

# Laguna de Bay: Case Study for Sustainable Fisheries Development

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National Academy of Science and Technology



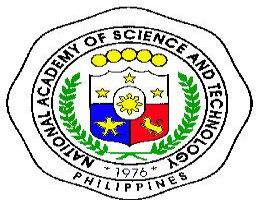
# What to do with the fish pens in Laguna de Bay

Published February 18, 2017, 10:00 PM

By Dr. Emil Q. Javier

'There are those who look at things the way they are, and ask why... I dream of things that never were, and ask why not?' – Robert Kennedy

The order of the President to dismantle the big fish pens in Laguna de Bay while welcome to the ears of the thousands of fishermen in the lakeshore towns of Rizal and Laguna who depend on the open waters of the lake



Dr. Emil Q. Javier

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## What to do with the fish pens in Laguna de Bay (Part II)

Published March 4, 2017, 10:00 PM

By Dr. Emil Q. Javier

'There are those who look at things the way they are, and ask why... I dream of things that never were, and ask why not?' – Robert Kennedy

Well-meaning but misplaced most charitably describes resolution No. 518 Series of 2017 of the Laguna Lake Development Authority (LLDA) and approved by DENR Secretary Regina Lopez directing "all operators of existing



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## What to do with the fish pens in Laguna de Bay (Part 3)

Updated March 19, 2017, 1:35 PM

By Dr. Emil Q. Javier

'There are those who look at things the way they are, and ask why... I dream of things that never were, and ask why not?' – Robert Kennedy

In the 05 March 2017 column I dealt at length with Resolution 518 series of 2017 of the Board of the Laguna Lake Development Authority (LLDA), and approved by the Department of Environment and Natural Resources (DENR) Secretary Regina Lopez, innocently titled "Declaring a Moratorium on the Operation of Aquaculture Structures within Laguna de Bay."

However, the resolution in its last paragraph gave an ultimatum to "all operators of existing fishpens/cages to harvest their fish stocks and demolish their structures by March 31, 2017, otherwise the same will be done by the LLDA."



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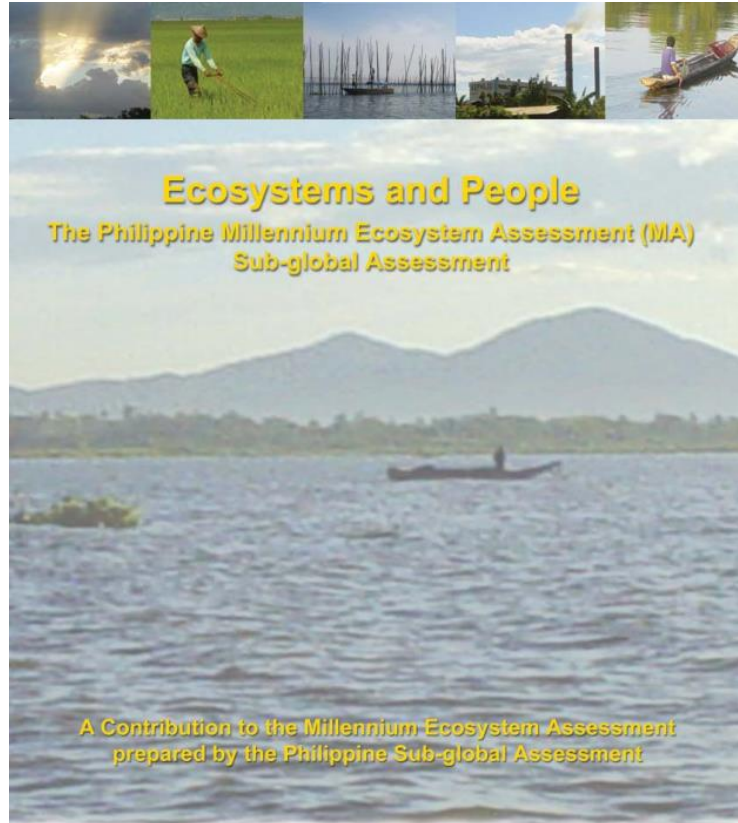


# Outline

- The Millennium Ecosystems (MA) assessment [plus]
- The state of fish resources
- Ways forward



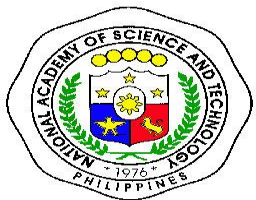
# I. The Millennium Ecosystems (MA) assessment [plus]



Millennium Ecosystem Assessment

STRENGTHENING CAPACITY TO MANAGE ECOSYSTEMS SUSTAINABLY FOR HUMAN WELL-BEING

[http://www.millenniumassessment.org/documents\\_sga/Philippine%20SGA%20Report.pdf](http://www.millenniumassessment.org/documents_sga/Philippine%20SGA%20Report.pdf)

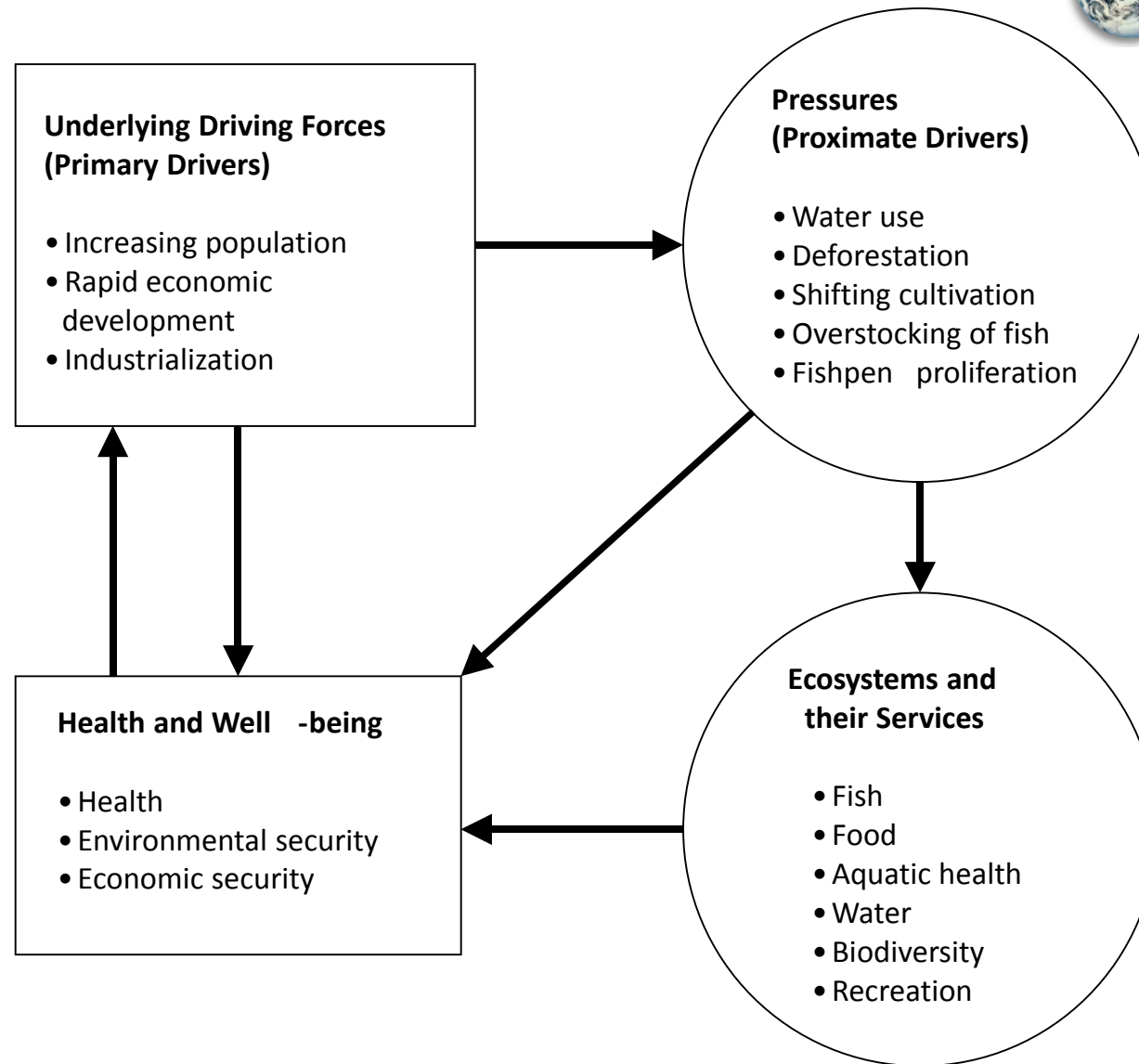




# The Philippine Sub-Global Assessment

- Involved 40 senior scientists/experts of various disciplines and from different organizations
- Assessed existing literature and their implications (IPCC approach)
- Focus on conditions and trends; responses; scenarios
- Ecosystems services: water, fish, rice, biodiversity, and climate

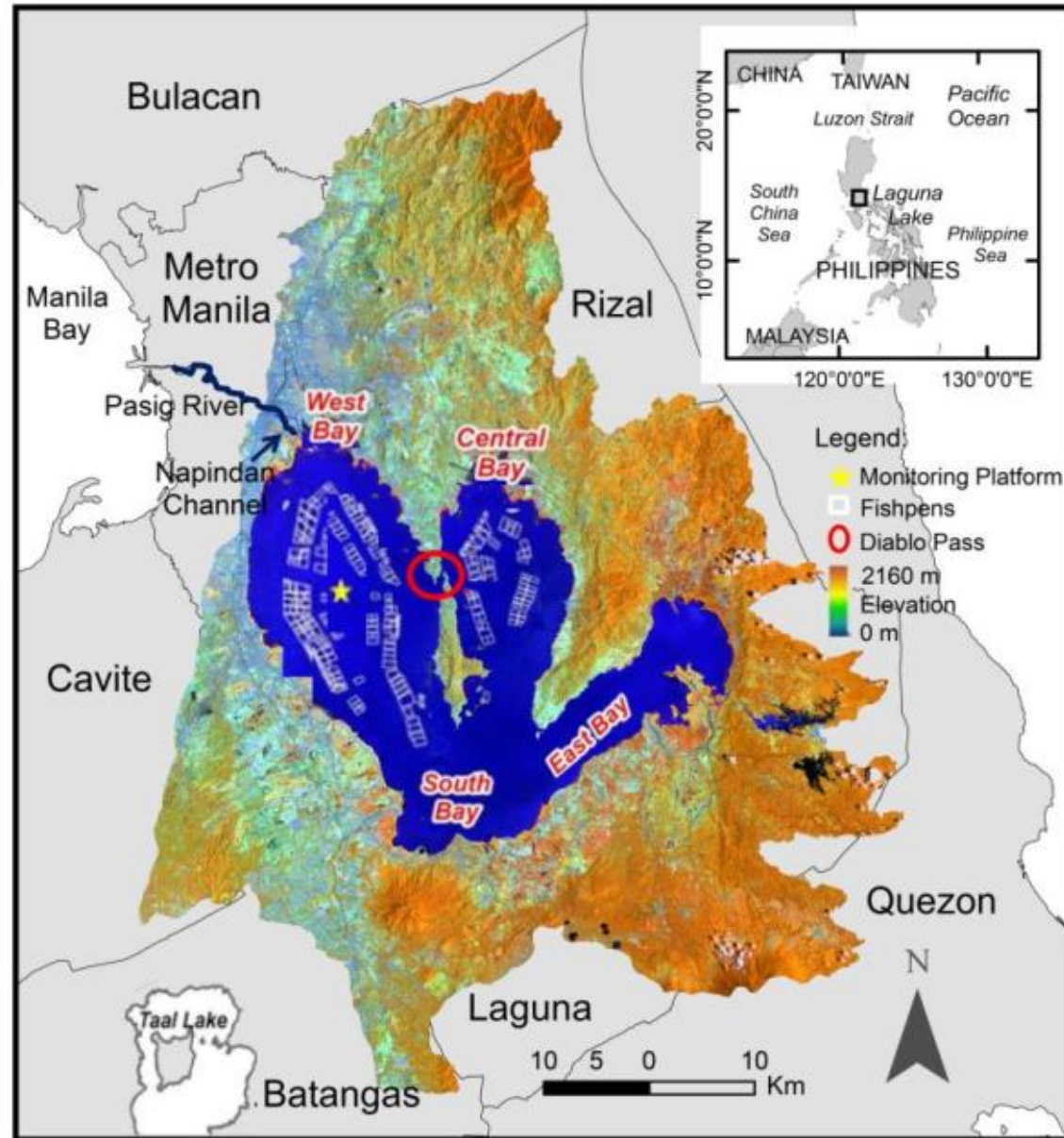




## Assessment framework for the Laguna Lake Basin



# The Laguna Lake Basin



Source: Herrera et al., 2015





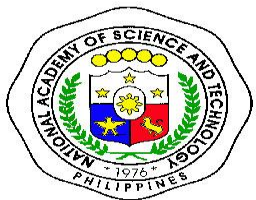
## 2

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# Laguna Lake's Tributary River Watersheds

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LEONARDO Q. LIONGSON, GUILLERMO Q. TABIOS III, ANTONIO M. DAÑO



## 3

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# Water Resources

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MACRINA T. ZAFARALLA, CARLITO R. BARRIL, ADELINA C. SANTOS-BORJA,  
EDUARDO V. MANALILI, JOSEFINA T. DIZON, JOCELYN G. STA. ANA,  
NORMA O. AGUILAR†





## Water Resources

- The Laguna Lake is the largest freshwater lake in the Philippines
- The dominant use of the lake is fisheries.
- Other uses: navigation, temporary storage of floodwater, hydroelectric power generation, source of irrigation, and domestic water supply as well as recreation





## Rivers and the 22 sub-basins of Laguna Lake





## Water Resources

- The biggest watershed is the Marikina River basin, and the second biggest is Pagsanjan River basin
- Of the 22 major river basins, 7 are regularly monitored by LLDA for physico-chemical and biological parameters
- Based on DO and BOD levels, most of the rivers on the western side of the lake are virtually dead (using Class C standards– suitable for fishery)
- Caused by the high discharge of domestic and industrial wastes





## Water Resources

- The absence of a sound solid waste management system is a major factor
- All of the rivers monitored failed to meet the criterion for total coliform count (TCC) of 5,000 MPN/100 ml set for Class C rivers





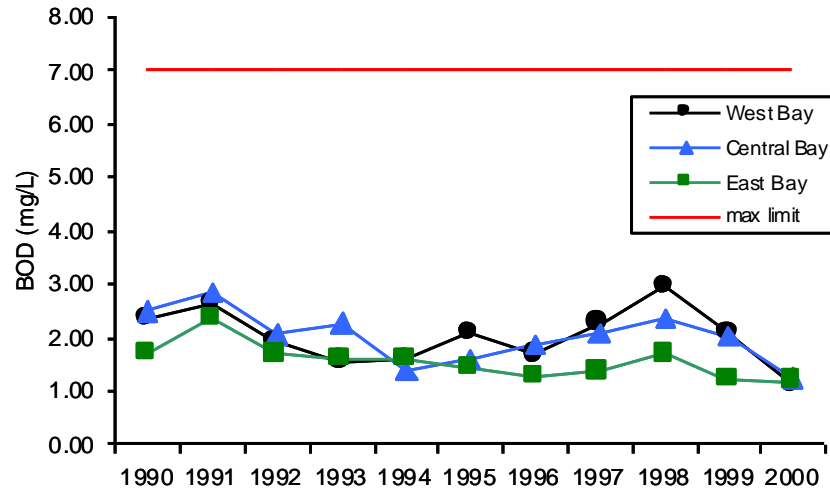
# Lake Water Quality

- A eutrophic body of water
- Eutrophication-- a process of over-enrichment of a body of water with nutrients [N, P].

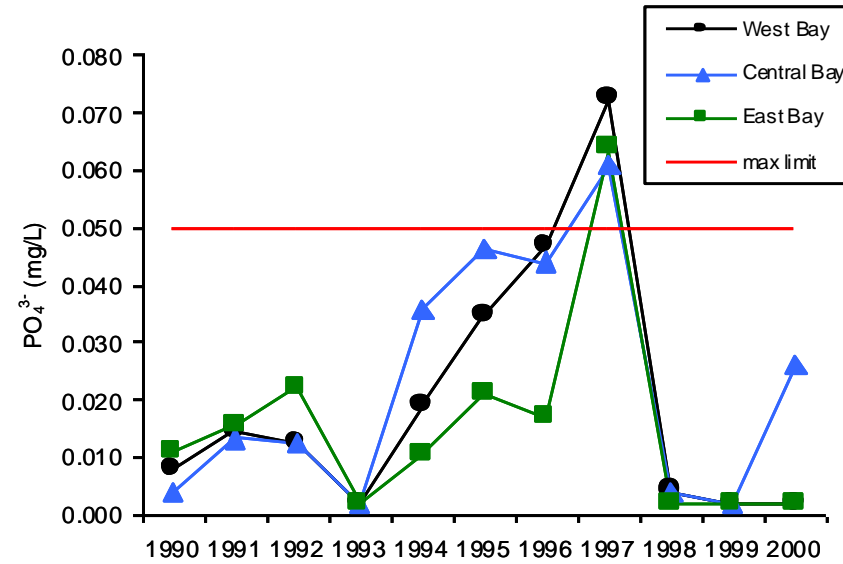




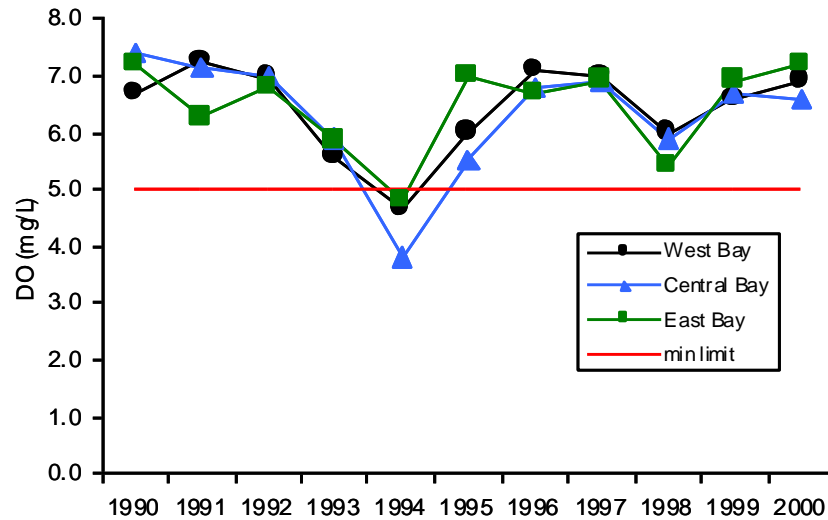
a) BOD



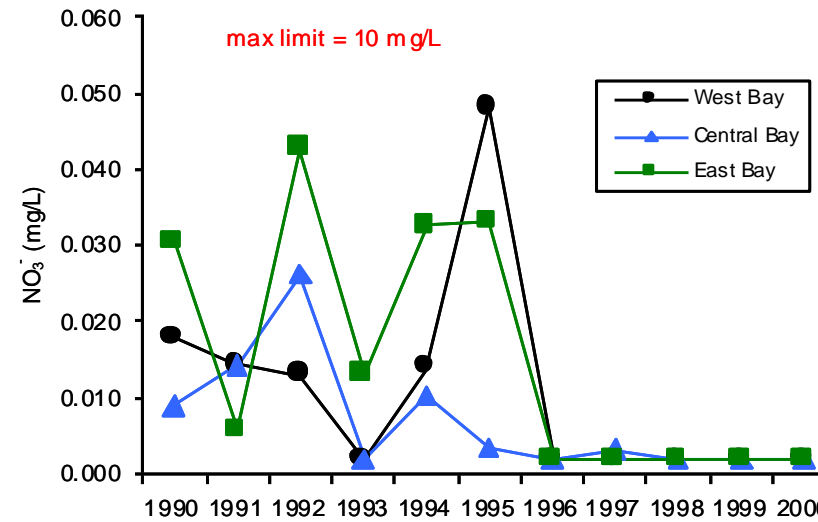
b) Phosphate



c) DO



d) Nitrate



(2) BOD, PO<sub>4</sub>, DO, and nitrate concentrations in the Laguna Lake. These met criteria for Class C (Source: LLDA)

# Lake water quality (Herrera et al., 2015)

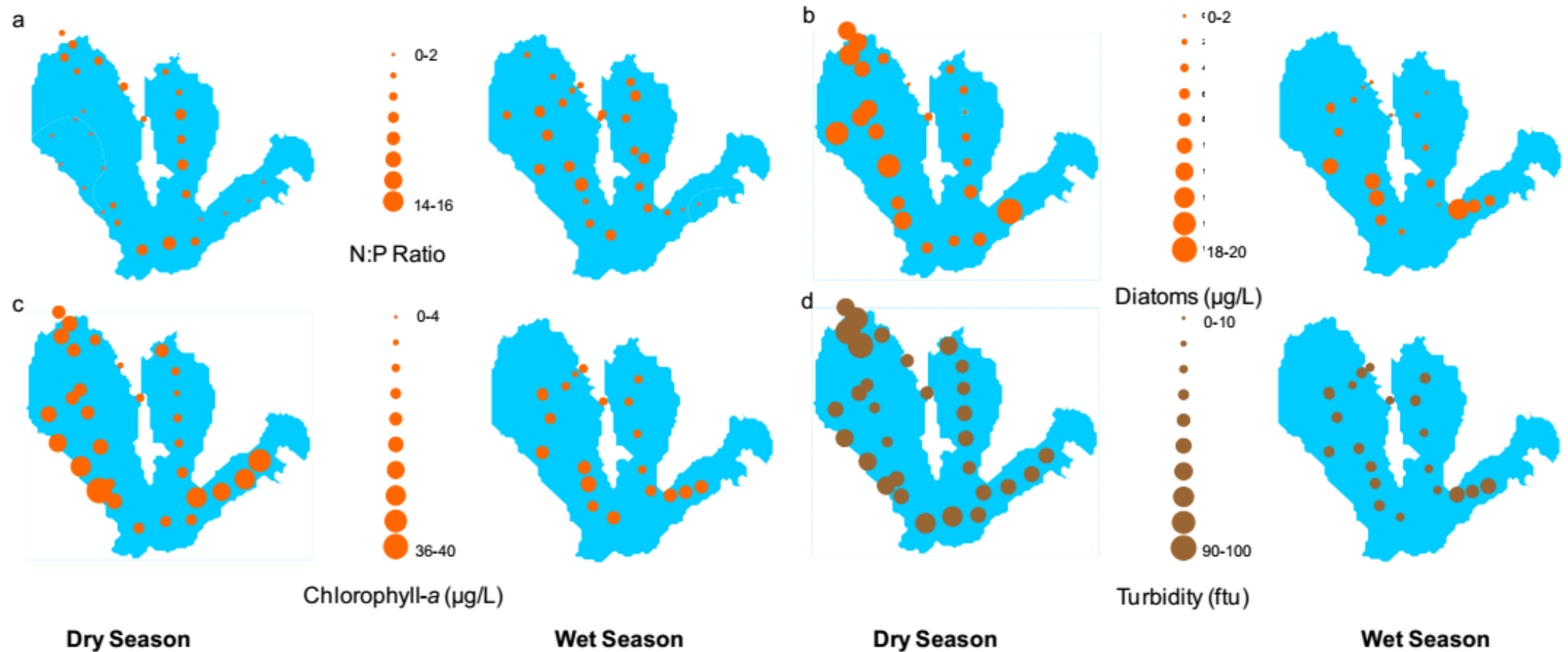


Figure 9. Spatial distribution of observed dry and wet season Laguna Lake water quality parameters ((a) N:P ratio (b) diatoms (c) chlorophyll-a (d) turbidity))

# Water elevation and salinity (Herrera et al., 2015)

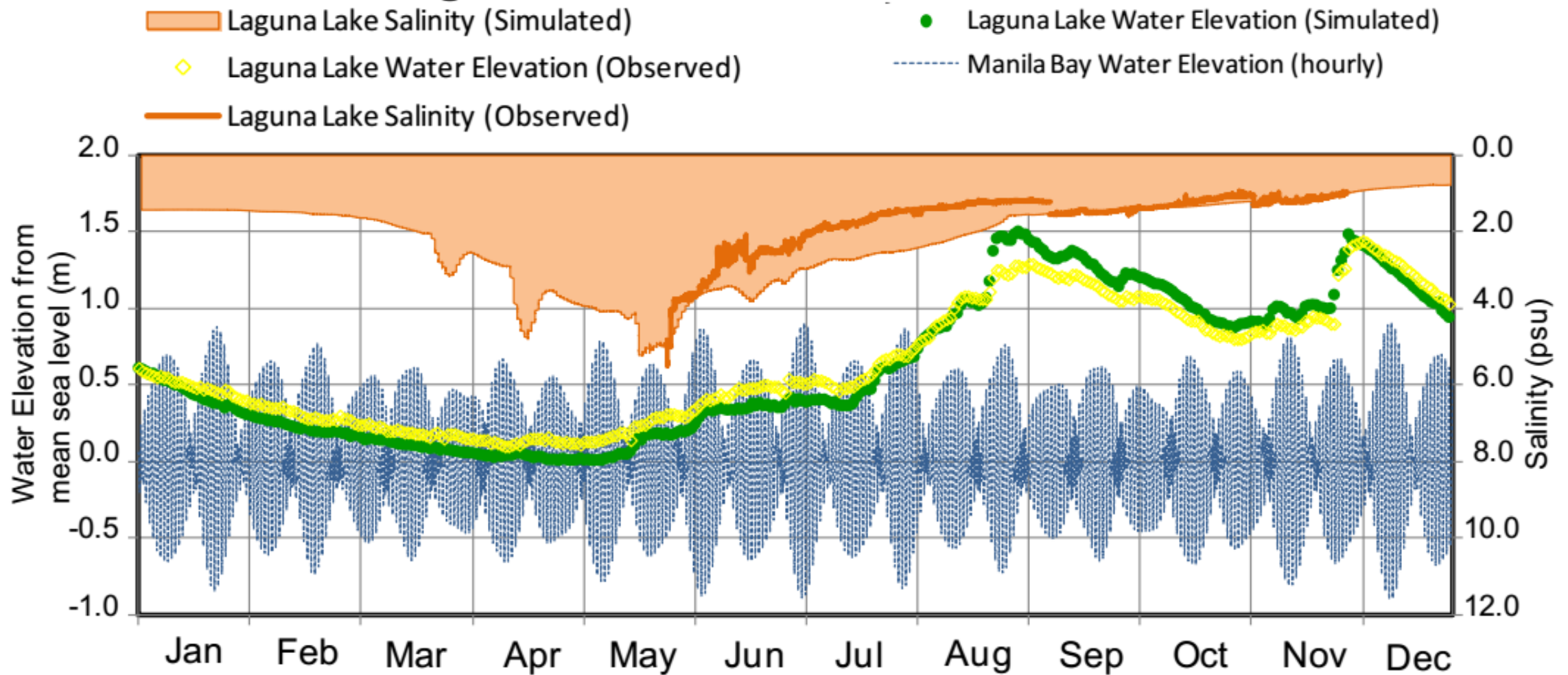


Figure 5. Laguna Lake model performance for water elevation and salinity (2008), together with Manila Bay water elevation





# Water-energy flow model (Spielberg et al., 2015)

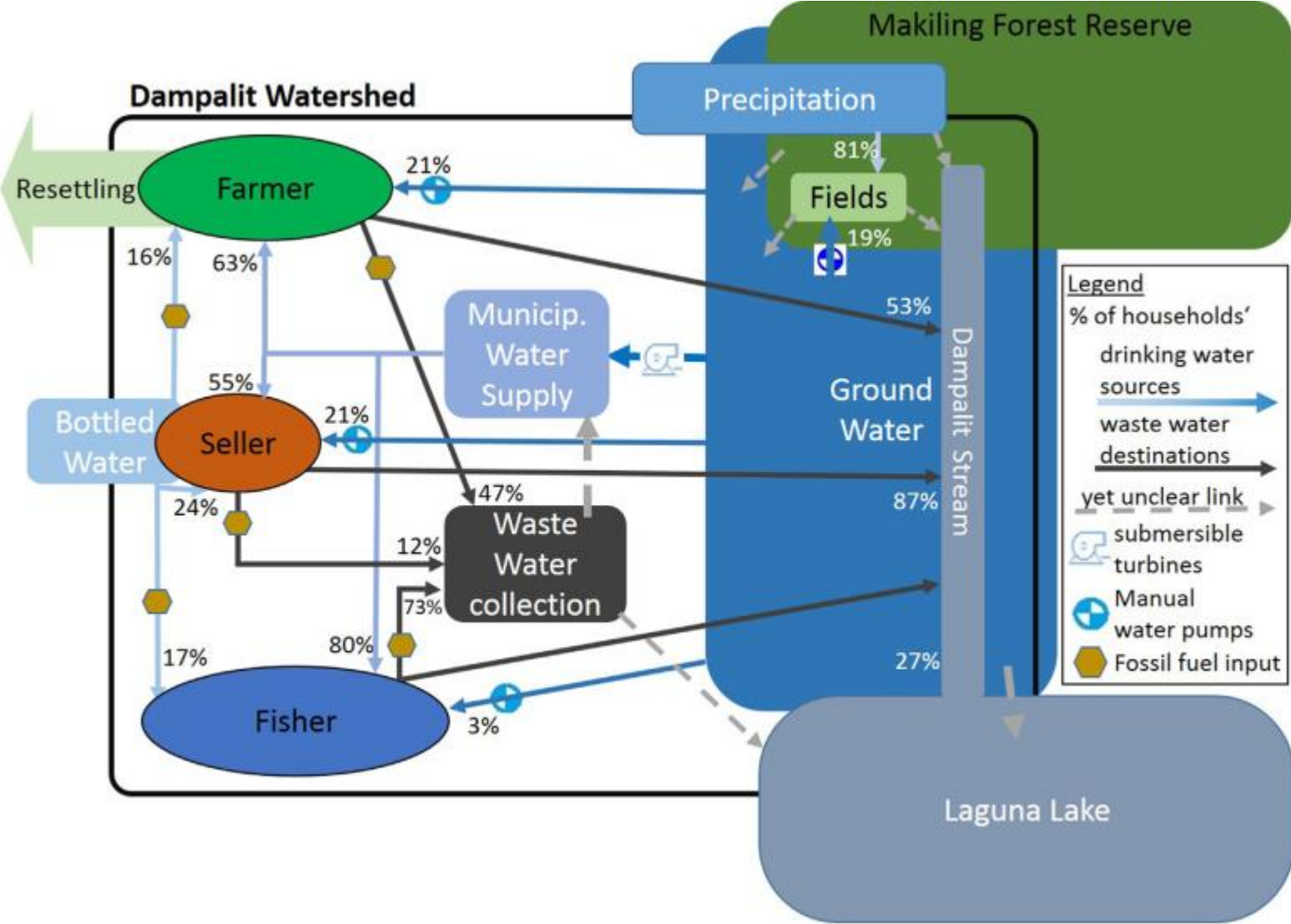
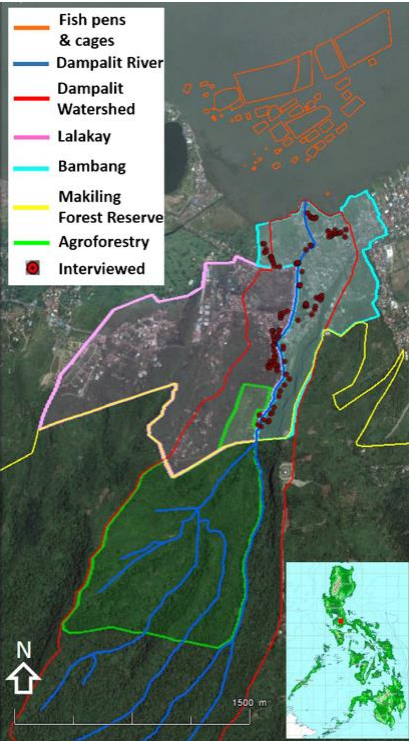
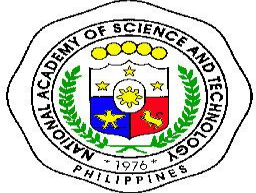
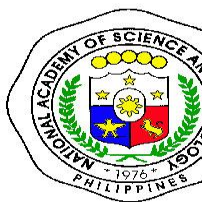
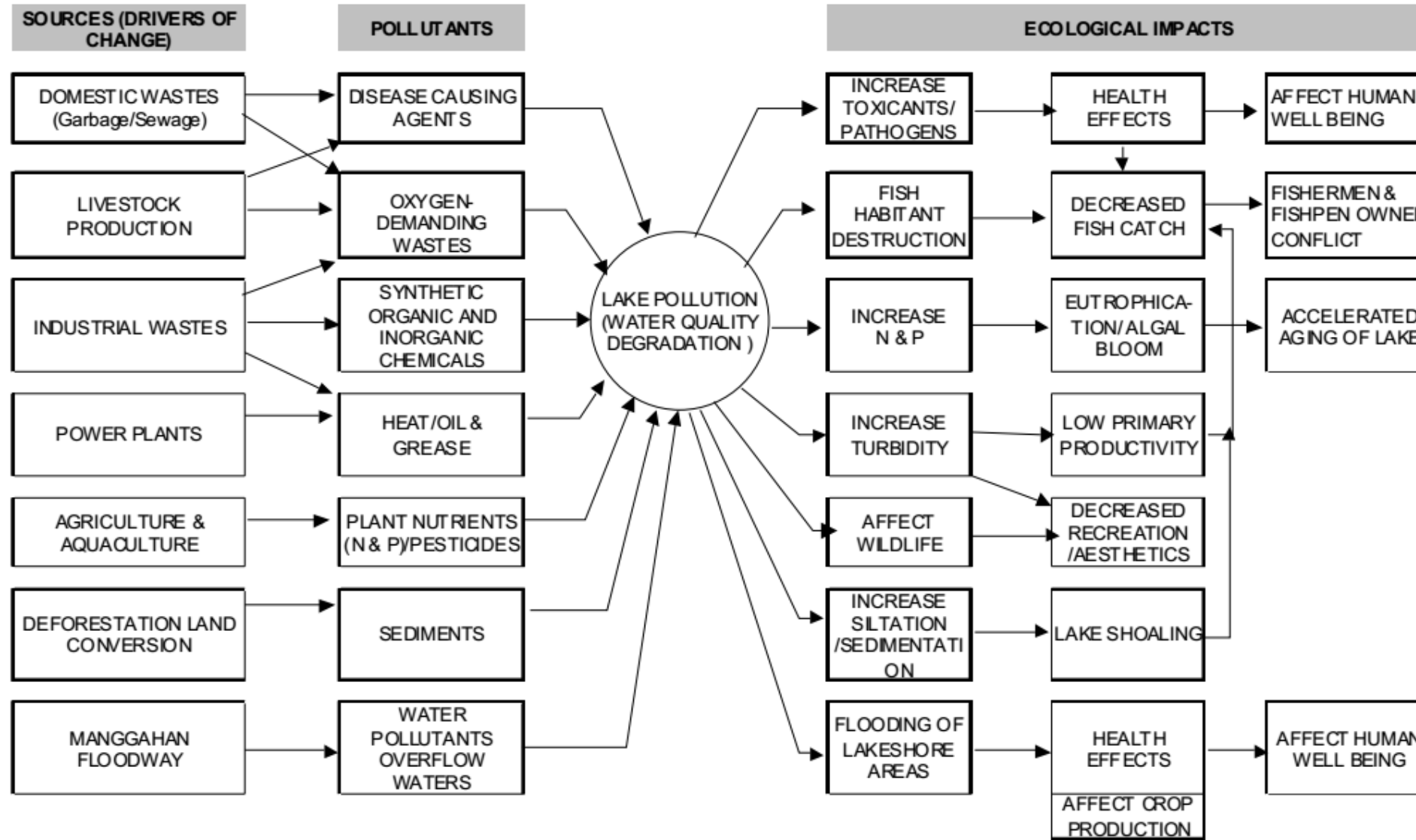


Fig. 4. Water-energy flow model.



# Factors (drivers of change) affecting water quality and their impacts on the lake ecosystem.

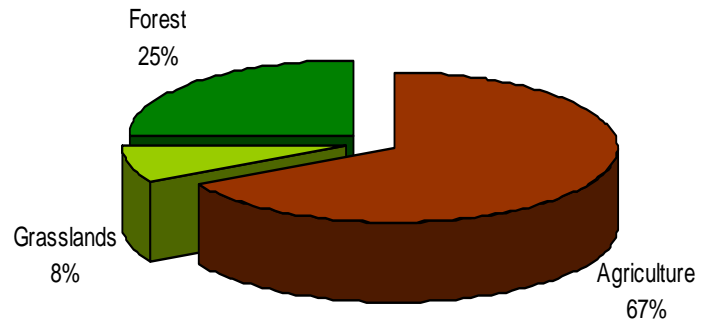




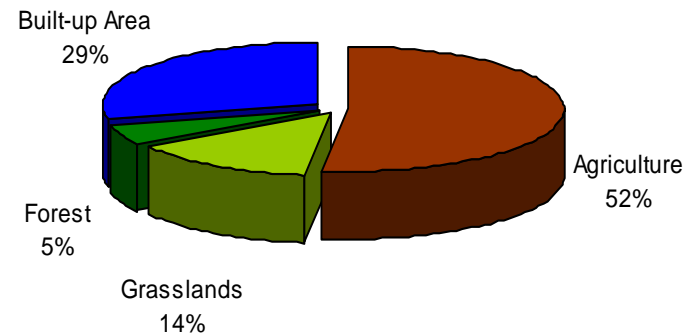
# Land cover change



Land Use 1966

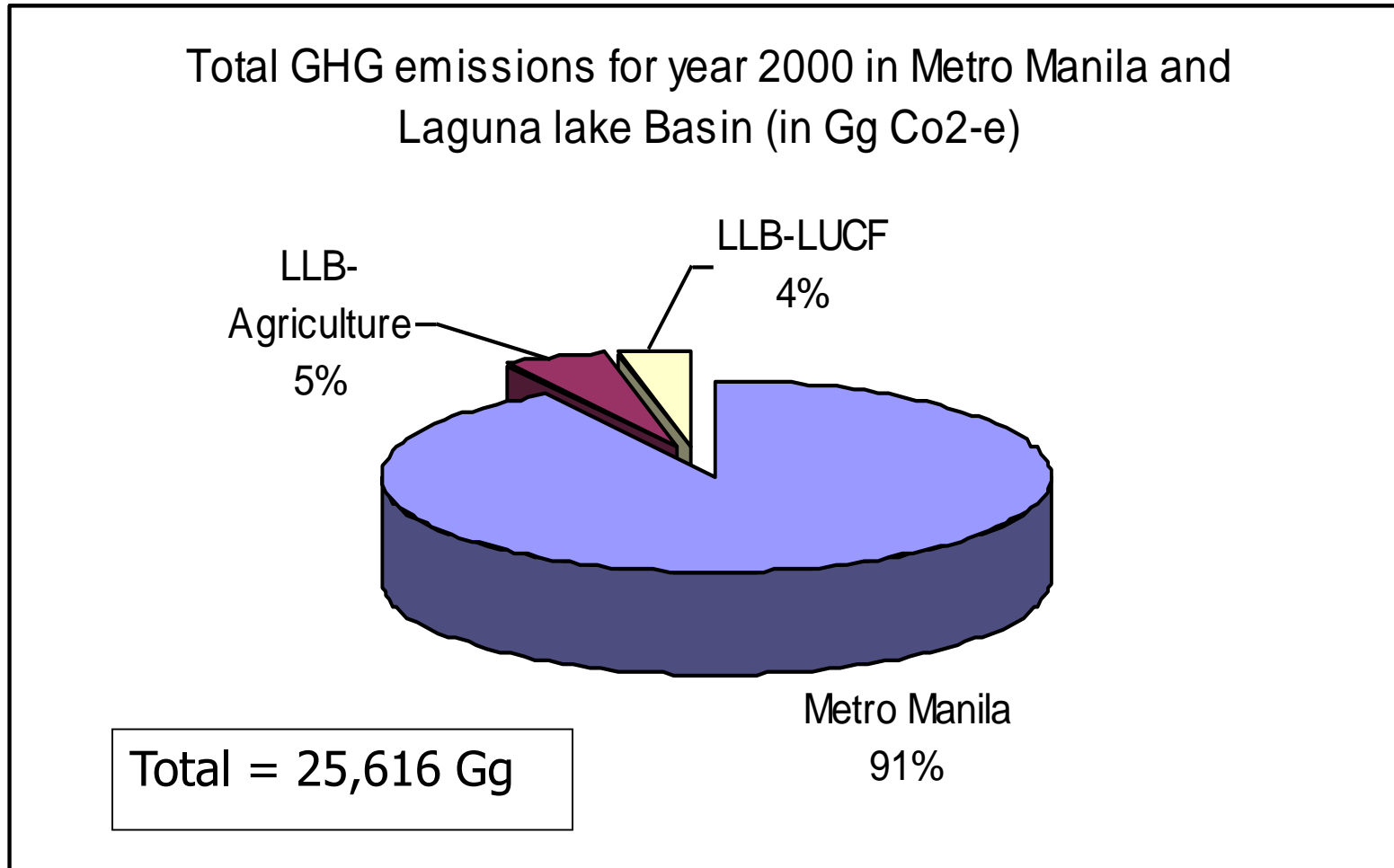


Land Use 2000





# GHG Emissions and Sinks





- Enhance removals by sinks through tree planting in the grassland areas of the basin.
- Currently, there are 540 km<sup>2</sup> of open lands in the basin.
- These have the potential to sequester more than 1,338 kt CO<sub>2</sub> per year from the atmosphere, more than enough to turn the basin to a net GHG sink.



## II. The State of Fish Resources



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# Fish

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ADELAIDA L. PALMA, ELIADORA C. MERCENE, MILAGROSA R. GOSS



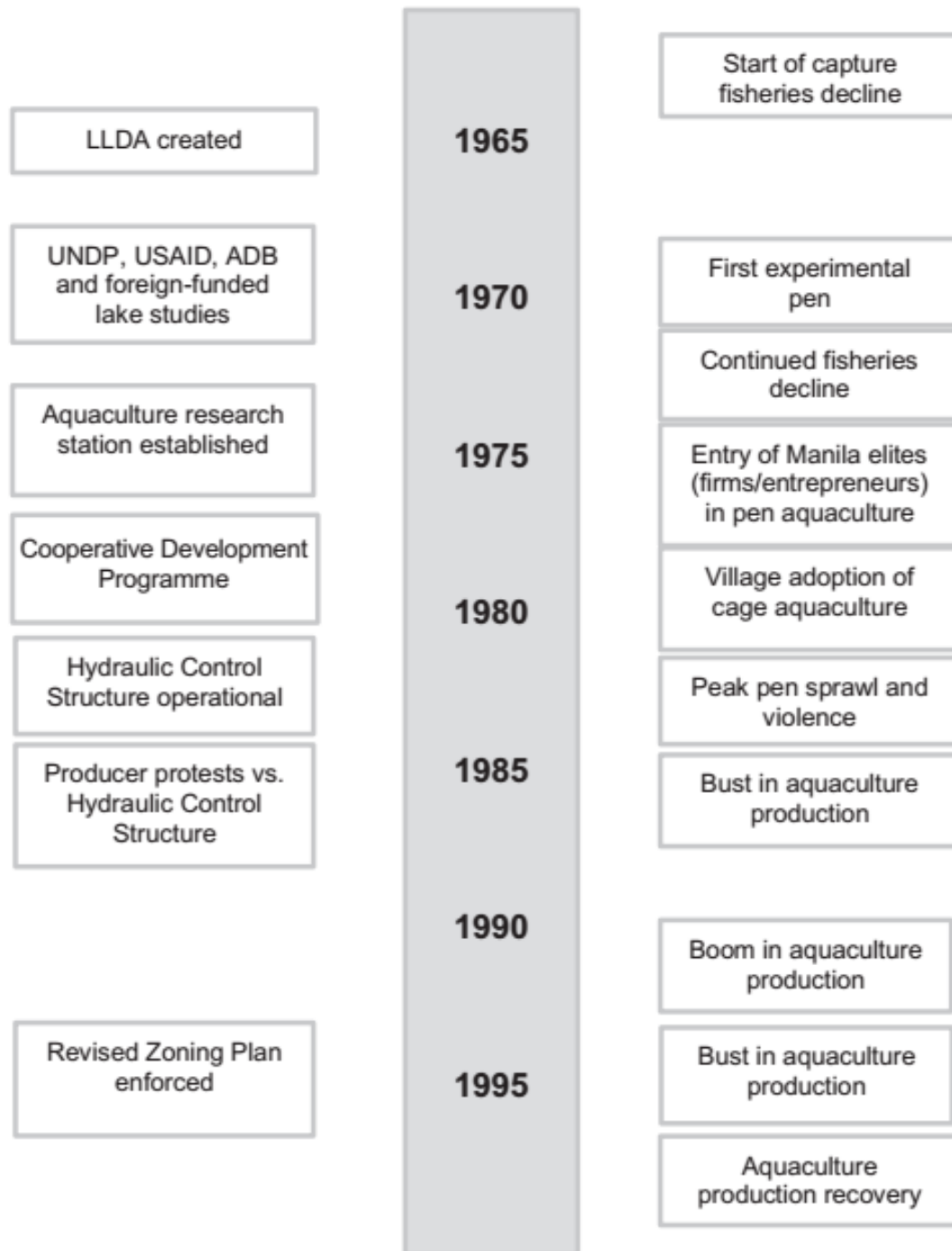
# Fish Production

- Fisheries is one of the most important traditional uses of Laguna de Bay.
- Success factors-- abundance of natural food, the absence of true plankton feeder among the indigenous economic species of the Lake, and the favorable water quality.
- Of 33 species, 14 are indigenous, 5 of which are migratory, and 19 introduced or exotic



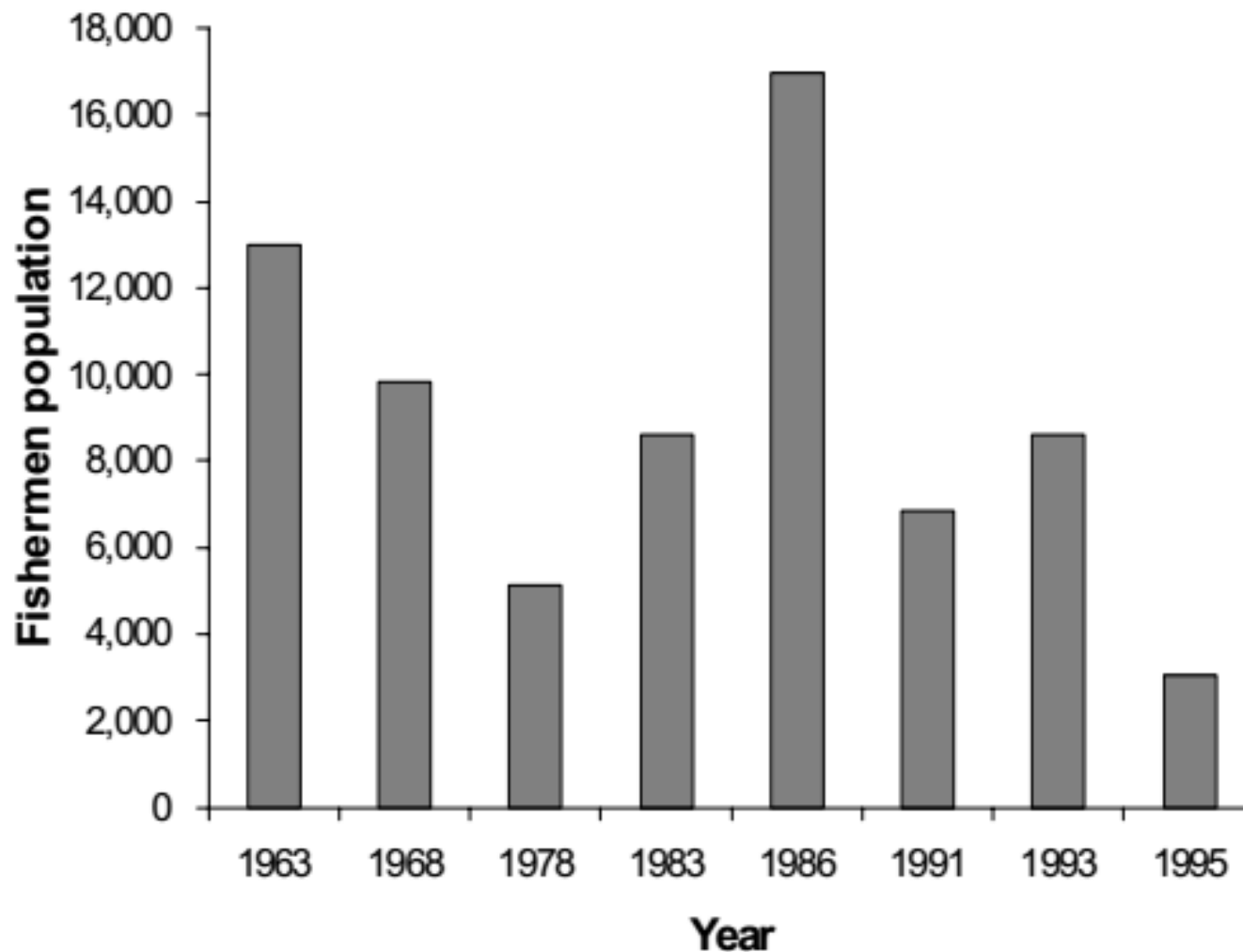


## Timeline of key events in aquaculture (Saguin, 2015)



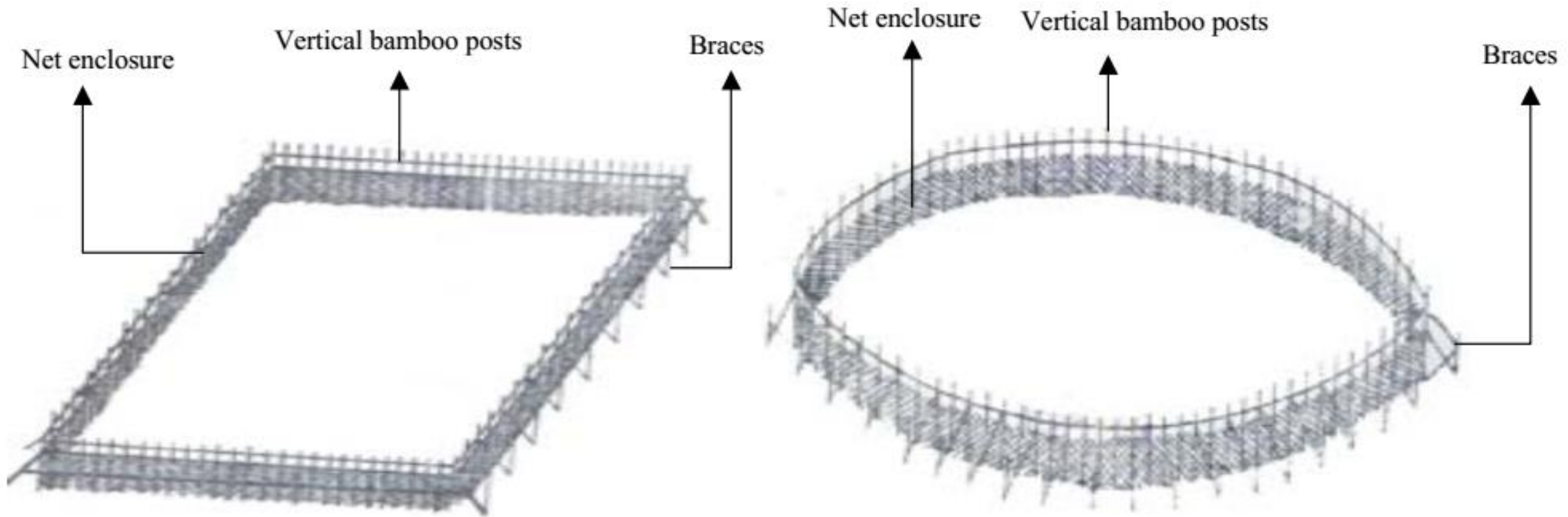


# There are about 3,000 fishers in Laguna Lake



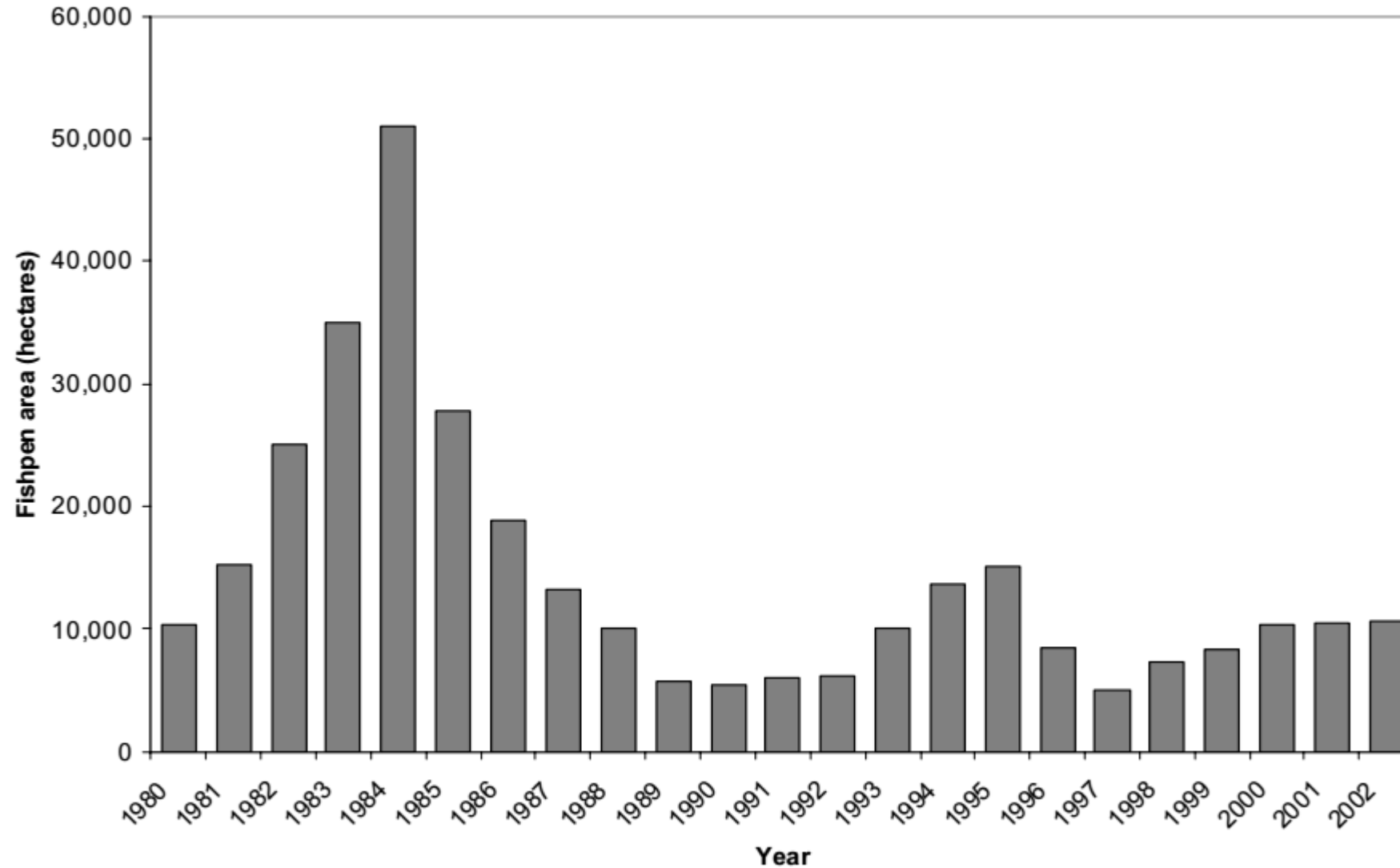


# Fishpen structures



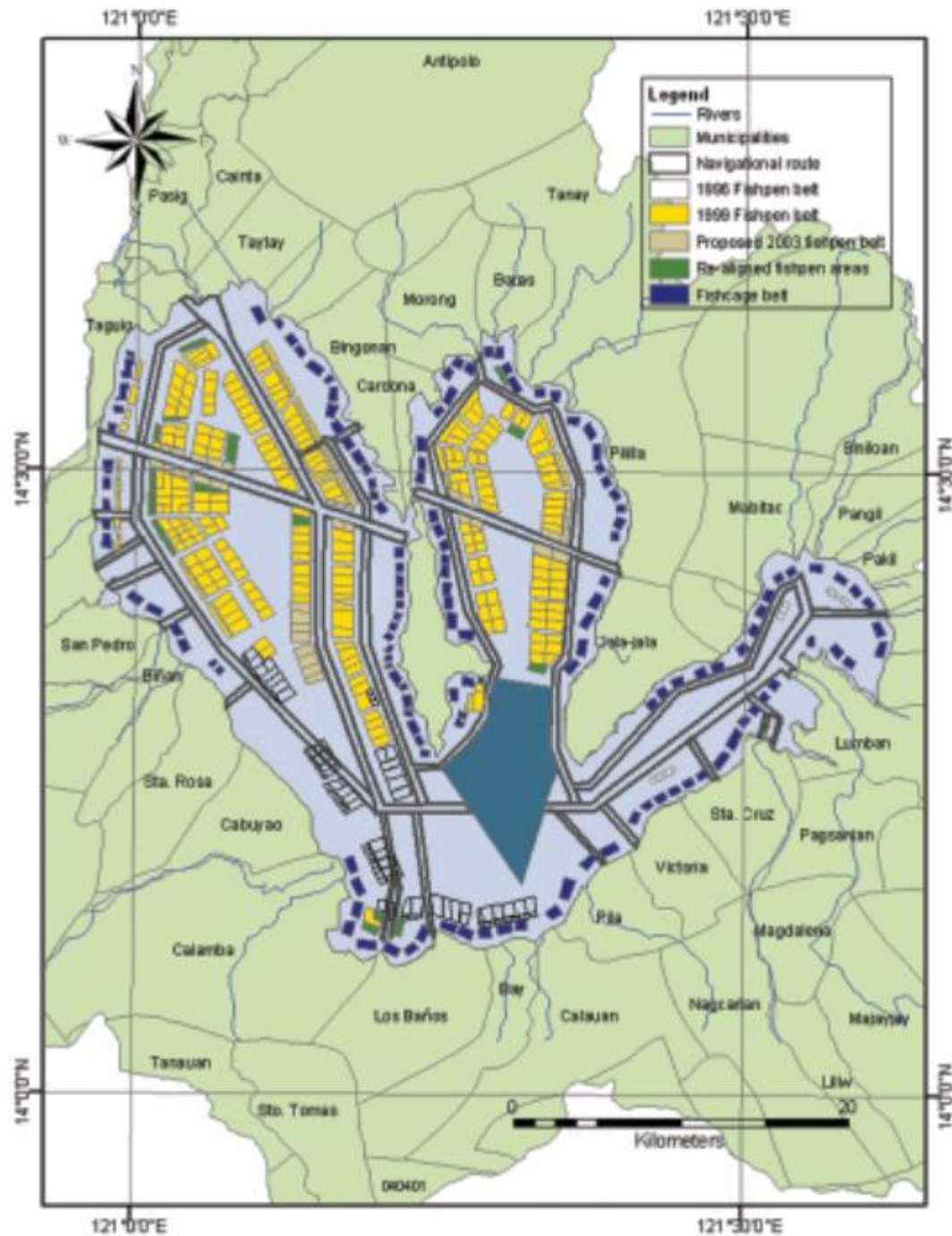


# Fish pen area (ca 10,000ha)



- To address conflicts among and between stakeholders, a **lake zoning map** was developed with designated areas for fishpen belt, fish sanctuary, navigational lanes, and open fishing areas.

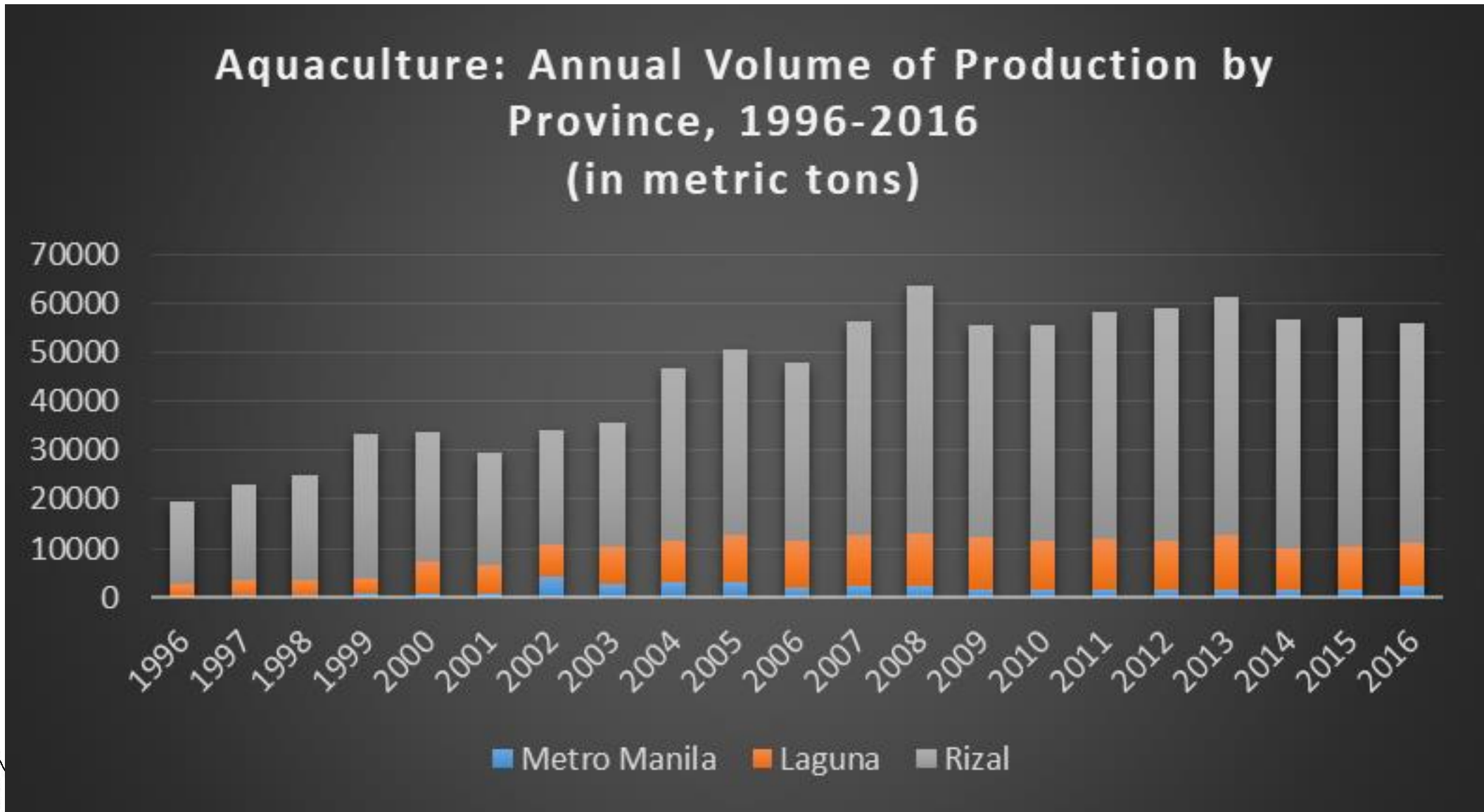




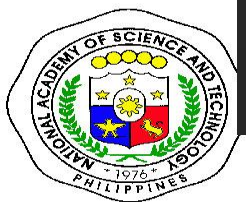
Zone map of Laguna Lake



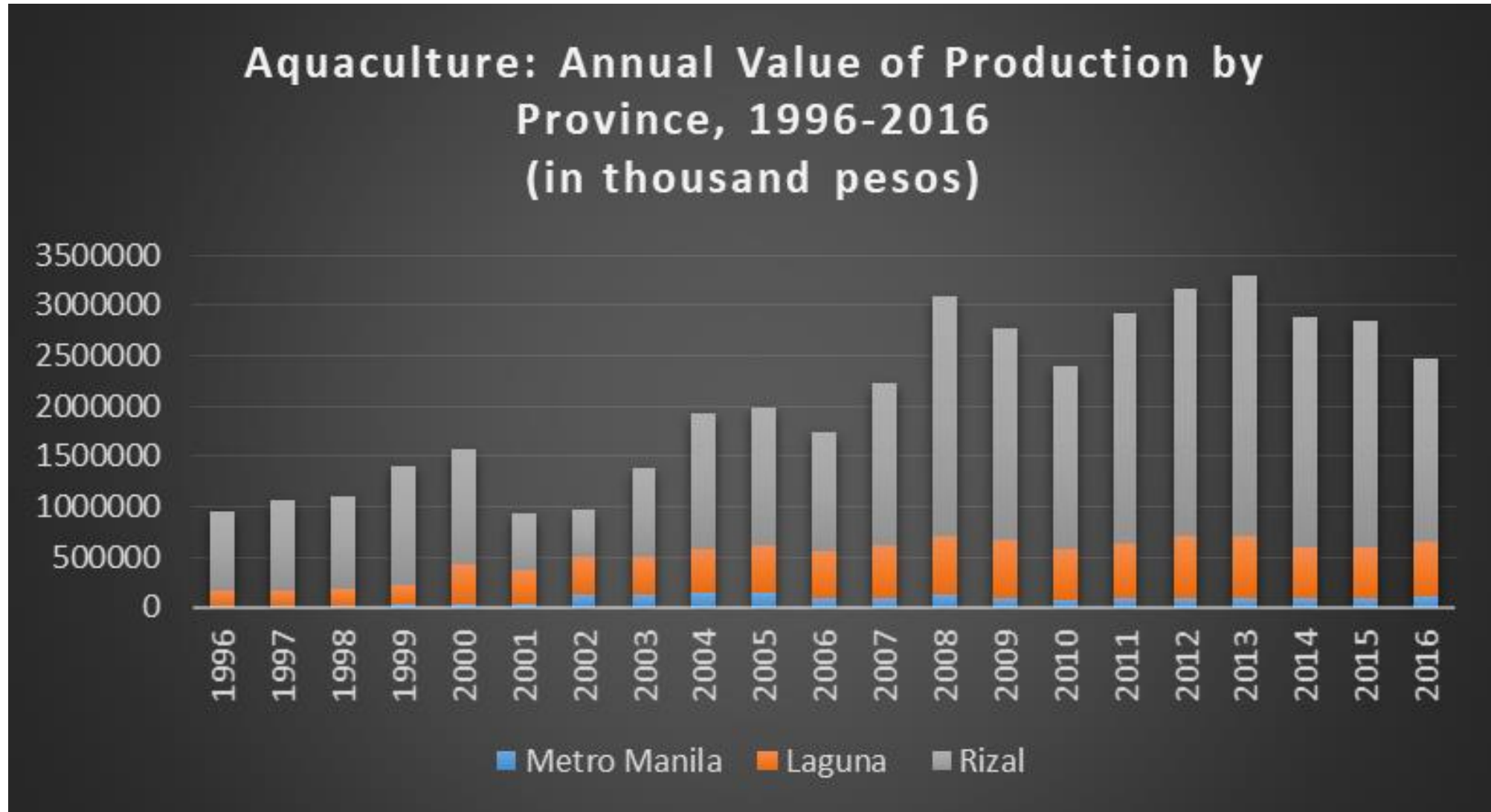
Total aquaculture production is ca 50,000 tons/year



Source: PSA/LLDA



# Total value of aquaculture production is PhP250 million per year



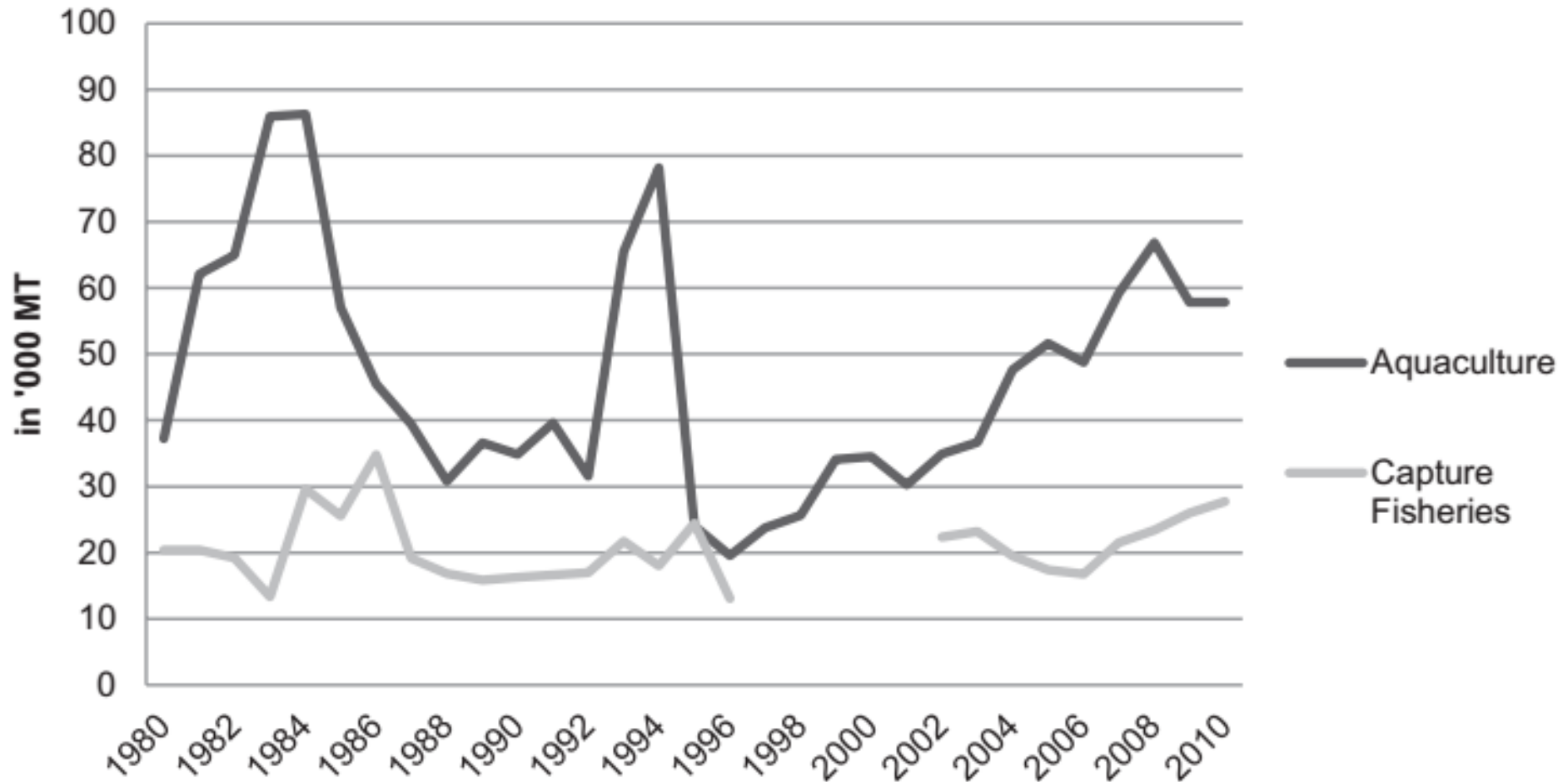
Source: PSA/LLDA





# Total fish production (Saguin, 2015)

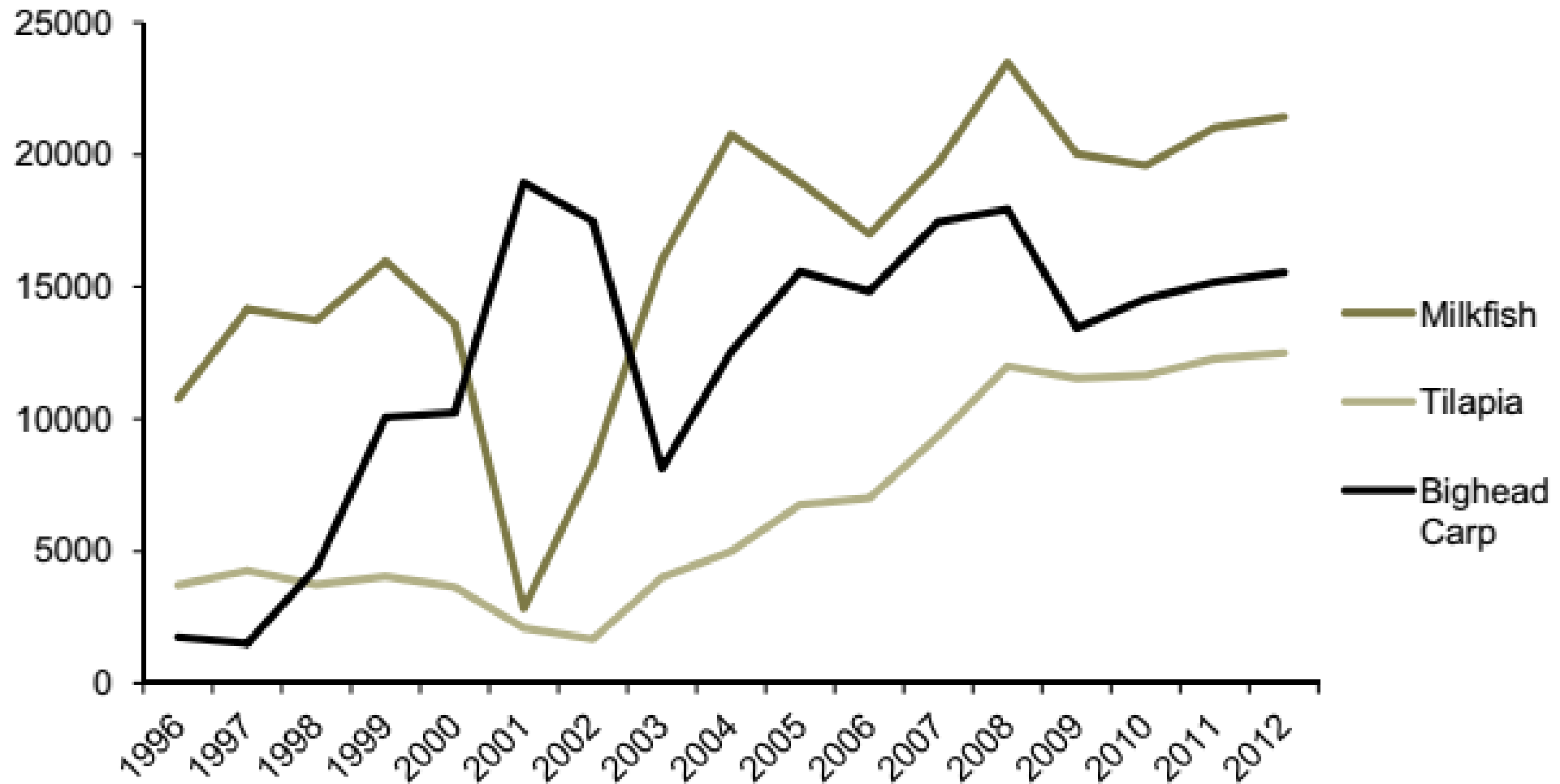
Figure 2 Laguna Lake fish production through aquaculture and capture fisheries, 1980–2010



Source: Bureau of Agricultural Statistics database, 2011; LLDA (1995); and NSCB (1999).



## Fish pen production (Saguin, 2014)



**Fig. 2.** Laguna Lake fish pen production by species in metric tons, 1996–2012 (Source: Bureau of Agricultural Statistics).

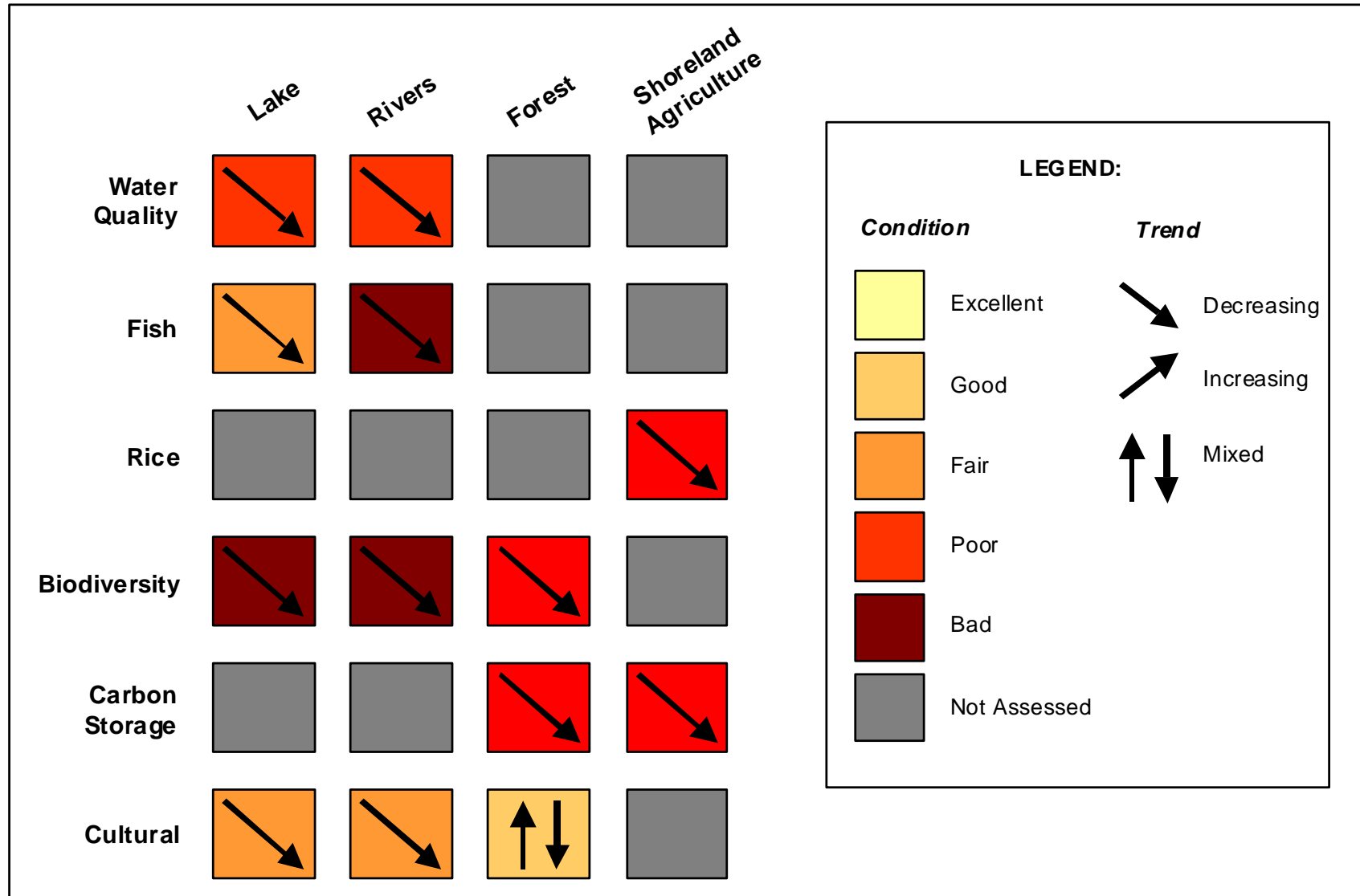


# Fish Production

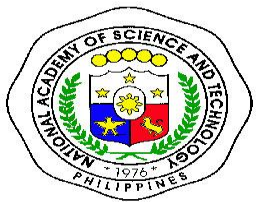
- Fish production in the lake **has declined** over the years due to the following factors:
  - operation of the hydraulic control structure which prevented the inflow of seawater that is vital in the natural primary productivity of the lake
  - decline in algal primary productivity
  - introduction of exotic fish species
  - the use of destructive fishing gears
  - domestic and industrial pollution that led to rapid deterioration of water quality.



# Summary of findings



# III. Ways Forward

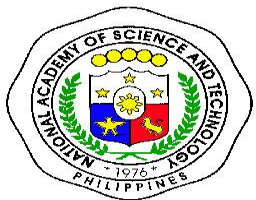


# No more fish pens by Du30's next Sona

Gov't resumes demolition of aquaculture structures in Laguna de Bay



**MGA FISHPEN BINAKLAS**



# Context

- Globally, fish farming (aquaculture) is the fastest growing food producing sector
- PH Fisheries code (RA 8550, 1988): 10% of the suitable water surface of all lakes and rivers be allotted for aquaculture purposes
- Laguna Lake is the chief source of affordable animal protein supply for Metro Manila and surrounding areas
- Goal is to manage Laguna Lake for sustainable fish production and the provision of other ecosystems services



# Critical Issues

- Declining ecological condition and ecosystems services
- Equity of access to fish resources





# Contribution of fisheries to eutrophication

- MA report: In 2000, total input of 13,800 tons N/yr of which 79% came from domestic sources, 16.5% from agricultural activities, 4.5% from industrial effluent and **0.5% from other sources** (including fish culture).
- Santiago et al study (SEAFDEC): 38.6 tons N/yr from aquaculture; about **0.3% of total load**
- Conclusion: fish culture has very low contribution to water pollution



# Carrying capacity

- Limit fish pens and cages to 10% of total lake area (9,000ha)
- There is need for a comprehensive study on the carrying capacity of the lake



# Equity of access

- Large operators/corporations controlling major portion of fish production
- How can access by smallholder fishers be increased?
- Can joint ventures between large operators and smallholders be promoted?



- In 2010, 410 registered pen operators occupied 13 per cent of the total lake area, or an average of 28 hectares per pen (Saguin, 2015)
- 2,920 cage operations with an average of 0.60 hectare, which occupy 2 per cent of the lake area.





## MA (2005) Recommendations

- Promote equitable access to fish resources of the lake;
- Enhance the effectiveness of river rehabilitation councils;
- Implement measures to reduce lake siltation;
- Control the extent of pollution with heavy metals and other toxic substances;
- Strengthen the role of local government units in lake resources management;
- Facilitate participation of local stakeholders in lake management.



## Draft Panel of Experts Recommendations (June 2017)

- Distribute the allowable area within the suitable area in the West Bay, Central Bay and East Bay
- Observe equity with priority entitlement to fishermen
  - 60 % of 9,200 hectares or 5,520 ha shall be allocated to fishermen and 40% or 3,680 ha shall be allocated to private corporations and individuals.
- Conduct a Programmatic Environmental Impact Assessment (EIA) of aquaculture operation in Laguna de Bay.



- Revise the 1999 Laguna de Bay Fishery Zoning and Management Plan (ZOMAP) reducing allowable area for aquaculture from 15,000 to 9,200 hectares.
- Monitor regularly the heavy metal concentration in the water, sediment and fish flesh and release the information to all sectors in a regular basis.
- Develop a risk communication program in disseminating information on the potential health risks from lake products
- Monitor extensively the compliance of wastewater dischargers to the effluent criteria.



- Address the increasing eutrophication of the lake through regulation of nutrient discharge.
- Empower the fisherfolks to organize fish cooperatives with the commercial fishpen operators providing technical support.
- Explore from financial institutions such as the Development Bank of the Philippines (DBP) and Land Bank of the Philippines (LBP) to provide financial assistance to fish cooperatives.





Thank you!

