

Non-Market Valuation



Nancy Kanbar
Dr. Dawn Parker (Nov. 18-25)

1

Economics: Science of choice. It studies how people choose to employ **scarce resources** that could have **alternative uses** in order to produce commodities and to distribute them for consumption, **now or in the future.**



When this definition of economics is applied to environmental resources, becoming scarce due to their **abuse** by increasing populations around the world, we are at the core of

environmental economics, which seeks the **optimal level** of environmental resources use to **sustain** and maintain **environmental quality.**

2

Environmental Benefits

Benefits generated from the conservation and sustainable use of environmental resources are categorized into 3 groups:

➤ **Ecosystem services:** protection of water resources, contribution to climate stability, maintenance of ecosystems...

➤ **Biological benefits:** represent the bulk of human consumption, whether direct consumptive use (food, medicinal resources, wood products) or indirect consumptive use (recreation, ecotourism).

➤ **Socio-economic benefits:** Tourism, aesthetic qualities of recreation areas and cultural values.

3

Population Growth vs. Resource Use

- World population: 6 billion (expected to exceed 8 billion in 2020).
- Global population increases by about 78 million people/year.
- Although population size and growth rate are important factors to determine the human impact on the env., they don't tell the whole story. Consumption varies from place to place.
- The effects of population size and population growth on the env. depend both on the numbers of people and the impact of each person.
- For some resources, low population growth in the developed world may have equal or greater impact than higher growth rates in the developing world.

U.S. consumes as much energy as India and China combined, though it has 1/8 as many people

Population growth in the U.S. has an effect on energy consumption 6 times greater than average

4

The Commons Problems

❖ **Common property resources** belong to all those people who would like to take part in their use. They are susceptible to overuse (fisheries, biodiversity).

❖ *The incentive to consume a resource before others do so has the potential to result in the **overuse and depletion.***

The process, by which a common property resource is depleted because no individual has an incentive to conserve, was outlined by Hardin (1968). **Tragedy of the Commons**

It is a **tragedy** because it would be in the interests of all if everyone were to conserve; without access restrictions, however, this will not happen.

5

Externalities

Individuals commonly consider costs and benefits when weighing the wisdom of a particular course of action. There are **costs that are not borne by, or benefits that are not realized by, the individual taking the action.** These costs and benefits are considered **externalities.** Environmental gains and losses are externalities.

Externalities cause **market failure.** In order to internalize them, their true costs and benefits must be known. These figures are **complex** and difficult to assess.



6

Environmental Abuse

With :

- Population growth,
- Environmental resource abuse,

Will they be enough resources to serve humanity?
Will the environmental impacts of resource usage harm life?



Questions to be asked are: ???

- ➔ Where are our **limits** to growth, and to the use of natural resources?
- ➔ Do our children and grandchildren have the **right** to enjoy what we have today?
- ➔ How can we place a **value** on the damage done to people when the natural world surrounding them is degraded?



8

The Production Possibility Frontier (PPF) shows trade offs facing **today's** generation.



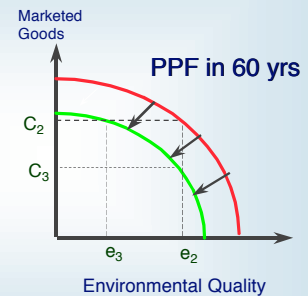
But!!!!

What about **future** generations?

9

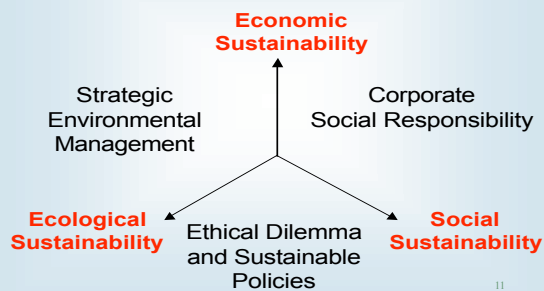
SUSTAINABILITY

- ➔ **Today**, we can choose any point on the red curve.
- ➔ But, **future** generations are dependent on the choices we make today.



10

3 objectives of Sustainability are identified:
economic, social, & ecological.
Tradeoffs are bound to exist among them



11

The challenge is to provide a **market value** for natural capital
A complex task!

It is well known that:

The valuation of goods that have a market comes from the **intersection of supply and demand**. Therefore, the equilibrium point determines the quantity of the good to be consumed at the corresponding price.

HOWEVER,

The value of the environment **is not equal** to the gross value of the quantity of biological production. The worth of a forest should not be considered only as that of the marketable things (wood) without taking into account social, cultural, touristic, non use, and option values.

A measure of the marketable value is a poor measure that **favours the exploitation** of resources rather than their conservation!!!

Env. Valuation is complex because the goods in question have no market value . How can we price a 3,000 old tree? How can we price a certain species on the verge of extinction? How do we value biodiversity?

Economists have developed new ways for calculating the economic and social values of biodiversity.

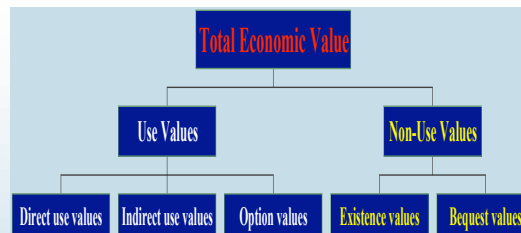


What are these values?

What are the main economic valuation methods?

13

Economic values of the Environment



14

DIRECT USE VALUES

Values derived from the direct use of the environment e.g. recreation, tourism, natural resource harvesting, gene pool services, education, research... These activities can be:

commercial: traded on a market (resource harvesting, tourism..)

non-commercial: there is no formal or regular market on which they are traded (informal grazing, fuel wood harvesting).

Values of **commercial** uses is a straightforward process of directly obtaining market priced values. However if these prices are administratively set, they may not reflect the true value of the product

Valuing **non-commercial** uses is more complex and entails a range of techniques which solicit values for goods and services of a roughly comparable nature from other markets

15

INDIRECT USE VALUES



- Are values derived from the indirect uses of resources.
- Largely comprised the ecological functions: breeding habitat, climatic stabilization..
- Are often widely dispersed and thus go unmeasured by markets.
- Alternative valuation techniques are necessary for measuring them.

16

OPTION VALUES

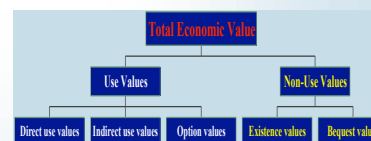
- These are values derived from the option of using the resource sometime in the future.



- These future uses may be either direct or indirect and may include the future value of information as particularly important for envt'l diversity (for example) as untested genes may provide future inputs into agricultural, pharmaceutical or cosmetic products.

17

NON-USE VALUES



2 common examples:

- Existence values:** reflect the benefit of knowing that the resource exists even though one is unlikely to use it in any way.
- Bequest values:** relate to the benefit of knowing that others benefit or will benefit from the resource.

Non-Use values are particularly **difficult** to measure.

18

Non-Market Valuation Techniques

- ♦ Measuring direct use values (traded on commercial markets) is straightforward because the markets have elicited values from the “customers”. The task of measuring these values involves identifying markets for them, gathering data about prices paid in the markets, & determining the amount of “good” or service traded. e.g. the direct use value of tourism could be measured through direct sales to tourists which may include expenditures on lodging and meals, entrance fees to a park, guided tours, etc.
- ♦ Where **markets do not exist**, values held by ‘customers’ must be elicited. Several methods have been developed:
 - 1- Contingent Valuation Method (CVM)
 - 2- Cost Benefit Analysis (CBA)
 - 3- Hedonic Pricing Method (HPM)
 - 4- Travel Cost Method (TCM)

19

Contingent Valuation Method (CVM)

- Contingent Valuation (WTP) is the subject of an immense literature. **Over 2,000 papers** on the subject. This body of research is motivated by the possibility that CVM might solve a serious problem in env. policy analysis: the need to **assign a value to non-market goods**.
- Only possible way of giving monetary value to existence values and option values. Important because it estimates values where markets do not exist.
- It asks people through surveys what they are WTP for the good or WTA for its loss creating a hypothetical market.
- Respondents should be made familiar with the good.
- Major criticism: there is a difference between professing a WTP and actually paying.

BIASES in CVM



Strategic Bias

- Known as the **free rider** problem. It emanates from the supposed problem of getting individuals to reveal their true preferences in contexts where, by not telling the truth, they will still secure a benefit in excess of the costs they have to pay.
- This is a common concern of **public goods (not excludable and not rival)**.

22

Design Bias (3 sources)

- **Starting point bias:** When the questioner suggests the first bid, the starting point, it is possible that this will influence the respondent by suggesting the range over which the ‘bidding game’ will be played.
- **Vehicle bias:** The respondent might be sensitive to some ways of payment (taxes, entrance fee, donation). A person might regard \$5 paid as taxes as more costly for him than \$5 he decided to pay as donation for preservation of biodiversity.
- **Information bias:** The information quality and sequence, given to the respondent, regarding the resource, is very important since it might influence his answers significantly.

These biases could be minimized by carefully designing the questionnaire and minimizing the number of questionnaires’ fillers.

23

Hypothetical and operational biases

- The basic idea of CVM is to create a hypothetical market. This market should be made as close as possible to a real market. The hypothetical bias is very much related to the information bias whereby the respondent is given information by the interviewer in a way to imagine a real market for the good in question.
- The operational bias can be explained in terms of the extent to which the actual conditions in the CVM approximate the actual market conditions.

24

COST BENEFIT ANALYSIS (CBA)

- CBA is an “estimation and evaluation of net benefits associated with alternatives for achieving defined public goals”
- Main analytical tool used by economists to evaluate env'l decisions. The bottom line of CBA is expressed as Net Present Value (NPV), that is, the difference between the sum of present and future benefits and the sum of present and future costs, all discounted to the present.

Difficulties in applying CBA

- 1- Emphasis on WTP as a measure for benefits
- 2- Discounting

1- WTP

- Value of a good to someone is what that person is WTP for it.
- Amount a person is WTP for something = The benefits that he gets from it. However, env. benefits are hard to measure because WTP is affected by: ability to pay and awareness of the env. impacts, and personal values!!

2- DISCOUNTING



Technique by which one can “reduce” future benefits & costs streams to their present worth.

“A bird in hand is worth two in the bush”

This wisdom reflects that:

- Present values are better than the same future values
- & that earlier returns are better than later.

1,000 \$ today > 1,000 \$ a year from now

Discounting is controversial in env. Projects.

Env. Projects deliver the bulk of their benefits in the long run. They may take lower priority than economic development projects that pay off more quickly.



2 schools:

- **Social Discount Rate:** deals more with env'l ethics. Its rationale is that a low social discount rate should be adopted when dealing with long term public projects. Since this type of projects have benefits that occur further in the future, it would be unfair if a market interest rate is used; consequently, these projects turn to be infeasible, and we will deprive the next generations of them.
- **Market Discount Rate:** based on the concept that public projects should be dealt with the same as the private projects in order to guarantee efficient allocation of resources.

3 discounted techniques: NPV, BCR, IRR

Decision Criteria: NPV>0, BCR>1

HEDONIC PRICING METHOD (HPM)

- This method separates the **factors that contribute to prices** to identify the contribution of those based on env'l amenities. e.g. a residential property adjoining a protected area is likely to hold a higher value.
- **Assumption:** Property values reflect a stream of benefits, some of which are attributable to the good. e.g. Price of a house reflects its particular characteristics.
- A hedonic-price relating house prices to characteristics is estimated. 3 kinds of characteristics are used:
 - 1- on-site characteristics (# of bedrooms)
 - 2- neighborhood characteristics (school quality)
 - 3- environmental amenities (access to a biodiverse forest)

29

LIMITATIONS OF HEDONIC PRICING

- HPM is effective for valuing marginal changes in the levels of env'l amenities, but cannot be used for valuing non marginal env'l changes.



- HPM technique is **data intensive**. Although individuals may be familiar with the goods and services provided by a resource (e.g. a forest). It is difficult to quantify the forest goods and services. Collecting such detailed information severely inhibits the use of this approach especially in developing countries.

30

TRAVEL COST METHOD (TCM)

- Indirect Valuation Technique
- Determines a person's value of an env'l good from what they spend on travelling in terms of time, travel expenditures and entry fees.
- PRICE = Entry price to the site
+ costs of travelling to the site
+ opportunity cost of time spent

Problems with TRAVEL COST METHOD (TCM)

- TCM useful in assessing the non-commercial tourism, recreation and leisure values of a biodiverse site.
- TCM:
 - 1- is data intensive
 - 2- relies on restrictive assumptions about consumer behavior
 - 3- highly sensitive to statistical methods.

Case Study: CVM and CBA

Study objectives:

- Identify and assess potential economic benefits that can be generated from a marine reserve.
- Estimate WTP of visitors, fishermen, & restaurants owners to protect the area.
- Conduct CBA to assess the overall feasibility of the reserve.

Tool: CVM (WTP), CBA

3 questionnaires were designed to target 3 groups beneficiaries of protection.

Sample: 200 visitors, 40 fishermen, 25 restaurants (population).

33

COSTS

| Years | Government contribution (\$) | NGO contribution (\$) | Scientific institutions contribution (\$) | UNDP /GEF contribution (\$) | Total (\$) |
|--------------|------------------------------|-----------------------|---|-----------------------------|----------------|
| 1 | 8,713 | 7,200 | 0 | 134,627 | 150,540 |
| 2 | 7,600 | 7,200 | 0 | 119,077 | 133,877 |
| 3 | 7,600 | 7,200 | 4,667 | 185,210 | 204,676 |
| 4 | 7,600 | 7,200 | 4,667 | 124,493 | 143,960 |
| 5 | 7,600 | 7,200 | 4,667 | 118,993 | 138,460 |
| Total | 39,113 | 36,000 | 14,000 | 682,400 | 771,513 |

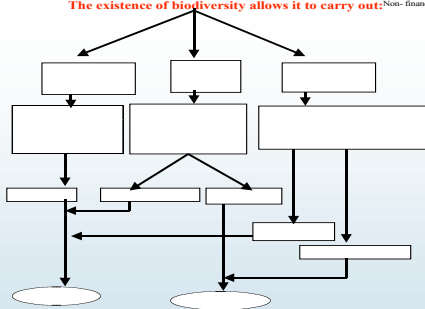
After yr 5, no fund will be available. The study assumes 15-year planning period to run CBA. After 5 yrs, costs are assumed to be reduced since some of the items will be fulfilled. To estimate the cost structure from year 6 to 15, it is assumed that after the rehabilitation plan is established, items such as personnel, offices, vehicles, boats, and equipment will be purchased, costs will be more or less stabilized.

The govt will contribute an amount of money to build a visitor center in the region of the reserve, this budget will be distributed equally from year 6-10. Assume maintenance requirements for all equipment as well as team salaries. Miscellaneous (10%) added each year to cover unforeseen events (Table A, Appendix).

34

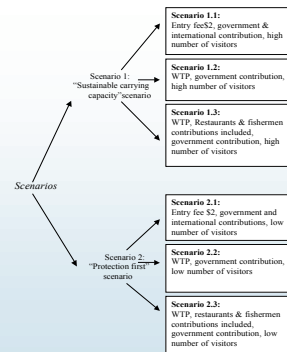
BENEFITS

The existence of biodiversity allows it to carry out: Non-financial values



35

CBA Scenarios



CBA Study Scenarios

36

Statistics- Visitors

AGE:

8% below 18 years
 89% between 19-60 years
 3% more than 60 years

Other Statistics:

- 40.5% know about the reserve from friends, only 4% from brochures & media.
- 68.2% will spend additional money on **restaurants**
- 49.7% will spend additional money on **snacks**
- 37.9% will spend additional money on **souvenirs**
- 48.7% will spend additional money on **boat tours**
- 43.6% will spend additional money on **sports act.**
- The av. additional expenditures of money is: **\$23/individual/visit.** These will be additional benefits for local community.
- WTP increase as educational level increases.

MONTHLY INCOME

23.5% : supported
 18% : <=\$300
 24% : \$301-\$500
 18% : \$501-\$1000
 16.5% : >\$1000

Statistics- Restaurants and Fishermen

Restaurants

- Sample: 25 boat & shore restaurants (**population**)
- 88% agree that the reserve will increase the number of customers.
- 76% expect that the reserve opening will yield to more restaurants in the area.
- 80% of rest. owners are WTP to keep PA

Fishermen

- 72% of fishermen agree to make PI a PA.
- 75% indicate that protection has an impact on their fishing.
- 47.5% said that the impact is positive.
- 35% indicate that they are catching new species after protection.
- 42.5% indicate that their fish yield has increased after protection.
- 60% are WTP to keep the PA

WTP RESULTS- Visitors

Per Visit Maximum WTP (\$) of Visitors to Visit and Keep the Islands as PA

| WTP | Percent | Valid % | Cumulative % |
|---------|---------|---------|--------------|
| Valid 0 | 2 | 2.1 | 2.1 |
| 1 | 1.5 | 1.5 | 3.6 |
| 1.5 | 1.5 | 1.5 | 5.1 |
| 2 | 1.5 | 1.5 | 6.7 |
| 3 | 32.5 | 33.3 | 40 |
| 5 | 25 | 25.6 | 65.6 |
| 10 | 25 | 25.6 | 91.3 |
| 15 | 3.5 | 3.6 | 94.9 |
| 20 | 5 | 5.1 | 100 |
| Total | 97.5 | 100 | |
| Missing | 2.5 | | |
| Total | 100 | | |

Mean WTP for all visitors sample = \$6.47

WTP RESULTS- Fishermen

Average WTP (\$) for fishermen sample to keep the Palm islands a PA

| | Valid Percent | Cumulative Percent |
|----------------|---------------|--------------------|
| Valid 10-25 \$ | 45.83 | 45.83 |
| 26-50 \$ | 16.67 | 62.50 |
| 51-100 \$ | 25.00 | 87.50 |
| >100 \$ | 12.50 | 100 |
| Total | 100 | |

60% of the surveyed fishermen are WTP to keep protection, while 40% are not.

WTP varies from a minimum of \$10 to maximum value of \$240 per year, with a mean value of \$62

WTP RESULTS- Restaurants

Maximum WTP (\$/year) of Restaurant Owners to keep the Islands Protected.

| Max WTP/year | Percent | Valid Percent | Cumulative Percent |
|------------------------|---------|---------------|--------------------|
| Valid 10-25 \$ | 28 | 41.18 | 41.18 |
| 26-100 \$ | 32 | 47.06 | 88.24 |
| >100 \$ | 8 | 11.76 | 100.00 |
| Total | 68 | 100.00 | |
| Missing System Missing | 32 | | |
| Total | 32 | | |
| Total | 100 | | |

80% of the restaurant owners are WTP to keep the protected area. The maximum annual WTP varies from a minimum value of \$10 to a maximum value of \$200, with a mean of \$65.

CBA RESULTS

Scenario 2.3: WTP of visitors (6.5\$/visit) & WTP of restaurants (\$65/year * 25 : population) and fishermen (\$62/year * 5000 fishermen*60% WTP)

| Year | Expected # of visitors | Tot WTP (visitors) | Tot WTP (rest) | Tot WTP (fish) | Total WTP (\$) |
|------|------------------------|--------------------|----------------|----------------|----------------|
| 1 | 0 | 0 | 1,625 | 186,000 | 187,625 |
| 2 | 0 | 0 | 1,625 | 186,000 | 187,625 |
| 3 | 0 | 0 | 1,625 | 186,000 | 187,625 |
| 4 | 5,000 | 32,500 | 1,625 | 186,000 | 220,125 |
| 5 | 7,500 | 48,750 | 1,625 | 186,000 | 236,375 |
| 6 | 10,000 | 65,000 | 1,625 | 186,000 | 252,625 |
| 7 | 12,500 | 81,250 | 1,625 | 186,000 | 268,875 |
| 8 | 15,000 | 97,500 | 1,625 | 186,000 | 285,125 |
| 9 | 17,500 | 113,750 | 1,625 | 186,000 | 301,375 |
| 10 | 17,500 | 113,750 | 1,625 | 186,000 | 301,375 |
| 11 | 17,500 | 113,750 | 1,625 | 186,000 | 301,375 |
| 12 | 17,500 | 113,750 | 1,625 | 186,000 | 301,375 |
| 13 | 17,500 | 113,750 | 1,625 | 186,000 | 301,375 |
| 14 | 17,500 | 113,750 | 1,625 | 186,000 | 301,375 |
| 15 | 17,500 | 113,750 | 1,625 | 186,000 | 301,375 |

CBA for scenario 2.3 at 6% discount factor

| year | TC (\$) | BENEFITS | | | DF 6% | DC (\$) | D B (\$) | NPV (\$) |
|------|------------|-----------|---------|-----------|----------|------------|-------------|-------------|
| | | Tot WTP | Gov Con | Tot Ben | | | | |
| 1 | 150,540 | 187,625 | 13,500 | 201,125 | 0.94340 | 142,019 | 189,741 | 47,722 |
| 2 | 133,877 | 187,625 | 13,500 | 201,125 | 0.89000 | 119,150 | 179,001 | 59,850 |
| 3 | 204,676 | 187,625 | 13,500 | 201,125 | 0.83962 | 171,850 | 168,868 | (2,981) |
| 4 | 143,960 | 220,125 | 13,500 | 233,625 | 0.79209 | 114,030 | 185,053 | 71,023 |
| 5 | 138,460 | 236,375 | 13,500 | 249,875 | 0.74726 | 103,465 | 186,721 | 83,256 |
| 6 | 89,540 | 252,625 | 13,500 | 266,125 | 0.70496 | 63,122 | 187,608 | 124,485 |
| 7 | 87,340 | 268,875 | 13,500 | 282,375 | 0.66506 | 58,086 | 187,796 | 129,709 |
| 8 | 90,750 | 285,125 | 13,500 | 298,625 | 0.62741 | 56,838 | 187,361 | 130,423 |
| 9 | 87,890 | 301,375 | 13,500 | 314,875 | 0.59190 | 52,022 | 186,374 | 134,352 |
| 10 | 90,090 | 301,375 | 13,500 | 314,875 | 0.55839 | 50,306 | 175,825 | 125,519 |
| 11 | 54,890 | 301,375 | 13,500 | 314,875 | 0.52679 | 28,915 | 165,872 | 136,957 |
| 12 | 54,890 | 301,375 | 13,500 | 314,875 | 0.49697 | 27,279 | 156,483 | 129,205 |
| 13 | 57,750 | 301,375 | 13,500 | 314,875 | 0.46884 | 27,075 | 147,526 | 120,550 |
| 14 | 57,090 | 301,375 | 13,500 | 314,875 | 0.44230 | 25,251 | 139,270 | 114,019 |
| 15 | 54,890 | 301,375 | 13,500 | 314,875 | 0.41727 | 22,904 | 131,386 | 108,483 |
| TOT | 1,496,633 | 3,935,625 | 202,500 | 4,138,125 | | 1,062,412 | 2,574,983 | 1,512,571 |

BCR= 2.4237

NPV & BCR indicate that the project is feasible (worst scenario/ restrictive assumptions)

Summary of the CBA Scenarios Outcomes

| Discount factor | NPV | | BCR | | PROJECT FEASIBILITY |
|-----------------|-----------|-----------|--------|--------|---------------------|
| | 6% | 12% | 6% | 12% | |
| Scenario 1.1 | (428,920) | (399,079) | 0.5963 | 0.5036 | Infeasible |
| Scenario 1.2 | 306,285 | 19,659 | 1.2883 | 1.0245 | Feasible |
| Scenario 1.3 | 2,128,546 | 1,297,547 | 3.0035 | 2.6140 | Feasible |
| Scenario 2.1 | (608,917) | (507,084) | 0.4269 | 0.3692 | Infeasible |
| Scenario 2.2 | (309,689) | (344,921) | 0.7085 | 0.5709 | Infeasible |
| Scenario 2.3 | 1,512,517 | 932,967 | 2.4237 | 2.1605 | Feasible |

- ✓ The reserve provides not only **social & ecological benefits**, but also **economic benefits** (increased tourism, increased income to restaurants, & increased fish yield).
 - ✓ Given CBA assumptions, the reserve can sustain itself once the near capacity & the proposed WTP (\$6.5) are applied.
 - ✓ Once the local community contribute to protection, more profits can be made.
 - ✓ If \$2 entry fee is applied, additional funds will be needed.
- Note: No **fund-raising activities** were considered. Once they are included in CBA scenarios, benefits will increase.
- Such activities might include:
 NGO can sell souvenirs, renting swimming accessories
 organizing sports activities, etc.

- Study Limitations**
- Further studies should include **all beneficiaries** (all businesses & shops)
 - Since the reserve is not yet **open for public**, no previous records on # of visitors & entry fee. The study had assumed low & high levels of visits, with high & low levels of entry fee. Other assumptions could be made.
 - It is recommended to include **additional benefits** in CBA (e.g. sports activities)
 - **Management** of the reserve is a very crucial to its sustainability.
 - Support **marketing & advertisement** programs
 - Encourage **community participation**.
 - Once the reserve is opened, use other economic techniques to assess the benefits of the reserve, such as **TCM**.
 - More studies on the **quantity & species of fish** caught after protection can be done, so that more reliable conclusions can be drawn.

CONCLUSIONS

- Valuation studies are **expensive and time-consuming**
- **Values** which people ascribe to the env. are like preferences and prices, and thus **change over time**.
- Tailoring the valuation study and **choosing the appropriate technique** to suit the particular needs of the decision at hand and the targeted stakeholder groups will make for a more efficient and effective study.
- It is misleading to recommend a single simple method that address every valuation problem. **Each valuation exercise is unique.**
- Economic valuation is **one** tool which can help ensuring a sustainable use of the environment.

THANK YOU!