

# INTERNATIONAL SYMPOSIUM ON QUANTITATIVE ECOSYSTEM INDICATORS FOR FISHERIES MANAGEMENT

## TABLE OF CONTENTS

---

Organization of Symposium	iii
An Introduction to the Symposium	iv
Practical Details About the Symposium	vi
About this Book	vii
Sponsorship of the Symposium	vii
Facilities at UNESCO	vii
Floor Plans	viii
Program Timetable	x
Keynote Address	xii
Theme 1: Environmental indicators	1
Theme 2: Diversity and species indicators	1
Day 1 Poster Session	2
Theme 3: Size-based indicators	35
Theme 4: Trophodynamics indicators	35
Theme 5: Spatial indicators	36
Day 2 Poster Session	36
Theme 6: Selecting and evaluating indicators	73
Theme 7: Integrated indicators	73
Theme 8: Frameworks for sustainable development	73
Theme 9: Implementation schemes	74
Day 3 Poster Session	74
Theme 10: World Implementation	113
Closing Session	113
Notes for Visitors to Paris	117
Restaurants and Cafes in the Area Close to UNESCO and Local Hotels	118
List of Participants	119
Index of Authors	141

Abstracts are sorted first by session and then alphabetically by the main author's surname. Main authors' names are in bold print. The Index of Authors lists all authors, including co-authors, in alphabetical order. Paper numbers and page numbers are also listed in the Index of Authors. Some abstracts in this collection have not been edited and have been printed in the condition that they were received.



# INTERNATIONAL SYMPOSIUM ON QUANTITATIVE ECOSYSTEM INDICATORS FOR FISHERIES MANAGEMENT

## ORGANIZATION OF SYMPOSIUM

---

### Scientific Program Committee

#### Co-Convenors

Philippe Cury, IRD-CRHMT, France  
Villy Christensen, Univ. of British Columbia, Canada

---

Keith Brander, ICES/GLOBEC Secretary, Denmark  
Robert Costanza, Gund Institute of Ecological Economics, Univ. of Vermont, U.S.A.  
Henrik Gislason, Univ. of Copenhagen, Denmark  
Daniel Pauly, Fisheries Centre, Univ. of British Columbia, Canada  
Ian Perry, PICES Science Board  
Marie-Joelle Rochet, IFREMER, France  
Jake Rice, Canadian Science Advisory Secretariat, DFO, Canada  
Keith Sainsbury, CSIRO, Australia  
Lynne Shannon, Marine and Coastal Management, South Africa  
Michael Sissenwine, Woods Hole Oceanographic Institution, U.S.A.  
Tony Smith, CSIRO Marine Research, Australia  
Kees Zwanenburg, Bedford Institute of Oceanography, Canada

#### Organizing Committee

Philippe Cury, IRD-CRHMT, France  
Villy Christensen, Univ. of British Columbia, Canada  
Patrice Cayré, IRD-DRV, France  
Serge Garcia, FAO, Fisheries Department (FIRD), Italy  
Skip McKinnell, PICES Secretariat  
Umit Unluata, IOC UNESCO, France  
Edward Urban, SCOR, The Johns Hopkins University, U.S.A.

#### Assistance with Symposium Preparation

Elizabeth Gross, Symposium Manager  
Alexander Bychkov, PICES Secretariat

Virginie Bonnet, IOC  
Christiane Le Conan, IOC  
Christina Chiu, PICES Secretariat  
Julia Yazvenko, PICES Secretariat

## AN INTRODUCTION TO THE SYMPOSIUM

---

Fisheries management builds on assessments of fish populations. Over the years, a variety of tools for management have been developed, and we are now used to reference points such as MSY, Yield-per-recruit,  $F_{0.1}$ ,  $F_{max}$ , and MBAL. While such indicators serve and will continue to serve an important role for evaluating how to best manage fish populations, the scope of fisheries research has widened. In recent years there has been a growing understanding that where fish populations are exploited, they must be considered as integral components of ecosystem function instead of phenomena that operate in a fashion that is independent of their environment. Internationally, there has been wide recognition of the need to move toward an ecosystem approach to fisheries, a development spearheaded by FAO through the Code of Conduct for Responsible Fisheries, and supported by numerous regional and national institutions as well as academia, NGOs and the public-at-large.

As we move to embrace an ecosystem perspective, we need new measuring sticks. Ecosystem approaches to fisheries include consideration of the interdependent way we utilize ecosystems. At a minimum, these components include ecological, economical, social, technological, as well as governance aspects. When considering the ecosystem, we must include not only the target species, but also their effects on dependent, competitor, and non-target species, as well as on the habitats shared by these species. An important question, thus arises, related to trade-offs. Management interventions directed at one target species may have consequences for many other species, including species that are targets of other fisheries. Such interventions may have different consequences with regards to ecological, economical, and social criteria. How do we evaluate the trade-offs involved, and how do we determine what direction we, as a society, should take?

To evaluate such questions, it is important to form our decisions based on well-founded science as well as on information about societal priorities. At this Symposium we will focus on the scientific aspects of ecosystem approaches to fisheries, and seek to provide information and guidelines about how to develop, test and apply indicators, or frameworks of indicators.

We are not starting the work from square one as we meet here in Paris. Internationally, the first major initiative related to the use of ecosystem indicators for sustainable fisheries development was taken by the Government of Australia in cooperation with FAO, through a Consultation in Sidney, January 1999, involving 26 experts from 13 countries. The consultation resulted in Technical Guidelines No. 8 for the FAO Code of Conduct for Responsible Fisheries: *Indicators for Sustainable Development of Marine Capture Fisheries*. The Guidelines were produced to support the implementation of the Code of Conduct; they deal mainly with the development of frameworks, and they set the stage for using indicators in the decision process.

The Guidelines do not, however, discuss the properties of indicators, nor how they are used and tested in practice. This instead became the task of an international working group, established jointly by the Scientific Committee on Oceanic Research (SCOR) and the Intergovernmental Oceanographic Committee (IOC) of UNESCO. SCOR/IOC Working Group 119 on '*Quantitative Ecosystem Indicators for Fisheries Management*' was established in 2001 with 32 members drawn from a large number of countries. The working group was established to support the scientific aspects of using indicators for an ecosystem approach to fisheries, to review existing knowledge in the field, to demonstrate the utility and perspectives for new indicators reflecting the exploitation and state of marine ecosystems, as well as to consider frameworks for their implementation.

The working group met twice to plan and report on progress, in Reykjavik, October 2001, and in Cape Town in December 2002, organizing its efforts with a series of task forces working in parallel on:

- Environmental indicators including habitat changes;
- Species-based indicators;
- Size-based indicators;
- Trophodynamic indicators;
- Integrated indicators;
- Selection criteria;
- Data sets and reviews; and
- Frameworks for implementing indicators.

As part of their work, the task forces have reviewed the current status of using indicators for ecosystem approaches to fisheries, as well as seeking to develop new theory, evaluate performance of indicators, etc. The major results of these endeavors form the core presentations at this Symposium.

More than 200 abstracts were submitted for presentation at the Symposium. The Program Committee was faced with a very difficult task in selecting presentations for oral and poster presentation. This was, however, a wonderful problem when planning a symposium and it clearly indicates that the timing was perfect for evaluating the role of indicators for an ecosystem approach to fisheries.

Indeed, the time was right. This is clear from the very generous and enthusiastic support the working group has received from all sides in carrying out its tasks. We acknowledge and value the support we have received from a large number of organizations, without whose support it would not have been possible to plan and conduct a symposium of this caliber. We especially thank our 'parents' SCOR and IOC for their initiative, which led to the establishment of the working group, as well as for their support throughout our work. The offer from IOC to host the Symposium at the UNESCO HQ has been a major factor in establishing the reputation of the Symposium, even before the first presentation is held.

We are glad to be here in Paris, we look forward to a productive and stimulating Symposium, and we extend a warm welcome to all participants. *Bienvenue à Paris.*

Philippe Cury and Villy Christensen  
Symposium Co-Convenors

## **PRACTICAL DETAILS ABOUT THE SYMPOSIUM**

---

The primary language of the Symposium is English and all oral presentations will be in English. We apologize that budgetary limitations prevented us from providing interpreters.

### **LOCATION:**

All sessions will be held in Salle I (Level 0) on the ground floor of IOC.

### **SPEAKERS:**

Due to the large size of our meeting room and the excellent projection facilities, all presentations must be on PowerPoint files. Please contact your session chairperson as soon as you arrive at the Symposium. All speakers must come to the registration desk and make arrangements to download their presentations onto the Symposium's laptop computer (MS Windows). This must be done at least one half day before the session in which your presentation is scheduled so that we can be certain that there are no problems in projecting your graphic files.

### **MANUSCRIPTS:**

Professor Niels Daan, the Guest Editor for the ICES volume arising from the Symposium, will be present throughout the meeting. He will have an office near the meeting – please ask for the exact location at the registration desk. Manuscripts must be given to Professor Daan on the first day of the Symposium; he will be collaborating with authors during the meeting.

### **POSTERS:**

There will be a different poster session on each of the first three days of the Symposium, with one hour set aside for formal viewing of posters during the afternoon coffee break; from 4 to 5 p.m. Authors are expected to be present at their posters during this time. Of course, posters may be viewed at other times. Posters must be placed prior to the start of the meeting each morning, and must be removed after the end of the session each evening. Supplies for mounting posters will be available at the registration desk. The chair of the poster session will select candidate posters for awards from each session during the first three days of the Symposium. Selected posters will be displayed again on the last day of the Symposium.

### **SCHEDULE:**

The daily schedule is as follows:

09:00	Daily Program Begins
10:30 – 11:00	Morning Coffee Break
12:30 – 14:00	Lunch Break
16:00 – 17:00	Afternoon Coffee Break and Poster Session
18:10 – 18:30	Daily Program Ends (time varies)

See the Program Timetable on page *x* for the overall schedule of events.

## ABOUT THIS BOOK

---

We hope you will find this book to be helpful, both as a reference during the Symposium, and afterwards. The list of participants includes those who completed registration for the conference before this book went to print on February 23, 2004. Similarly, the abstracts, both for speakers and the poster sessions, reflect the status of the program for the conference on that date. Changes to the program will be posted at the conference and you are advised to look for these. Updated programs will be placed near the doors of the Symposium hall each day.

## SPONSORSHIP OF THE SYMPOSIUM

---

The Symposium has been organized by Working Group 119 of the Scientific Committee on Oceanic Research (SCOR), which is co-sponsored by the Intergovernmental Oceanographic Commission of UNESCO (IOC). These two organizations, and the North Pacific Marine Sciences Organization (PICES), have provided financial and staff support for the Symposium. We are also grateful for financial support, through SCOR, from the US National Science Foundation (Division of Ocean Sciences) and the National Marine Fisheries Service of NOAA. Support for the Symposium has also been received from:

- Institut Français de Recherche pour l'Exploitation de la Mer (IFREMER)
- Institut de Recherche pour le Développement (IRD)
- Institut Français de la Biodiversité (IFB)
- International Council for the Exploration of the Sea (ICES)
- Food and Agriculture Organization of the UN (FAO)
- SCOR/IOC Program on Global Ocean Ecosystem Dynamics (GLOBEC)
- The Sea Around Us Project of the Pew Charitable Trusts
- South African Department of Environmental Affairs and Tourism (DEAT)

## FACILITIES AT UNESCO

---

The UNESCO building contains many useful facilities for meeting participants:

- Automatic banking machine - near the poster area.
- Bank with exchange facilities - first floor, main building
- Travel agency - first floor, main building
- Cafeteria, coffee bar with sandwiches and light snacks, and formal restaurant - 7th floor, main building
- Telephones opposite Salle I can be used to make long distance calls, but they require telephone calling cards that are available for purchase at a number of places, including the small shops known as "Tabacs" in France.
- Telephones in the registration area, near the Salle des Actes, can only be used for local calls.
- Email access: several computers are available for participants in Salle VII on the lower level. Take the stairs near the registration area. Because of the large number of participants, we must ask you to limit your use of these computers to 15 minutes at a time.
- You may also find cybercafés at the following nearby addresses:

***Planet-Cyber café***

173 rue de Vaugirard  
Tel: 01 45 67 71 14  
10:30am – 8:00pm 6 days  
a week

***skool@rena region***

199 Rue de Vaugirard  
Tel: 01 44 49 02 03  
24/7 closed Sunday 10:00-  
12:00

***9c.com***

83-85 rue de Javel  
Tel: 01 56 77 14 00

***Cyber'Act***

32 rue des Volontaires  
Tel: 01 53 69 10 60

***Cyberbase***

215 rue de Vaugirard  
Tel: 01 40 56 06 27

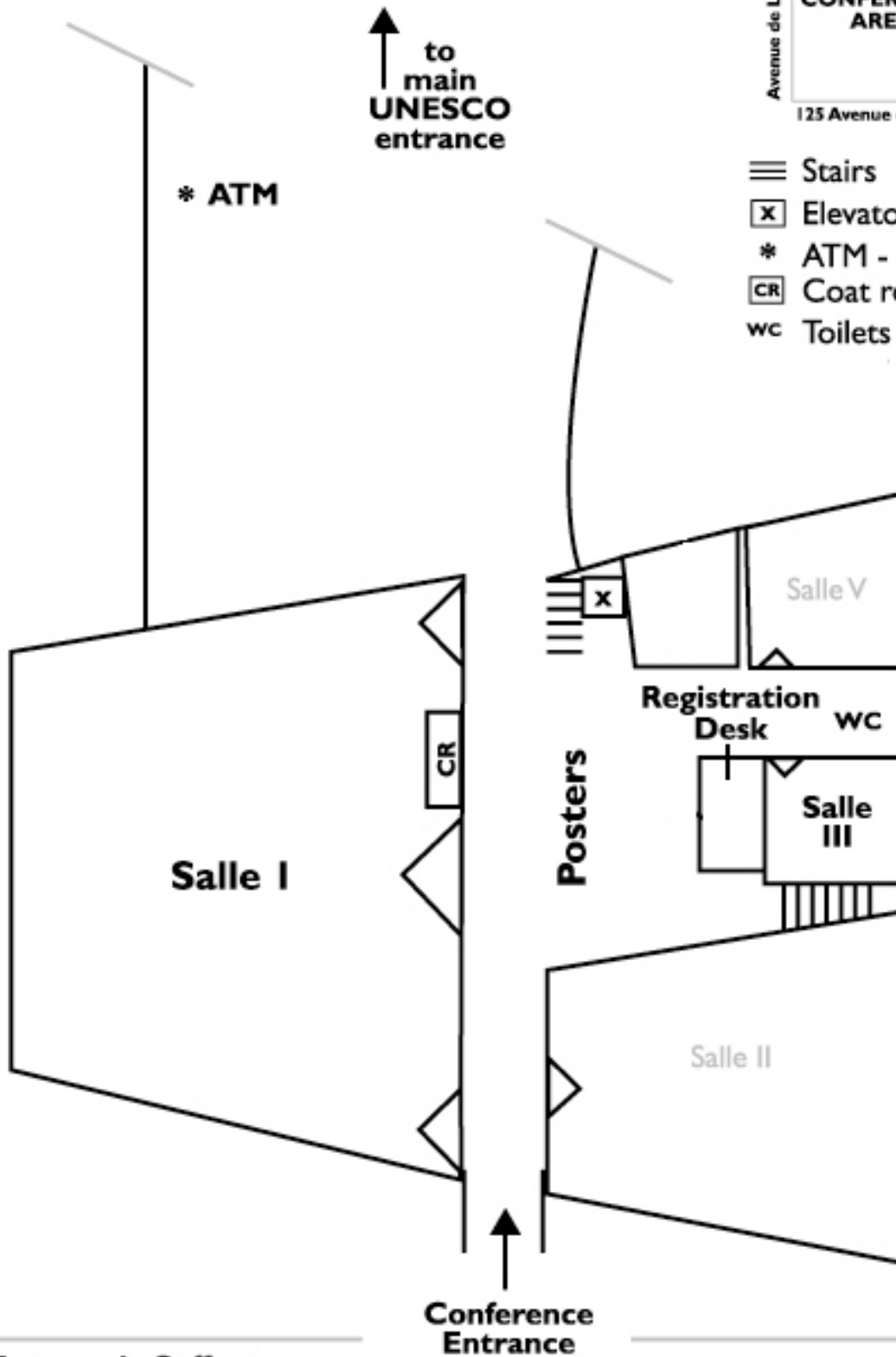
***Naninet CyberCafé***

43 rue Dutot  
Tel: 01 45 66 55 00

# LEVEL 0 (GROUND FLOOR)



- ≡ Stairs
- ⊗ Elevator
- \* ATM - Cash machine
- CR Coat room
- wc Toilets



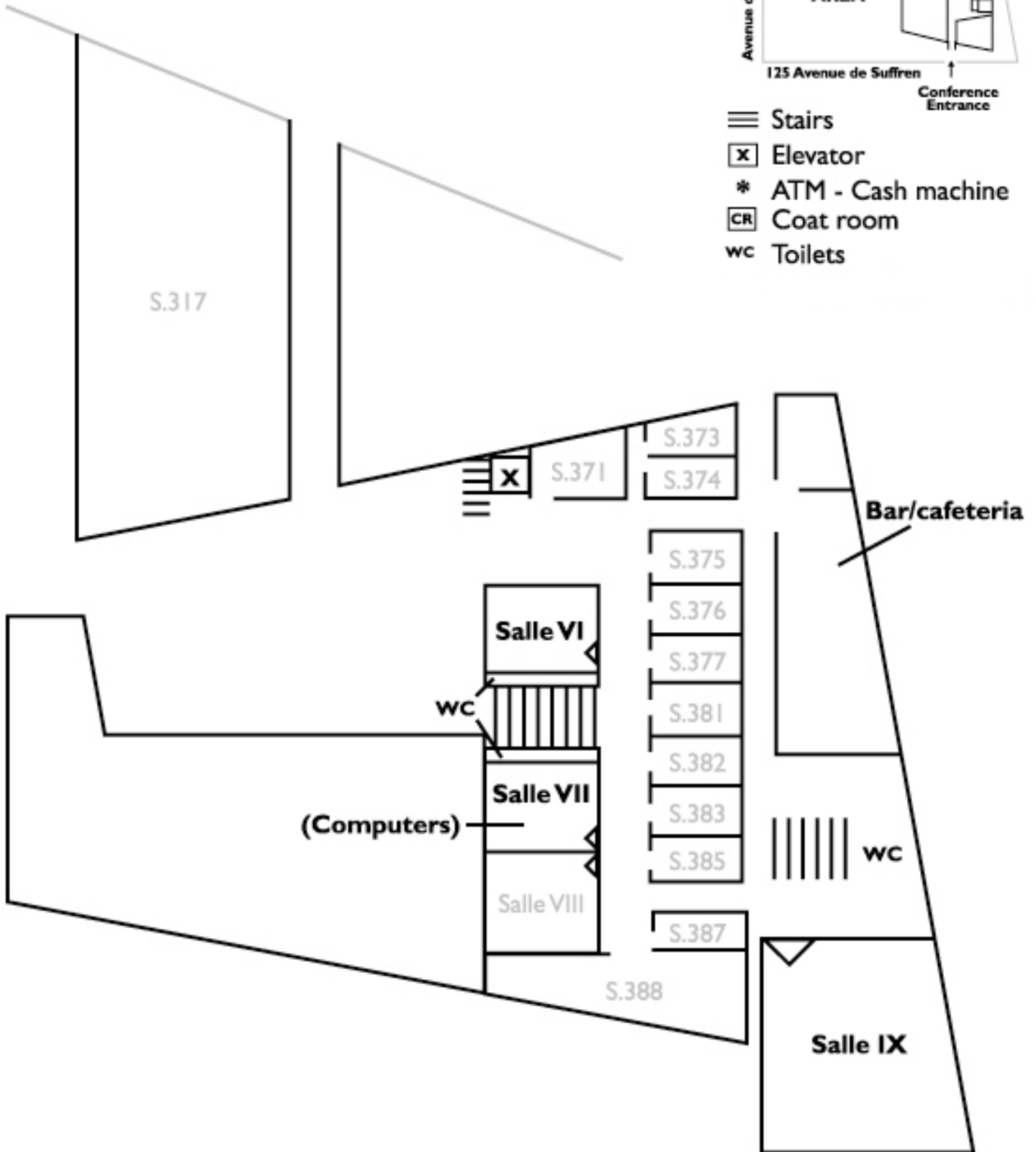
125 Avenue de Suffren



# LEVEL - I (BASEMENT)



- ≡ Stairs
- ⊠ Elevator
- \* ATM - Cash machine
- CR Coat room
- WC Toilets



## PROGRAM TIMETABLE

	<b>Tuesday March 30</b>	<b>DAY 1 Wednesday March 31</b>	<b>DAY 2 Thursday April 1</b>	<b>DAY 3 Friday April 2</b>	<b>DAY 4 Saturday April 3</b>
		8-9 a.m. Registration	Put up Posters For Day 2	Put up Posters For Day 3	
9:00		Opening and Welcome  Keynote Speaker	Theme 3 Size-based Indicators	Theme 6 Selecting & Evaluating Indicators	Theme 10 World Implementation
10:30- 11:00		COFFEE	COFFEE	COFFEE	COFFEE
11:00		Theme 1 Environmental Indicators	Theme 4 Trophodynamics Indicators	Theme 7 Integrated Indicators	11:00-12:45 Poster Review Symp. Review Panel Discussion Closing remarks
12:30- 14:00		LUNCH	LUNCH	LUNCH	
		Theme 1 cont'd	Theme 4 Continued	Theme 8 Frameworks for Sustainable Development	
		Theme 2 Diversity & Species Indicators			
16:00- 17:00		COFFEE & POSTERS	COFFEE & POSTERS	COFFEE & POSTERS	
	5-8 p.m. Registration	Theme 2 cont'd	Theme 5 Spatial Indicators	Theme 9 Implementation Schemes	
		Reception 7-8 p.m. 7 <sup>th</sup> Floor Take down posters	Take down posters	Take down posters	



# Keynote Address

## **The role of indicators in the ecosystem approach to fisheries**

Serge M. Garcia and K. Cochrane

FAO, Fishery Resources Division (FIRD), Via Delle Terme di Caracalla, 00100 Rome, Italy. E-mail: Serge.Garcia@fao.org

Following on UNCED (Rio de Janeiro, 1992) and preceding WSSD (Johannesburg, 2002), the FAO-Iceland Conference on Responsible Fisheries in the Marine Ecosystem (Reykjavik, 2001) prepared the basis for the formal adoption of the Ecosystem Approach to Fisheries (EAF) by Member countries of FAO. Following the instructions of the Conference, preliminary guidelines (FAO, 2003) have been developed by FAO through an Expert Consultation. A key issue in the guidelines relates to the need to better define quantitative and qualitative indicators of the state of the exploited ecosystem. The same issue had already emerged within FAO leading to the preparation of the FAO guidelines on indicators for sustainable development of Fisheries (FAO, 1999). In both cases, preliminary indicators have been proposed for testing but it was clear that more work was needed to identify and promote the most meaningful and usable ones.

Following UNCED, FAO has also adopted (FAO, 1996) the precautionary approach to fisheries (PAF). The approach relies, inter alia, on the use of indicators and reference points. It is therefore obvious that the three frameworks (Indicators, PAF and EAF) overlap in the following way. The sustainable development of fisheries \_as measured by indicators and reference values\_ aims at ensuring human and ecosystem well-being. The EAF \_in which humans and fisheries are recognised to be integral components of the ecosystem\_ specifies the need for proactive management driven by operational objectives and corresponding indicators and reference values. The PAF ensures that related uncertainties are identified and integrated into the research and decision-making processes.

The main difficulty in the whole process relates to defining a set of compatible and complementary policy objectives for fisheries combining conservation and development requirements, explicitly connected to a set of valid and measurable indicators, reference values and societal value judgements. The inclusion of societal choice and values is fundamental in view of the growing importance of environmental ethics and implies political decisions on acceptable impacts based on a scientific analysis of the related risks (*e.g.* in terms of biological extinction, socio-economic stress or reversibility).