



Economics of Community-Based Stock Enhancement of Abalones in Sagay Marine Reserve, Negros Occidental, Philippines*

Nerissa Salayo and Teruo Azuma

*Southeast Asian Fisheries Development Center/Aquaculture Department
(SEAFDEC/AQD), Tigbauan, Iloilo, Philippines*

**International Institute of Fisheries Economics & Trade Conference 2014
QUT Gardens Point, Brisbane, Qld, Australia
7-11 July 2014**

Sagay Marine Reserve

Sagay City
Negros Occidental province
*** Visayan Sea**





Barangay Molocaboc

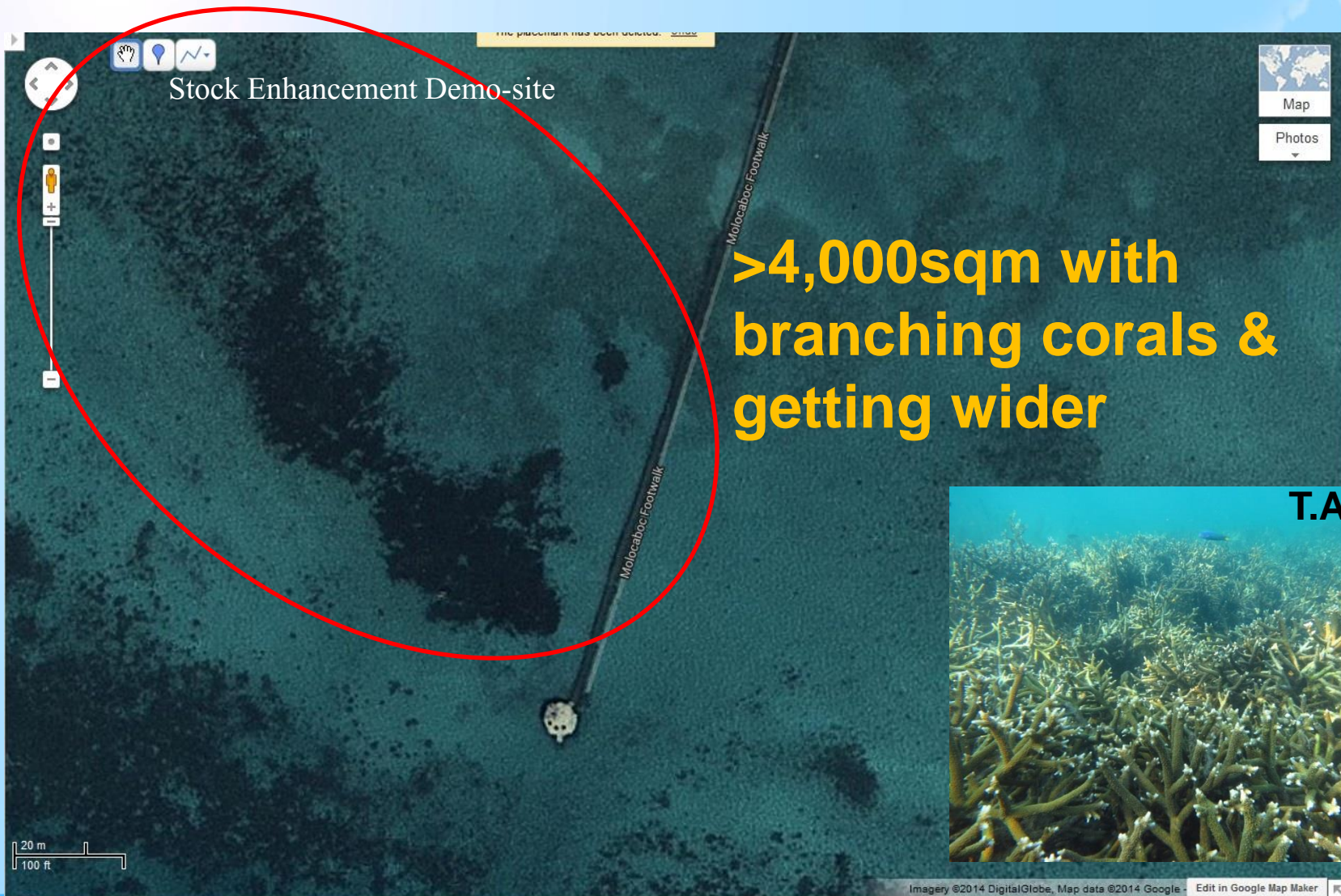


Intertidal flats of Molocaboc Daku





Stock Enhancement Demonstration Site



**>4,000sqm with
branching corals &
getting wider**



T.Azuma

Stock Enhancement Demo-Site, Molocaboc Dacu in Sagay Marine Reserve



NDSalayo



T. Azuma

Why stock abalone?

- **high-value shellfish endemic in Sagay Marine Reserve (SMR)**
- **overfished in Molocaboc fishing grounds**
- **threatened species identified for stock enhancement by Government of Japan Trust Fund (GOJ-TF) and SEAFDEC**
- **SEAFDEC technology for tagged hatchery-bred abalone, *Haliotis asinina***



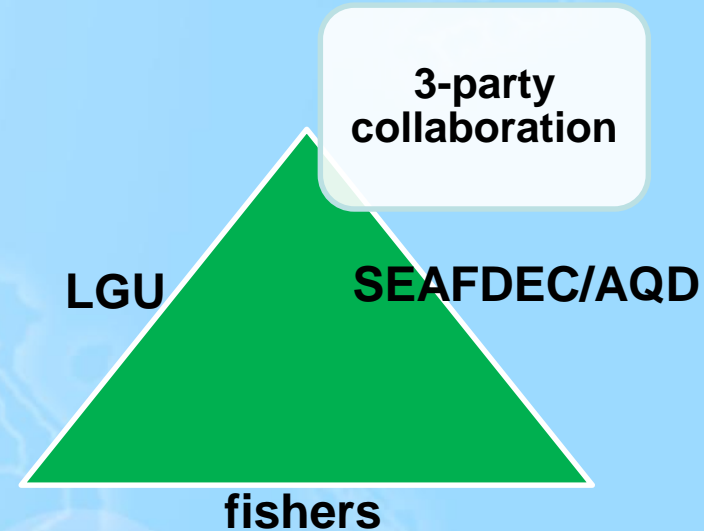


Objectives

- **Test community-based tri-party collaboration model (fishers-LGU-AQD) for implementing stock enhancement**
- **Demonstrate community-based stock enhancement protocol with goals as:**
 - replenish overfished fisheries (long-term)
 - provide supplemental income & organization funds from spill-overs (short-term)
- **Estimate economic benefits vs cost**
- **Institute local regulations to improve governance & management of stocks**

Tri-party stakeholder participation model for resource enhancement in Brgy Molocaboc, Sagay City

- 1. fishing community (BFARMC) – contribute labor, oversight on day-to-day operations**
- 2. LGU (barangay & municipal level through SMR-PAMB) and few traders- provide logistical support; and**
- 3. SEAFDEC/AQD-GOJ-TF5- technical expertise and hatchery-bred juveniles for release in demo-sites**





What experts say?

Updated responsible approach to marine stock enhancement

Lorenzen, Leber & Blankenship, 2010

Stage I: Initial appraisal and goal setting

Stage II: Research and technology development including pilot studies

Stage III: Operational implementation and adaptive management

Assess economic costs & benefits



Updated responsible approach to marine stock enhancement

Lorenzen, Leber & Blankenship, 2010

Stage I: Initial appraisal and goal setting

- Understand the **role of enhancement** within the fishery system
- **Engage stakeholders** and develop a rigorous and accountable decision making process
- Quantitatively **assess contributions** of enhancements to fisheries management goals
- Prioritize and select **target species** and stocks for enhancement
- Assess economic and social **benefits and costs** of enhancement

Stage II: Research and technology development including pilot studies

Stage III: Operational implementation and adaptive management



Updated responsible approach to marine stock enhancement

Lorenzen, Leber & Blankenship, 2010

Stage I: Initial appraisal and goal setting

Stage II: Research and technology development including pilot studies

- Define enhancement system designs suitable for the fishery and management objectives
- Develop appropriate aquaculture systems and rearing practices
- Use genetic resource management to maximize effectiveness of enhancement and avoid deleterious effects on wild populations
- Use disease and health management
- Ensure that released hatchery fish can be identified
- Use an empirical process for defining optimal release strategies

Stage III: Operational implementation and adaptive management



Updated responsible approach to marine stock enhancement

Lorenzen, Leber & Blankenship, 2010

Stage I: Initial appraisal and goal setting

Stage II: Research and technology development including pilot studies

Stage III: Operational implementation and adaptive management

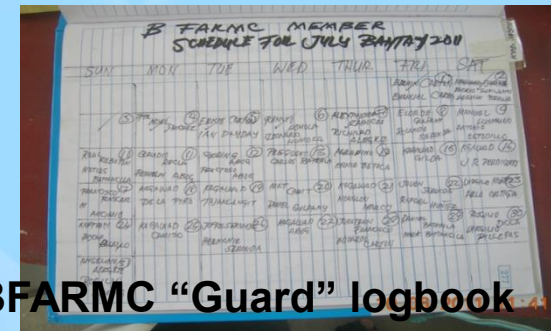
- Devise effective **governance arrangements**
- Define a **fisheries management plan** with clear goals, measures of success, and decision rules
- Assess and manage ecological **impacts**
- Use **adaptive management**

Milestones

- 2007 - Socioeconomics baseline survey
- 2008 - Information dissemination
- 2009 - Stakeholder relations & community organizing/BFARMC
- 2010 - Barangay ordinance - 6cm catch-size regulation
- 2011 - Released stocks to demonstrate & implement community-based resource enhancement
- 2012 - Monitoring of released stocks & up-scaling catch-size regulation to citywide ordinance
- 2013 - Promote “stock-protect-partial harvest” protocol, exit strategies
- 2014 - Assess impact, compliance to regulations, cost-benefit analysis



Village (2010) upscaled to citywide regulation (2012)



BFARMC “Guard” logbook



First stock release June 2011

Organizational strengthening and human capacity building

Based on BFARMC internal policy and as of Jan 2014

- 15 members protect the demo-site
- 30 participate in meetings
- vs
- 150 signed membership forms in 2011

4th set of BFARMC officers elected in November 2013; oath-taking with Sagay City Mayor Thirdy Maranon in January 2014



STOCK

9,860 pieces tagged hatchery-bred abalones released periodically, June 2011 to January 2014 in Molocaboc Dacu and two other sites in Matabas and Dacu – all in Sagay Marine Reserve



STOCK

Fishers & LGU
do it with us!



Figure 1. Number of released hatchery-bred and wild abalones sampled periodically; and number of released and harvest abalones in the demo-sites, Molocaboc, Sagay City, June 2011 to Dec 2013

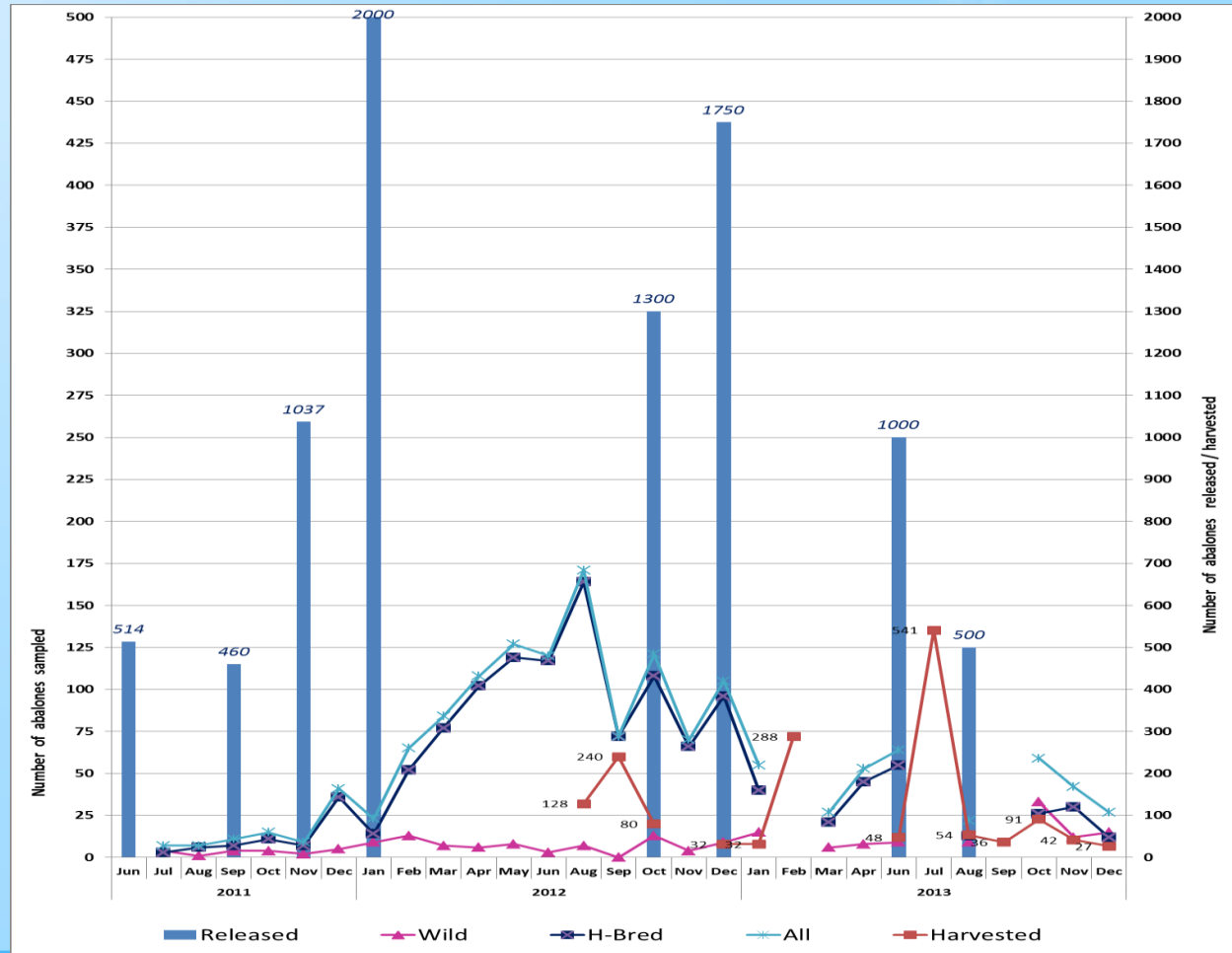
STOCK



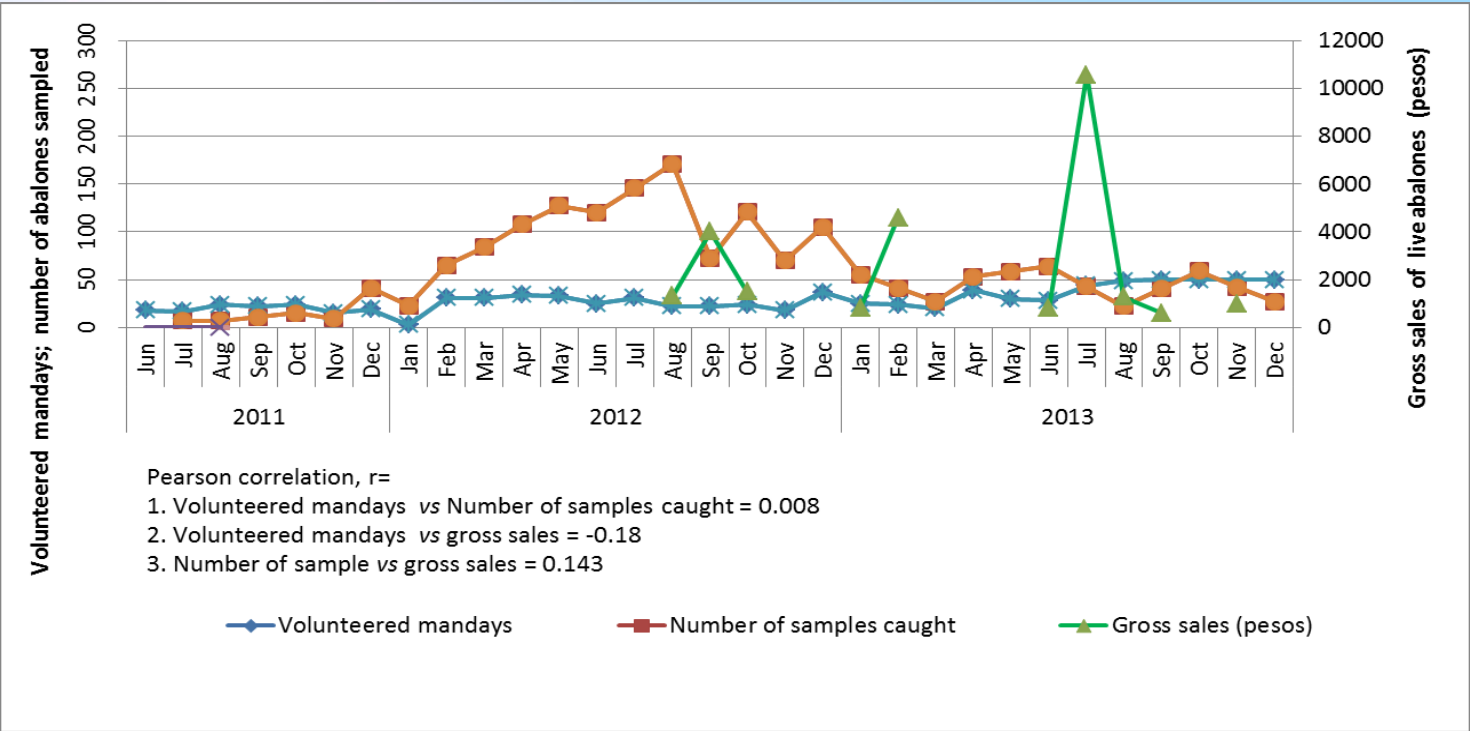
**Dr Azuma,
AQD &
BFARMC
President
Carlos,
2011**



**SMR Superintendent
Mr Antonio Cueva**



PROTECT



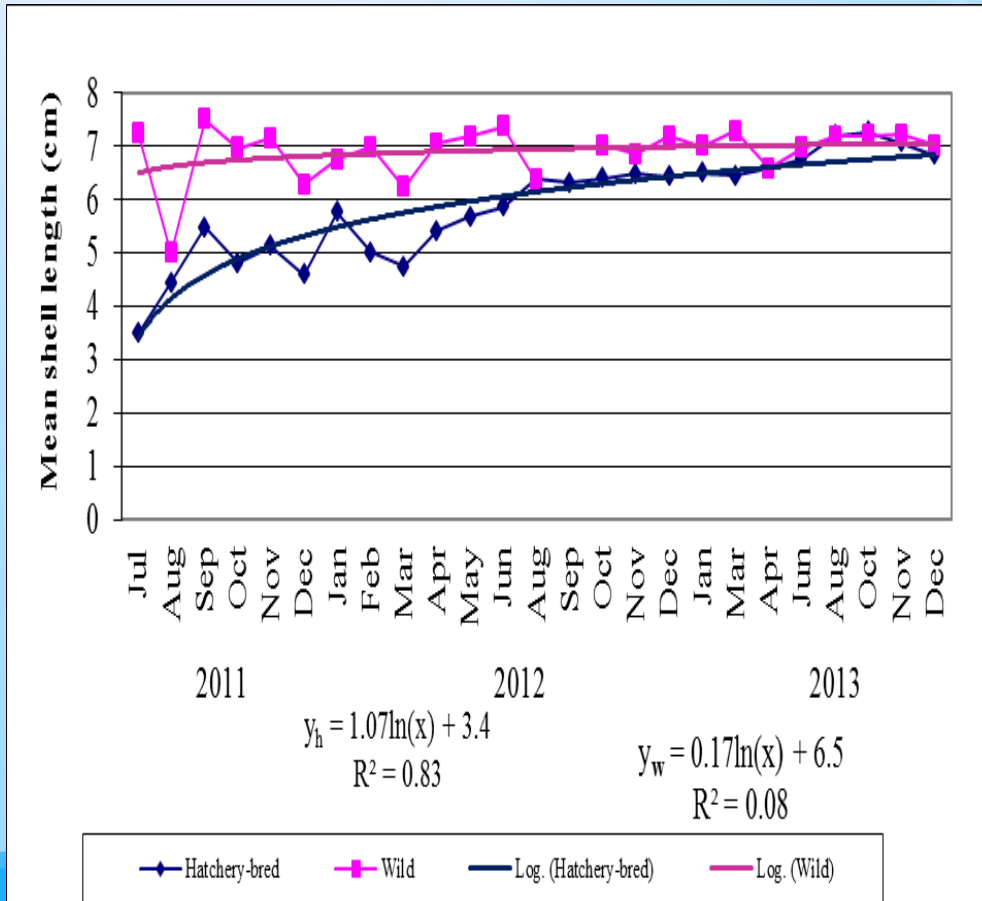
BFARMC members continue to secure the demo-site

Variable levels of participation; fewer dedicated members

Figure 2. Relationship between number of volunteered man-days to secure the demo-site, number of abalones sampled monthly, and gross value of sales of abalones from the demo-site in Molocaboc, Sagay City, June 2011 to December 2013

Results of monthly monitoring

Figure 3. Mean shell length of sampled hatchery-bred and wild abalones in the demo-site, Molocaboc, Sagay City, July 2011 to Dec 2013

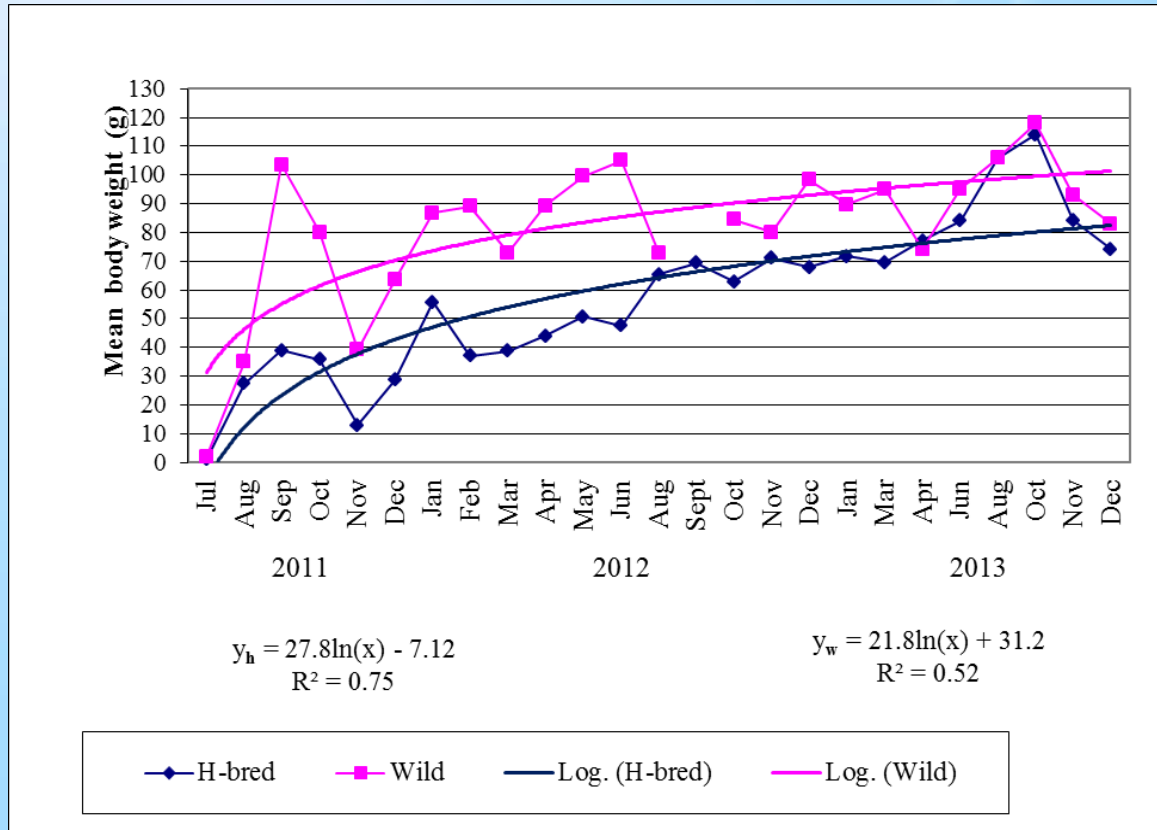


note: branching corals grew; wild and HB abalone samples increased in number & SL since demo-site protected from harvesters



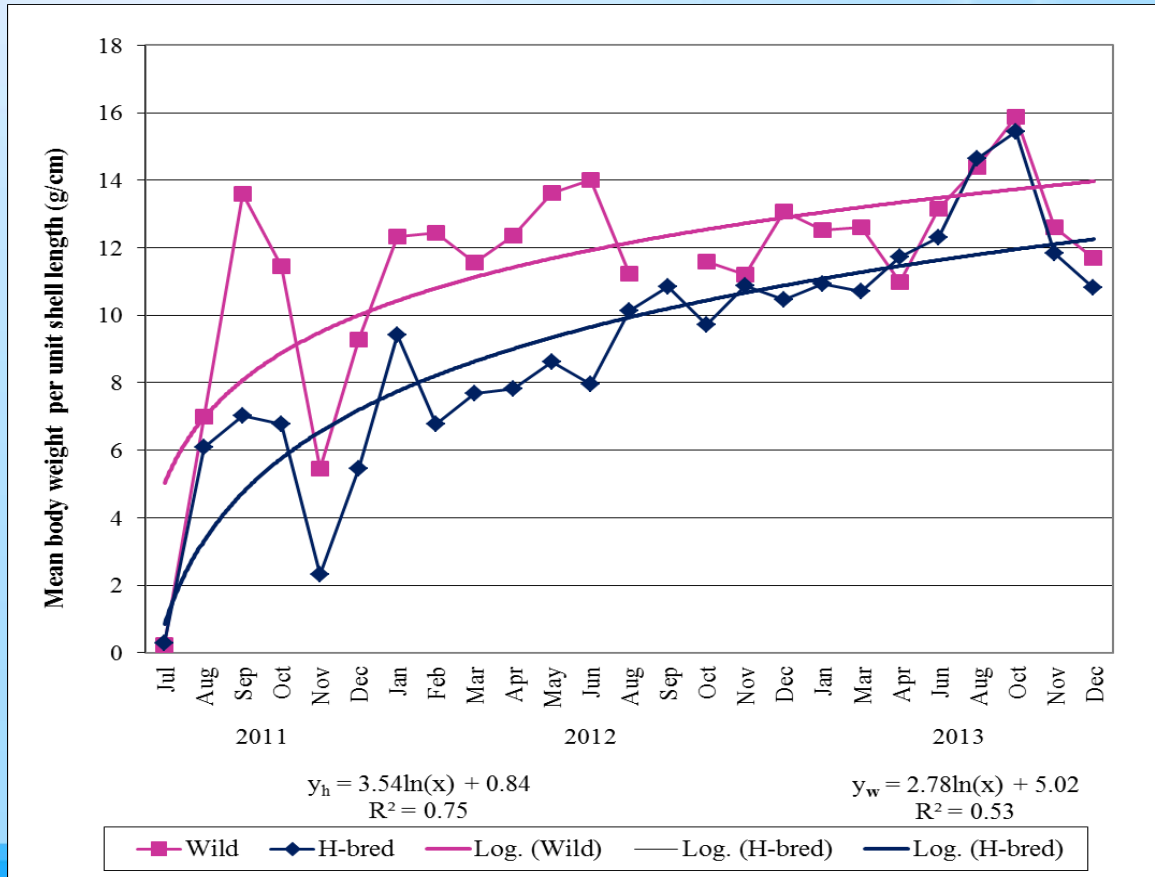
Results of monthly monitoring

Figure 4. Mean body weight of sampled hatchery-bred and wild abalones in the demo-site, Molocaboc, Sagay City, July 2011 to Dec 2013



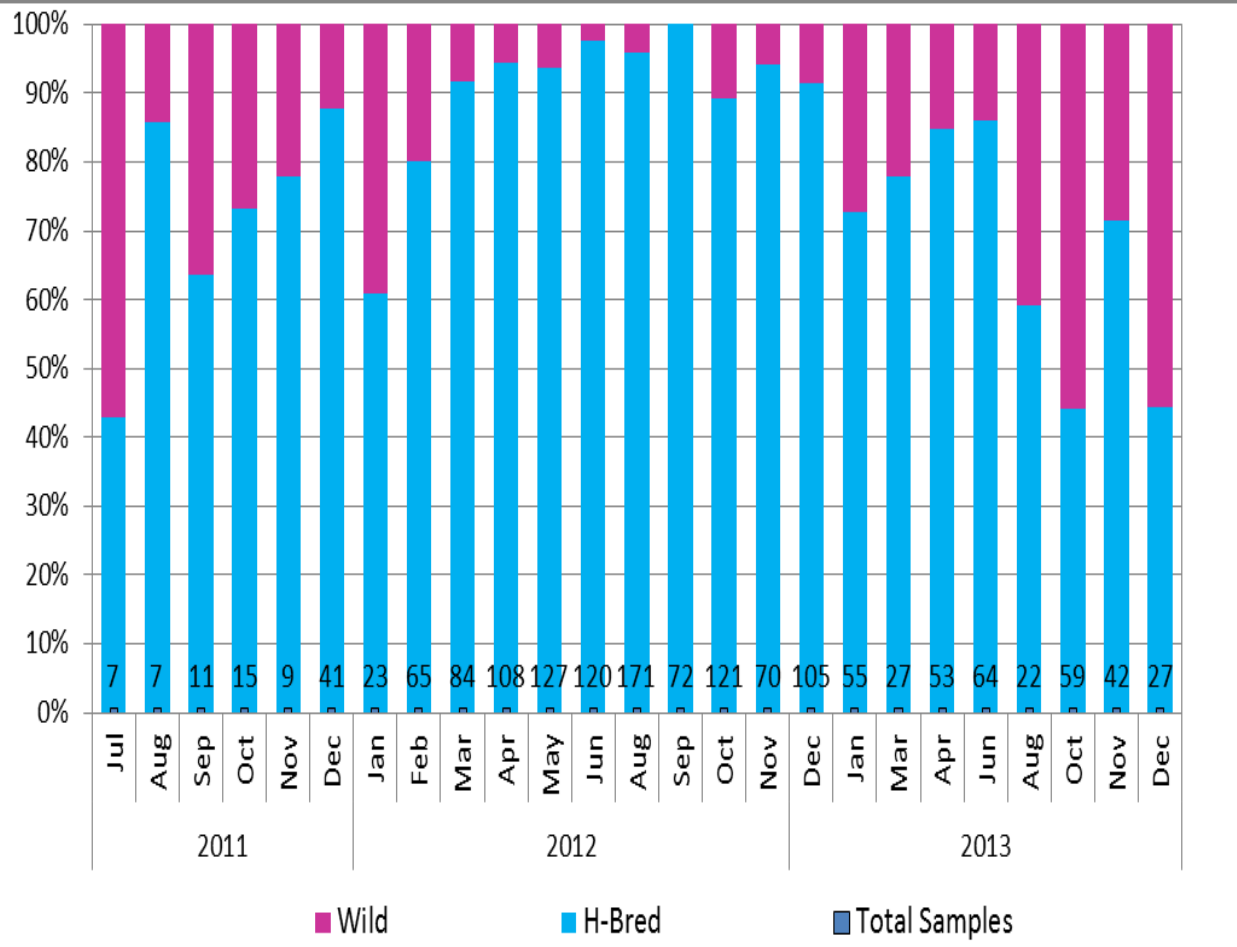
Results of monthly monitoring

Figure 4. Average **body mass index** (BMI, g body weight per cm shell length) of sampled hatchery-bred and wild abalones, Molocaboc, Sagay City, July 2011 to Dec 2013



PROTECT

Figure 5. Percent sampled hatchery-bred and wild abalones in the demo-site in Molocaboc, Sagay City, July 2011 to Dec 2013



Variable trend in the proportion of HB to wild samples



PARTIAL HARVEST

Economic Benefits for Stakeholders

55kg of live abalones harvested periodically
 August 2012 to August 2013, or approximately
 1,024 individuals, >60g ABW

Total gross sales – Php 25,482 (USD582, Sept 2013)

Operating expenses - 11,845 (275)

Net income - 13,637 (317)

Bank deposit - 9,000 (210)

Petty cash funds/loans - 4,637 (109)

Farm price varied from Php 270 (USD6.30)
 to 350/kg (USD USD8.15) live

Price set by the buyer in Brgy Vito

Stocker-buyers in Molocaboc buy from
 gleaners at P230/kg (USD5.35) live



NMP Seafoods Dealer
 0517913, 136

RECEIVING REPORT No. 24312

Quantity	Unit	Price	Amount
3.1	kg	997	

Stamp: **RECEIVED**
 11/07/2013

NEGROS OCC - ESCALANTE

SAVINGS ACCOUNT NO. 3020112975

MERISSA D. SALAYO

AND ANICIA P. ABONG

BDO Cash Deposit Slip

0112979
 MERISSA D. SALAYO
 11-13 15:58:44
 cdinitial Online

PHP9,000.00

11/09/2013

Study Leader ND Salayo and
 BFARMC Treasurer Aida Abong
 opened joint savings account on
 behalf of BFARMC in Sept 2013.

Steps towards Sustainability

Supplemental livelihood development to complement resource enhancement

- Establish hatchery (LGU-SMR) to ensure sustainable supply of juveniles
- Seaweed planting to supply nursery & hatchery requirement
- Continue IEC - promote “stock-protect-partial harvest” protocol
- Assured market & commensurate prices

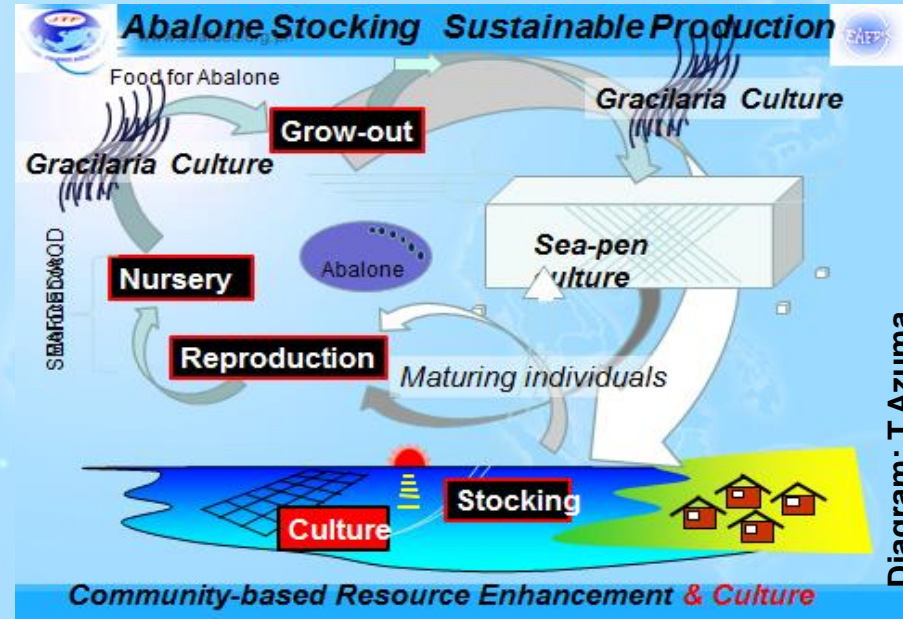


Diagram: T.Azuma



New adoptor's release site 2014



Cost-Benefit Analysis of Community-Based Stock Enhancement, 2007-2013

Private Benefits

- Higher volume & value of catch of fishers
- Improved household food consumption

Social Benefits

- Restored fisheries
- Improved fishing livelihood/income
- Community solidarity

Cash – actual project records, FY2007-13
USD 85,244

Private Costs

- Opportunity cost of individual participation
- Reduced common access gleaning area & income

Non-cash - implicit values to be estimated

Social Costs

- Social preparation - \$17,800 (20.9%)
- Release & monitoring - \$3,500 (4.1%)
- Direct research cost - \$55,850 (65.5%)
- Research operations cost - \$8,110 (9.5%)
- Disease prevention costs
- Community participation
- Governance transactions
- & management cost



Summary of Results

Ecological goal - juveniles established in release site, together with wild stocks, corals recovered

Economic goal – supplemental income from regulated partial harvest & gleaners in open access areas

Social / Community goal - tri-party collaboration reinforced community-based stock enhancement, although participation of stakeholders and uptake of stock enhancement process remain variable

Lessons learned

Economic analysis of stock enhancement initiatives

- guide policies for rebuilding fisheries in the Philippines and similar countries (public support needed)

Social aspects of stock enhancement

- ***remain a challenge and its relationship with values and motivations of fishing communities in the Philippines should be studied***

Ecology/biology/fishery

- ***attainable if seed production technologies are developed & habitat are recoverable***



Concluding comments

- The on-going study shows that stock enhancement has potentials to contribute to coastal area capability development since stakeholders, especially fishers, expect economic benefits as well as non-cash environmental gains from restoration of the fisheries and improved community solidarity.
- An economic analysis of stock enhancement initiatives will guide policies that promote coastal area capability development in the Philippines and other similar countries.



Thanks to:

- Raisa Castel, Dianne Tormon, Rafael Bariddo, Nestor Bayona, Shelah Ursua, Frances Nievaes, Ramil Piloton
- Molocaboc BFARMC officers & fisher-members & Sagay CFARMC
- Sagay Marine Reserve-Protected Area Management Board
- Local Government Officials of Brgy Molocaboc, Sagay City
- SEAFDEC/AQD & Government of Japan-Trust Fund



29.01.2014

Stock release team



BFARMC with families after "Yolanda" Dec 2013



29/01/2014

BFARMC, LGU-SMR, SEAFDEC-GOJTF5 Jan 2014