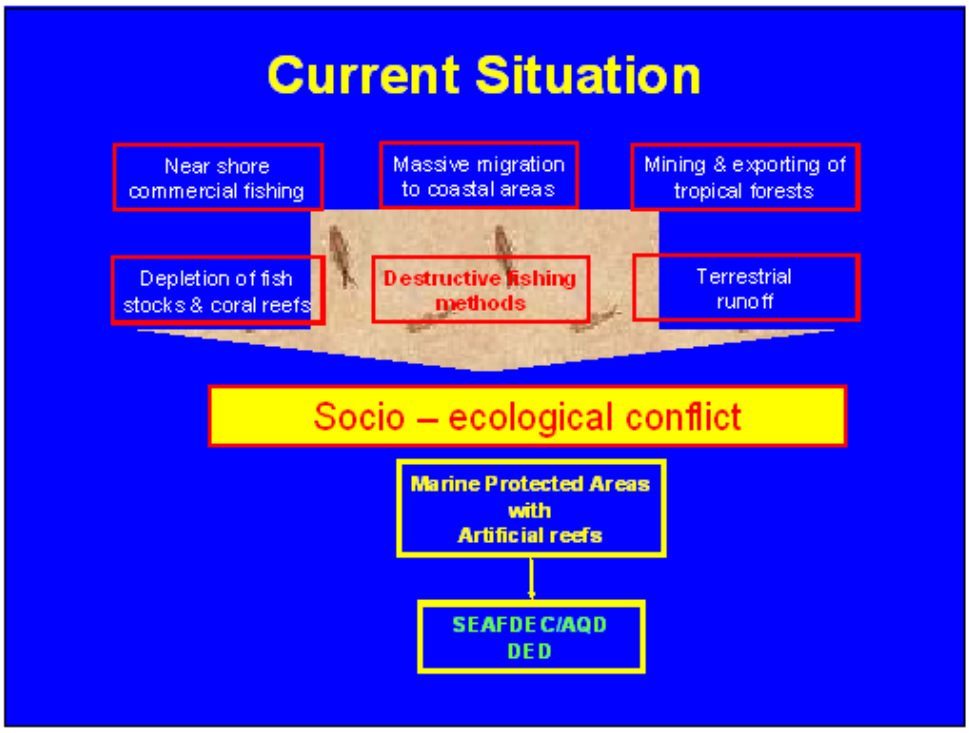
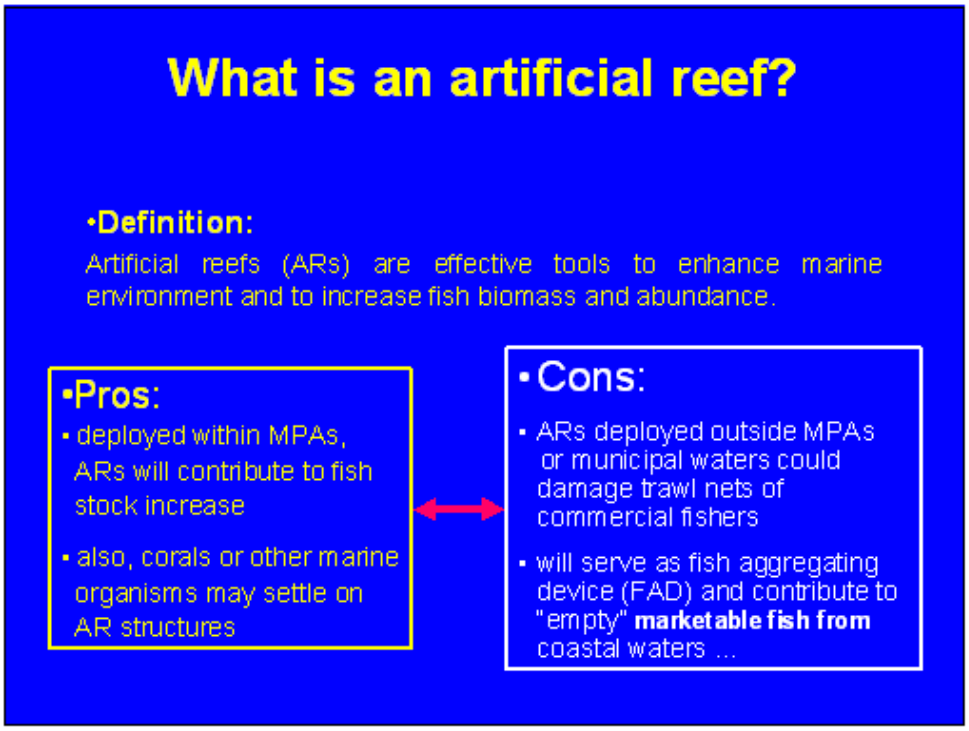
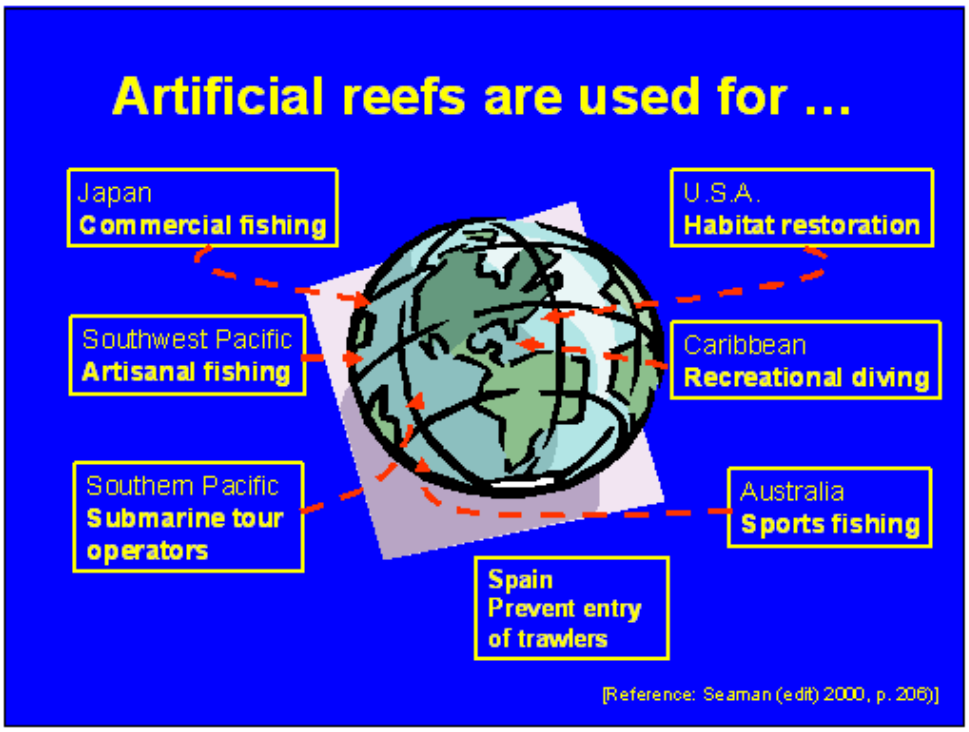

Artificial reefs – a rewarding attempt?
J. H. Primavera & K. - J. Kühlmann
Aquaculture Department
Southeast Asian Fisheries Development Center
Tigbauan, Iloilo, Philippines
German Development Service (DED)
Provincial Planning & Development Office (PPDO)
Kalibo, Aklan, Philippines
SEAFDEC
ded
Deutscher
Entwicklungsdienst


Current Situation
Near shore commercial fishing
Massive migration to coastal areas
Mining & exporting of tropical forests
Depletion of fish stocks & coral reefs
Destructive fishing methods
Terrestrial runoff
Socio – ecological conflict
Marine Protected Areas with Artificial reefs
SEAFDEC/AQD
DED


What is an artificial reef?
•Definition:
Artificial reefs (ARs) are effective tools to enhance marine environment and to increase fish biomass and abundance.
•Pros:
• deployed within MPAs, ARs will contribute to fish stock increase
• also, corals or other marine organisms may settle on AR structures
• Cons:
• ARs deployed outside MPAs or municipal waters could damage trawl nets of commercial fishers
• will serve as fish aggregating device (FAD) and contribute to "empty" marketable fish from coastal waters …


Artificial reefs are used for …
Japan
Commercial fishing
U.S.A.
Habitat restoration
Southwest Pacific
Artisanal fishing
Caribbean
Recreational diving
Southern Pacific
Submarine tour operators
Australia
Sports fishing
Spain
Prevent entry of trawlers
[Reference: Seaman (edit) 2000, p. 206)]

## 1989: IDRC grant to AQD for CRM Project

**SITE SELECTION**

**Socioeconomic** – dependence on fishing, use of fishing credit, potential alternative livelihood membership in association, awareness of NGOs

**Biophysical** – extent of live coral/seagrass, hard substrates, water depth (10-30 m) & transparency, absence of runoff, monsoon protection



## MALALISON FISHERIES

- 1980s: destructive fishing (dynamite, cyanide, muro ami), open access fishery
- Fishing gears: hookah (compressor diving), set gill net, spear gun, hook and line
- Fishing sites – Nablag reef, Balabago reef


INSTITUTION BUILDING
- FAMI organized & registered (1990)
- community organizing by NGO PROCESS
- cross visits


4 STAGES OF PROJECT
I – community/institution-building
II – livelihood: interest-free loans for seaweed farming, hog raising (1992), cooperative store started in 1994
III – territorial use rights in fisheries (TURFs), AR deployment
IV – searanching
1993 start of yearly SEAFDEC AQD-FAMI Forum

## TURFS & Artificial Reefs

1990 - Mun. Ord. 5-90 designating 100 ha exclusive TURF for FAMI
1991 - Mun. Ord. 2-91 prohibits transient & commercial fishers
ARs allowed in TURF area
1995 - Village Ord. establishing Guiob reef sanctuary, creation of FARMC
1995 - ARs (blocks, culverts) deployed: 8.5% expenses from village
1996 - Guiob Sanctuary ordinance approved by Culasi Municipality
1997 - LIPASECU established: 4 municipalities with 14 fish sanctuaries
1999 - Village Ord. 11-99 bans compressor (hookah) fishing


## ARTIFICIAL REEFS

Design: survey of Japanese prototypes, availability, cost of materials, ease of transport, installation/deployment

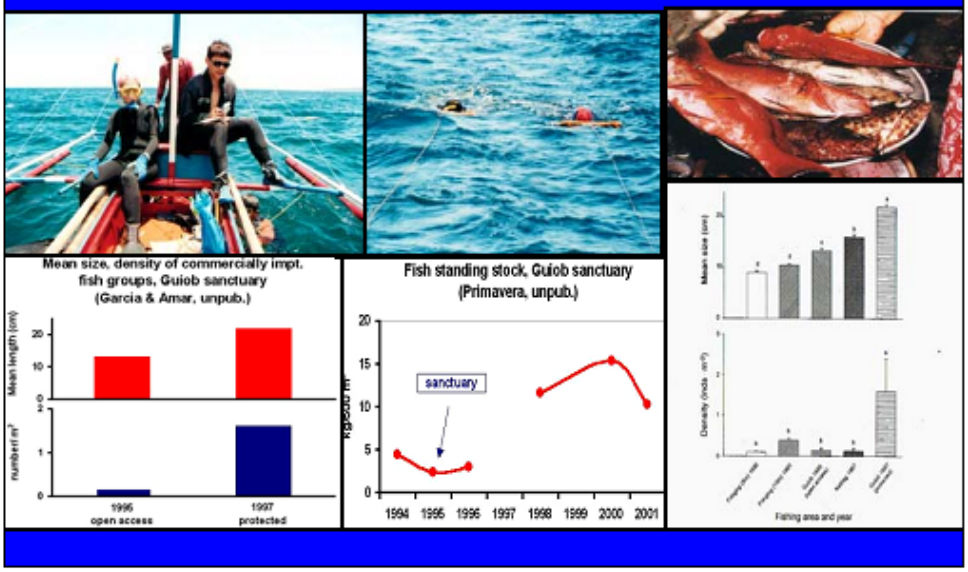
Siting: based on data from fishers, AQD survey
- water velocity
- hard substrate, topography
- declared fish sanctuary

Transport & deployment:
- motorized boat ( 10 min) vs raft towed by 4 boats (45 min)
- good weather, clear water
- teams of 6-8 persons
- each block tied with ropes, lowered by divers with air compressors then assembled

## MALALISON AR TYPES

| | Building Blocks | Culvert | Modified Culvert |
|---|---|---|---|
| Unit size | 1.5 cmx20cmx2m | 30cm dia x 1.2m | 40cm dia x 50cm |
| Module no: size | 16: 2x2x1.6m | 15: 1.2x2.5x2.1m | 30: 1.5x2.5x1.5m |
| Construction cost | US$178 | US$156 | US$138 |
| Deployment cost | US$38 | US$38 | US$38 |
| Handling | difficult because of corners | easy to roll | easy to roll, lightest |
| Time to deploy | 4 hr | 3 hr | 3 hr |
| No. of fish species | 9-16 | 21-22 | 20-24 |

## EFFECT OF ARS ON FISHERIES



## MALALISON – WHAT NEXT??

- 1998 - Project turn-over from SEAFDEC/AQD to FAMI; 6 Antique towns federated into LIPASECU
- stock monitoring/assessment
  - corals, fish
  - natural reefs vs ARs
  - sanctuary vs open area
- stock enhancement
  - abalone, top shell, sea horse, fish species??
  - sanctuary vs open area
- documentation/info. dissemination
  - SEAFDEC courses on CRM

2003 - AQD ACTIVITIES STOPPED!!!



## MALALISON PAPERS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- Primavera, YH. 2002. Aspects of hookah fishing in Malalison Island, west central Philippines. Presented at the Asia-Pacific Conference on Marine Science and Technology, May 12-16, 2002, Kuala Lumpur, Malaysia (fisheries)
- Primavera, YH. 2002. The coral reef fisheries of Malalison Island, west central Philippines two years after fish sanctuary protection. UPV J. Nat. Sci. 7 (1 & 2): 120-132 (fisheries)
- Garcia, LMB. Coral reef Almanac of the Philippines (corals)

## Conclusions (1)

- Artificial reefs can contribute to enhance fish biomass/ abundance once deployed within marine protected areas
- Artificial reefs should be placed on hard soil of coral free areas, e.g. rubble stones
- Artificial reefs should be made of concrete for easy settlement of marine organisms (corals, sponges, feather stars)
- Artificial reefs to be placed in vicinity of healthy coral reefs so coral larvae can easily settle

## STOCK ENHANCEMENT IN ARS - SOME POINTS TO CONSIDER

a) Interventions to restore depleted stocks:
1st: regulate fishing effort = habitat protection/ rehabilitation
2nd: stock enhancement

b) Candidate species/sites for stock enhancement:
Mortality not density-dependent
Release sites with natural food, shelters
Need behavioral conditioning

c) Species (mis)match:
Enhancement of cultured stock in artificial reefs (=natural habitats)

## STOCK (CULTURED) ENHANCEMENT IN ARTIFICIAL REEFS (CAPTURE)??

| Malalison fish biomass, 1995-97 (Primavera, 2002) | AQD Cultured Species | Habitat |
|---|---|---|
| 33% Caesionidae | X | coral reef |
| 28% Acanthuridae | X | coral reef |
| 6% Holocentridae | X | coral reef |
| 4.4% Scaridae | X | coral reef |
| 2% Serranidae (groupers) | *Epinephelus coioides* | estuary- coral reef |
| 1% Lutjanidae (snappers) | *Lutjanus argentimaculatus* | estuary- coral reef |
| ?? | seahorse | seagrass |
| ?? | ornamental fish | seagrass, coral reef |
| X | Siganidae (rabbitfish) | seagrass |
| X | *Chanos chanos* (milkfish) | estuary-pelagic |
| ?? | mudcrab, tiger shrimp | estuarine, sed. comm. |
| ?? | oyster, mussel | estuarine, sed. comm. |
| | topshell, abalone | seagrass, coral reef |

Note: Species differences in fisheries (*Penaeus indicus*/ *P. merguiensis*) vs aquaculture (*P. monodon*)

## Conclusions (2)

Fish stock enhancement in artificial reefs:
- most reef-dwelling fish species are not cultured
- cultured reef fish species (grouper, snapper) are not abundant in nature

Invertebrates are more promising for stock enhancement
- seagrass/coral reefs – abalone, top shell, sea urchin, giant clam
- sediment communities – mudcrab, shrimp, windowpane shell
- mangroves – mudcrab

Juveniles for stock enhancement need behavioral conditioning for
- foraging (for natural food)
- avoidance of predators