Chapter 8: Role of Science and Information

Importance of Reliable Information

- Reliable information is necessary to make decisions on lake basin management
  - See Rast for an overview of this theme.

- Information includes both scientific and social information. Local communities, including indigenous communities, may hold valuable information that can be used for lake basin management.
  - Example: important fish breeding areas of Lake Albert (Uganda and Congo).

Scientific Information

- Scientific information is very important since it can:
  - show the limit to a resource use
  - enlighten connections that are hard to see
  - provide innovative solutions

Showing Limits of a Resource

- Great Lakes, USA and Canada
  - Based on scientific information, both countries decided to reduce phosphorus load to the lakes by
    1. enhancing phosphorus removal at wastewater treatment plants
    2. banning the use of detergent containing phosphorus

Enlightening Hard-to-see Connections

- Lake Naivasha
  - A simple, spreadsheet-based water balance model was developed. The model surprisingly explained very well about the horticultural industry's impacts on the decline of lake level.

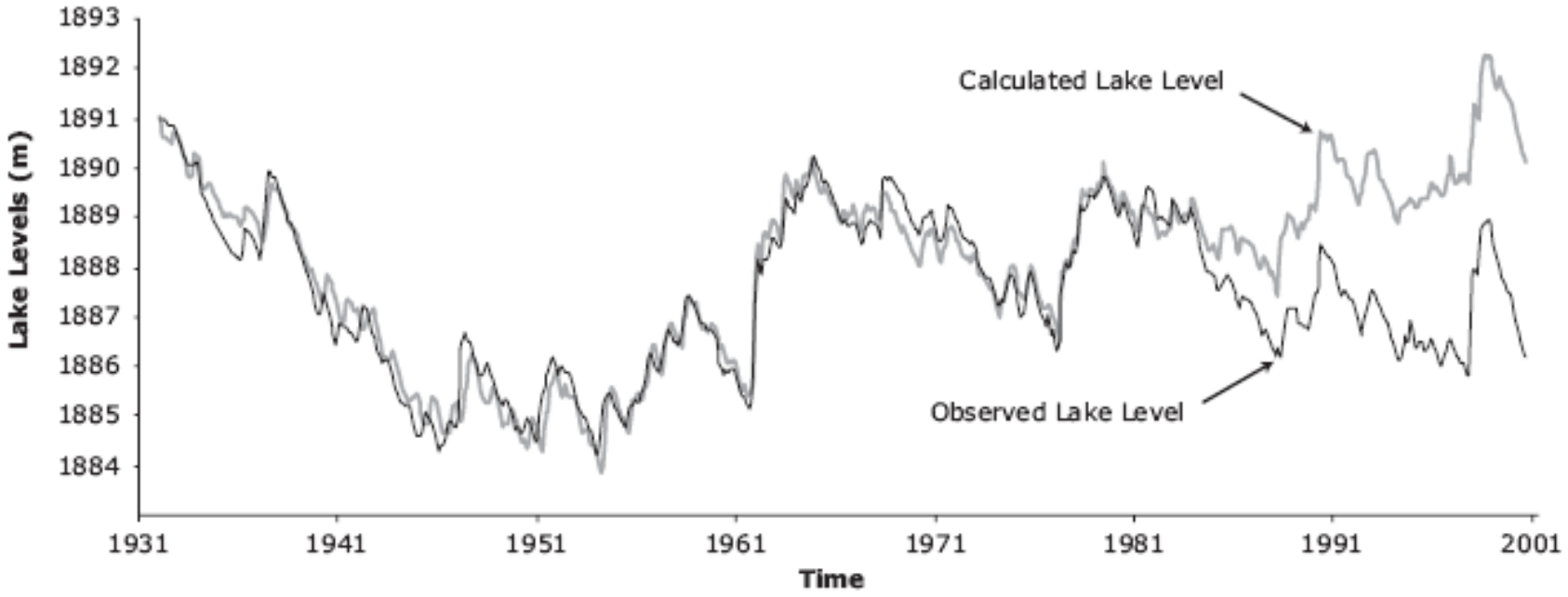


Figure 4. Long-term Water Level Change in Lake Naivasha.

Providing Innovative Solutions

- Chilika Lagoon
  - Modeling study showed that dredging a channel between the lake and the ocean could improve the salinity of the lake
  - Construction of the channel dramatically improved the salinity of the lake, which led to the recovery of fish and prawn catches

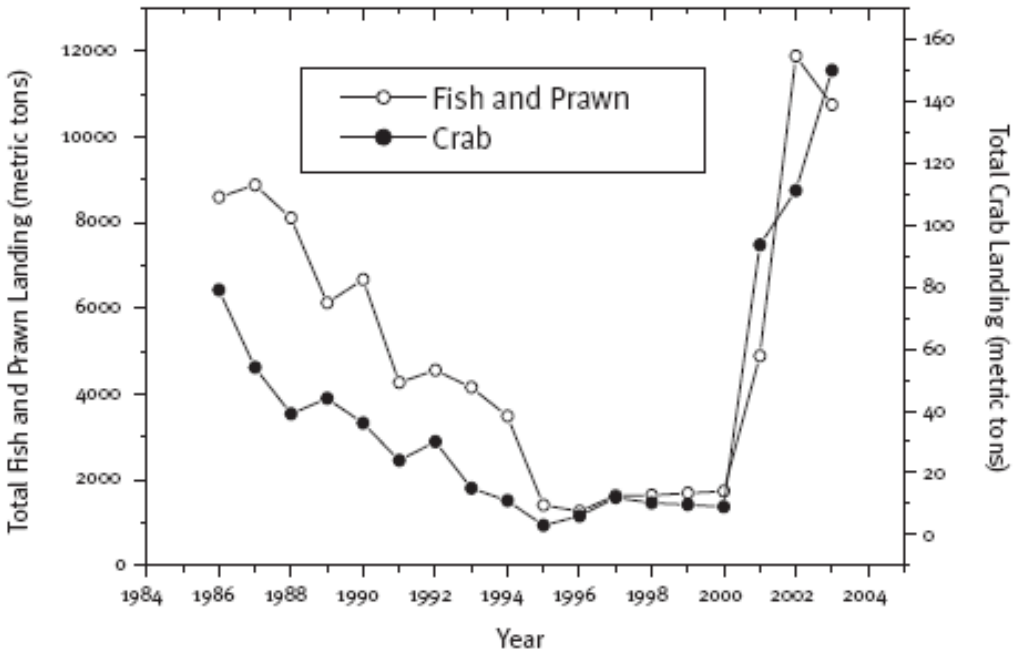


Figure 3. Changes in Fish, Prawn and Crab Landings.

Modeling

- Models can be used to determine the most effective intervention
- It is not always the complicated models that are effective: simple models can be very effective
- Complexity of a model should match the capacities of users
- Selection and design of models provides the opportunity to involve people (lake managers and other stakeholders)

Remote Sensing

- For lakes with little or no direct monitoring programs, remote sensing can provide a reasonable (and sometimes, free) way to monitor conditions in the lake as well as the land use in the basin.

- Bradt provides an overview of the currently available methods that can be used even in developing countries with limited capacity.

Geographic Information Systems (GIS)

- The need to manage and manipulate spatial information is felt by all lake managers.
- Recent advances in GIS technology (as well as more and more data available for free use) are gradually putting this key technology within reach of developing countries.
- Gyllenhammar examines the use of GIS (as well as remote sensing and modeling) for Lake Kyoga, Uganda.

Monitoring

- Monitoring is necessary to assess

1) the baseline condition

- Example: Lake Nakuru
  - Monitoring data revealed naturally high variation of lake level, dissolved oxygen, and other parameters. This data helped decision makers to be aware of the baseline condition (next slide).

2) the effects of interventions

- Example: Lake Dianchi
  - Policies to reduce the pollutant loads from individual enterprises have been proven effective.

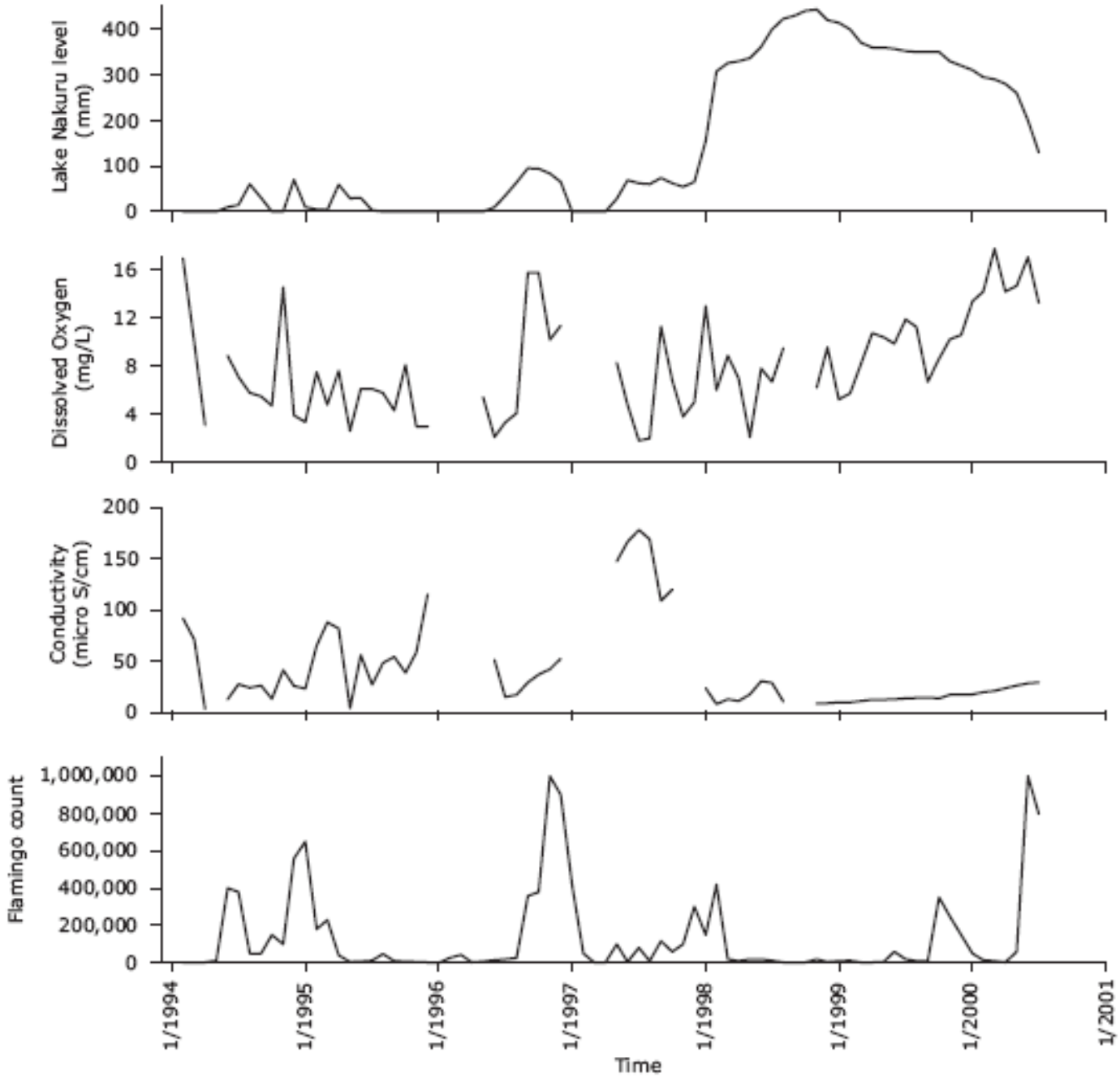


Figure 3. Njoro River Gauge Height, Lake Nakuru Level, Dissolved Oxygen, Conductivity and Lesser Flamingo Population, January 1994-June 2000 (Source: Official Monitoring Data).

Lake Nakuru: Monitoring helped decision makers to be aware of large natural variation of the lake level and dissolved oxygen.

Long-term Monitoring

- Long-term monitoring can have serendipitous effects (long-retention time)
  - Example: Lake Biwa
    - Long-term records of snowmelt, water temperature and dissolved oxygen concentration provided the potential effects of global warming on the lake. Because snow melt contains high dissolved oxygen, when snowfall decreases, dissolved oxygen concentration of the lake can decrease in certain areas.
  - Associate long-term monitoring with the long retention time of lakes

Consistency of Monitoring

- In some transboundary lakes, countries had inconsistencies of monitoring programs (different parameters, sampling and analysis techniques, locations and frequencies). This made it difficult to develop a reliable picture of the status of lakes
- Monitoring programs need to be harmonized. Lakes Ohrid and Xingkai/Khanka are trying to harmonizing monitoring programs with the assistance from GEF.

Sharing Information

- Scientific information shall be translated into the language of decision makers. Following methods can be used.
  - Use of indicators
  - Museums and information center

Innovative Example: The Water Mondriaan

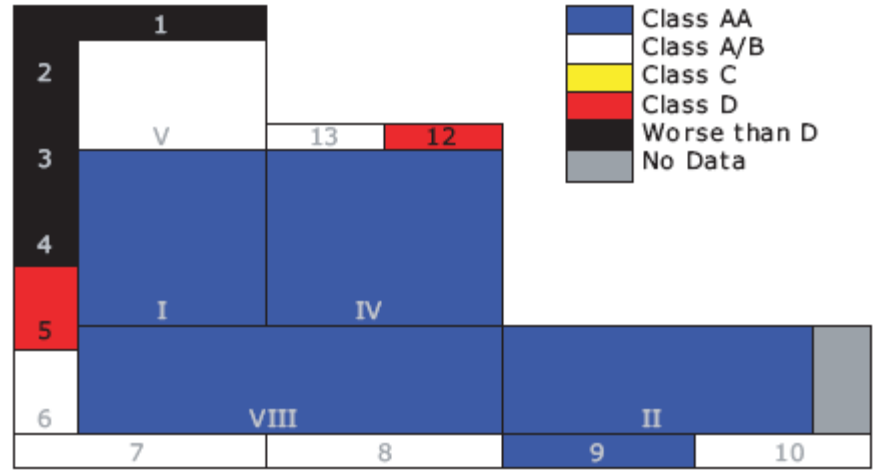


Figure 8. The Water Mondriaan.

Water Mondariaan is a colored indicator to represent the environmental status of the lake. Developed within the Sustainable Development of the Laguna de Bay Environment (SDLBE) project (bilateral cooperation between Philippines and Netherlands), the indicator is used to monthly report the status of the lake to the stakeholders. (Source: http://www.llda.gov.ph/New_Mondriaan/m_about.htm)

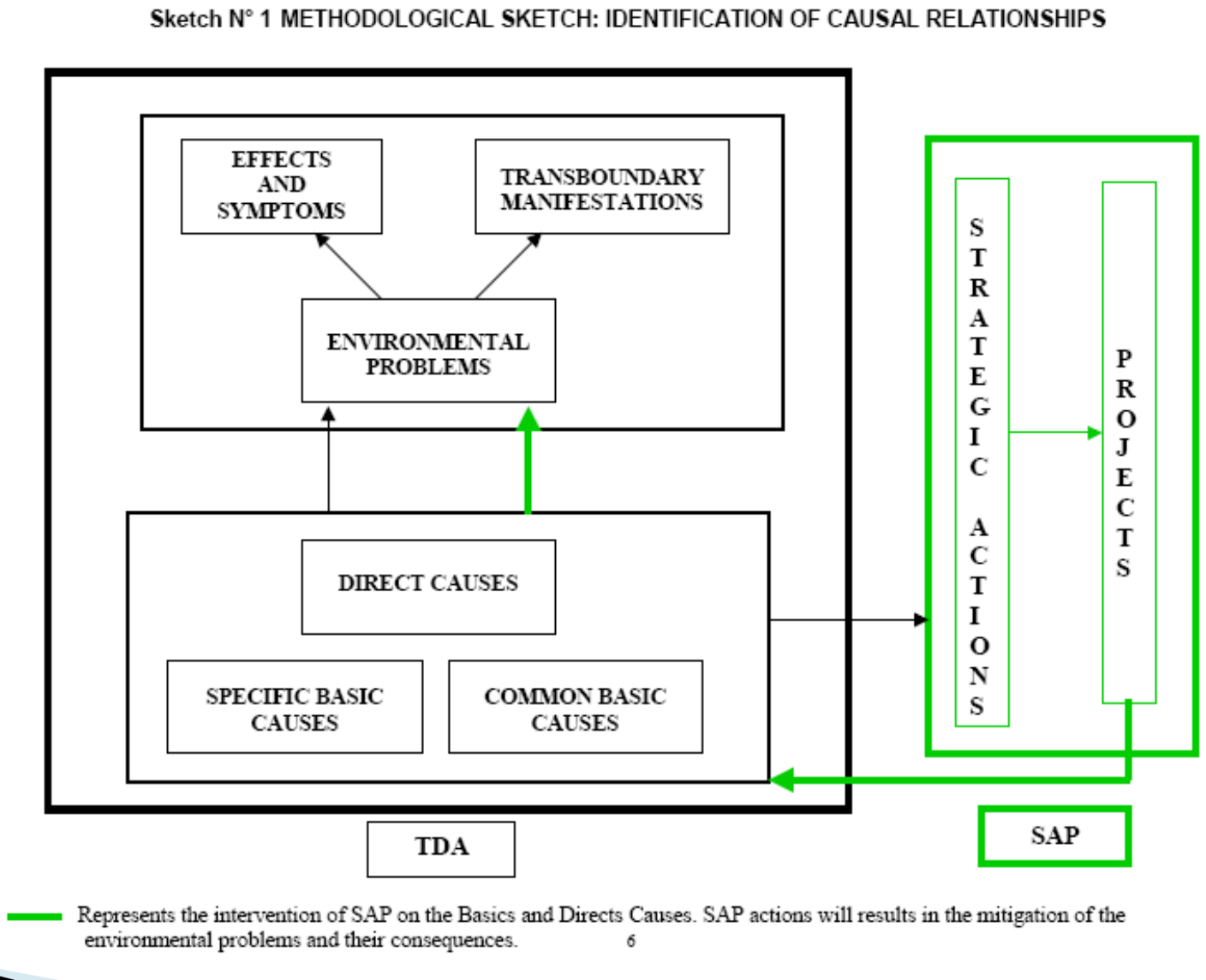
Example of Outreach: Lake Biwa Museum

- The museum was established in 1996 to communicate the diverse values of the Lake Biwa to the stakeholders and broader audience.
- The change of the lifestyle, geological history, history of the natural disasters, and other social and scientific information are displayed. The facility also has an aquarium.
- Website: http://www.lbm.go.jp/english/index.html

Integration of Infomation

- Due to the integrating nature of the lakes, and complex response dynamics, scientific information as well as socioeconomic information must be integrated for decision making.
- Integration of the information is especially critical in transboundary lakes. Transboundary Diagnostic Analysis (TDA) is a helpful tool to analyze scientific, technical, and socioeconomic information. Based on the analysis, effective intervention (such as Strategic Action Program (SAP)) can be developed.
- The joint effort among riparian countries to find and prioritize problems would advance cooperation.

Example of TDA/SAP, Bermejo River Basin



Source: Transboundary diagnostic analysis of the binational basin of the Bermejo river (2000)

Some Additional Topics

- Verma shows that not all necessary information is “technical”: information on values of a lake and how those values will change under different policies crucial to design efficient and fair policies.

- Robarts makes a case for why global-scale monitoring of lakes and reservoirs is of importance for the international community as well as stakeholders in individual lake basins.