solely on lake environments. There was little consistency between projects on how issues were defined or on issues to address; but, in successful cases, completion of a comprehensive TDA that adequately collected and synthesized existing information, and emphasis on certain aspects of project design proved to be extremely important. Projects were more successful if they focused on clear objectives, conducted basin-level scientific analyses, reviews and assessments, set achievable and measureable targets, and separated the technical and political influences on scientific design.

GEF projects still need more links between natural sciences and social science. Effective research, monitoring and assessment were affected by a variety of factors that showed some commonality, including baseline data, reference sites, need for more rigorous study designs and regular, effective evaluations of project deliverables, and ongoing challenges related to a lack of regional infrastructure. In addition, there were some project-specific issues that hindered the success of IW activities including long-range transport and deposition and effects on water quality; unique system characteristics that make achieving short term change difficult; and challenges with the political will in the region.

Lakes were not often considered as specific ecosystems, and studies did not always consider external drivers. The review divided project aims and objectives into increasing and sharing knowledge, providing planning tools and capacity development, and catalyzing management. It also summarized best practices for a variety of aspects of IW projects, and defined critical science gaps and potential future issues. The review determined that the success of science application and the potential for lasting impact are strongly related to how well science-management linkages are developed and managed before, during and after the projects.

IW:Science

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