FINDING A WAY OUT FOR DEPLETED SMALL-SCALE FISHERIES (SSF) IN THE PHILIPPINES

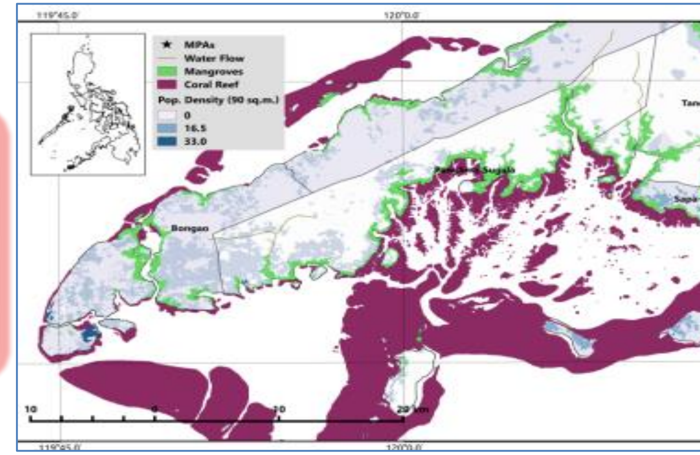
Richard N. Muallil, Ph.D., OYS 2016
Professor/Director for Research

[2]Mindanao State University – Tawi-Tawi College of Technology and Oceanography, 7500 Bongao, Tawi-Tawi, Philippines

Venue: Bacolod Business Inn, Bacolod City, Philippines
Date: September 20, 2016

Tawi-Tawi is <3..

Fig. 1. Map of Tawi-Tawi showing its vast coral reefs.



Source: modified from ECOFISH Tawi-Tawi

Photos by Basil Sali and Rosendo Reyes

Outline

Social-ecological state of SSF

Social-ecological processes

for fishing pressure alleviation

Synthesis

1 **Status and trends in SSF**

2 **Ecological:** Marine Protected Areas

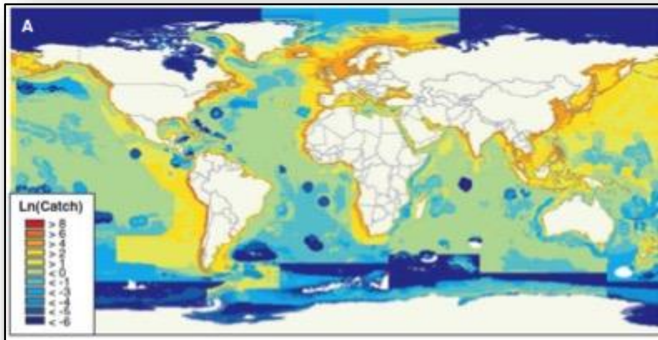
3 **Social:** Fishing effort

4 **Synthesis:** The way out for depleted SSF

Muallil 2015. On the sustainability of small-scale fisheries in the Philippines. PhD Dissertation.

Status of the world fisheries

At least 63% of the global fisheries are overfished
(i.e. Biomass is below B_{MSY} or <0.5 of "unfished" levels)!

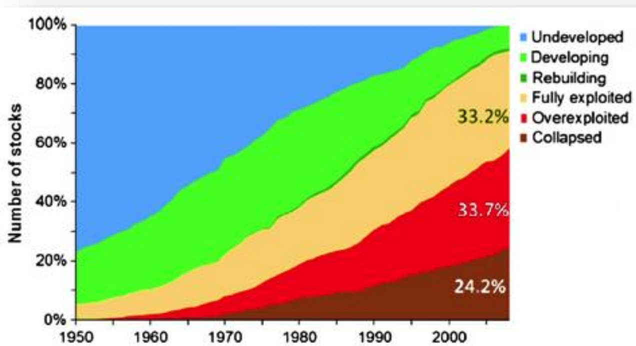


Science AAAS
Worm et al., 2009

Conditions are much worse in unassessed small fisheries
(which comprise >80% of the global catch)

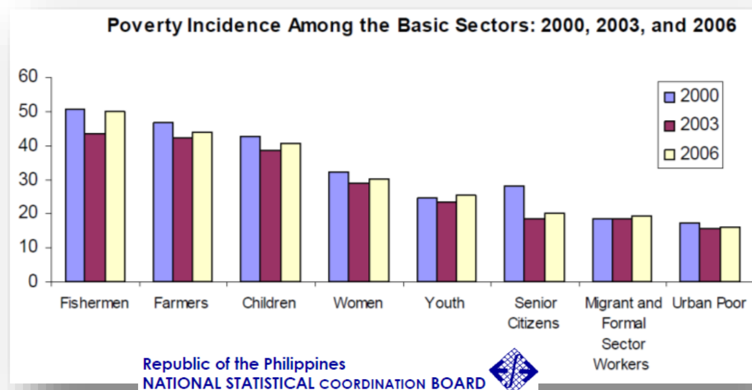
Science AAAS
Castro et al. 2013.

Drastic decline since the 1950s



MARINE POLLUTION BULLETIN
Pitcher and Cheung 2013

Fishers are the poorest of the poor!



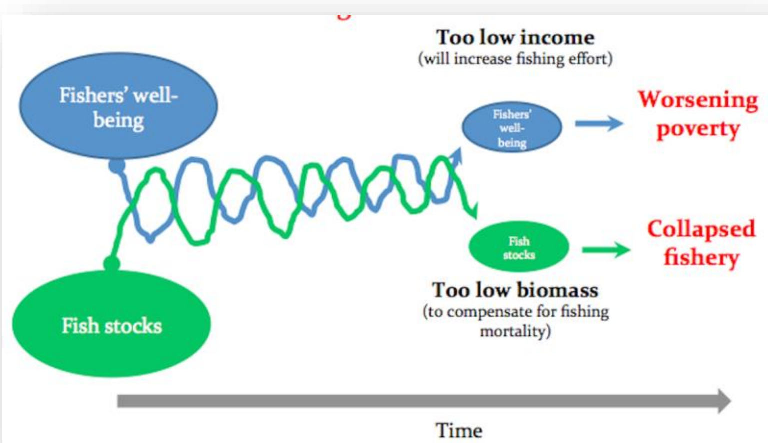
Fishery and poverty

"Malthusian Overfishing" and the "Tragedy of the Commons"

"Get it while you can!!"

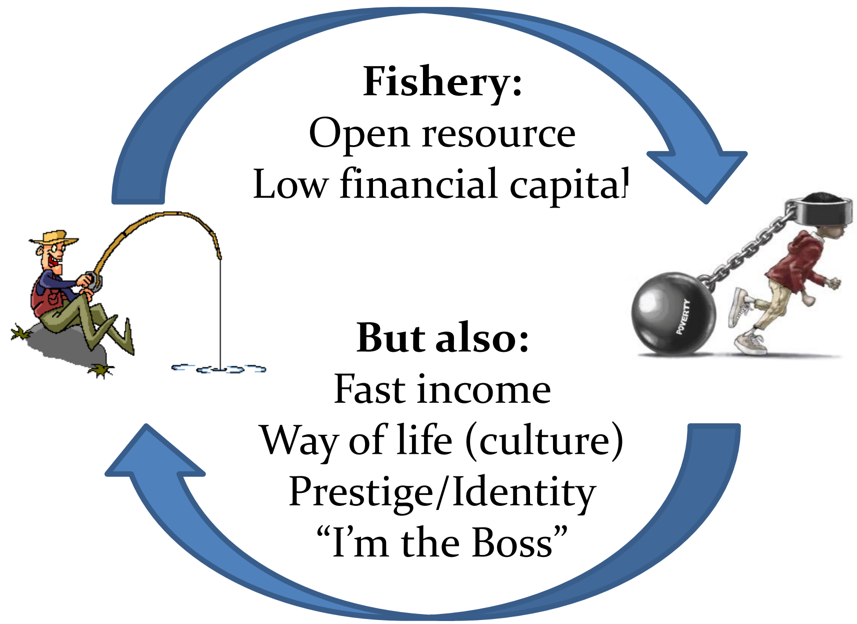
Hardin (1968)

Social-ecological trap



Cinner (2011)

Is **Fishing** the occupation of the last resort?



Polnac et al. (2011);
Cinner (2014)

Study 1: Status and trends in Philippine SSF

Main objectives:

- To project SSF sustainability based on social-ecological attributes of the fishing communities.
- To estimate fishing capacity or the size of MPAs needed for long-term sustainability of SSF.
- To characterize catch trends in SSF over the last few decades.

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Status, trends and challenges in the sustainability of small-scale fisheries in the Philippines: Insights from FISHDA (Fishing Industries' Support in Handling Decisions Application) model

Richard N. Muallil [a,b,c,*], Samuel S. Mamauag [b], Reniel B. Cabral [d], Emerlinda O. Celeste-Dizon [e], Porfirio M. Aliño [a,b]

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Catch trends in Philippine small-scale fisheries over the last five decades: The fishers' perspectives

Richard N. Muallil [a,b,c,*], Samuel S. Mamauag [b], Jeffrey T. Cababaro [a], Hazel O. Arceo [a], Porfirio M. Aliño [a,b]

ABSTRACT

Understanding catch trends through time is a crucial management consideration that would ensure long term sustainability of the fisheries. This study describes some changes in small-scale fisheries in the Philippines over the past five decades using both "quantitative" and "qualitative" estimates of current and past daily catches. "Quantitative" estimate was determined as the difference between current and past catches in kg per trip, as reported by fishers, on a normal fishing day. "Qualitative" estimate, on the other hand, was determined by asking fishers whether current catches are (i) less than half, (ii) lower to 50%, or (iii) the same or higher than past levels. "Quantitative estimate" indicated that current catches are lower by 16 ± 14% of the 2000–2010 levels and 24 ± 13–26 ± 19% of catch levels in the preceding four decades. Catch decline over the past five decades was much worse based on "qualitative" estimate. The relatively more stable catches from "quantitative" estimate could be attributed to the improvement in fishing strategies employed by fishers to keep catches high even as the fish stocks continue to decline. The results of the study further suggest that the condition of small-scale fisheries in the Philippines has been deteriorating since the 1970s but initial signs of severe depletion of fish stocks to the level indicative of biological and economic overfishing occurred in 1990s. Increasing fishing population was attributed as the main cause of fishery decline. Other factors include destructive fishing, large-scale fishing in coastal waters, climate change, siltation/pollution from land-based activities and even marine protected areas establishment and tourism activities that closed some traditional fishing grounds. Important insights and policy prescriptions for improved management of small-scale fisheries are further discussed.

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Study 1a. Status, trends and challenges in Philippine small-scale fisheries.

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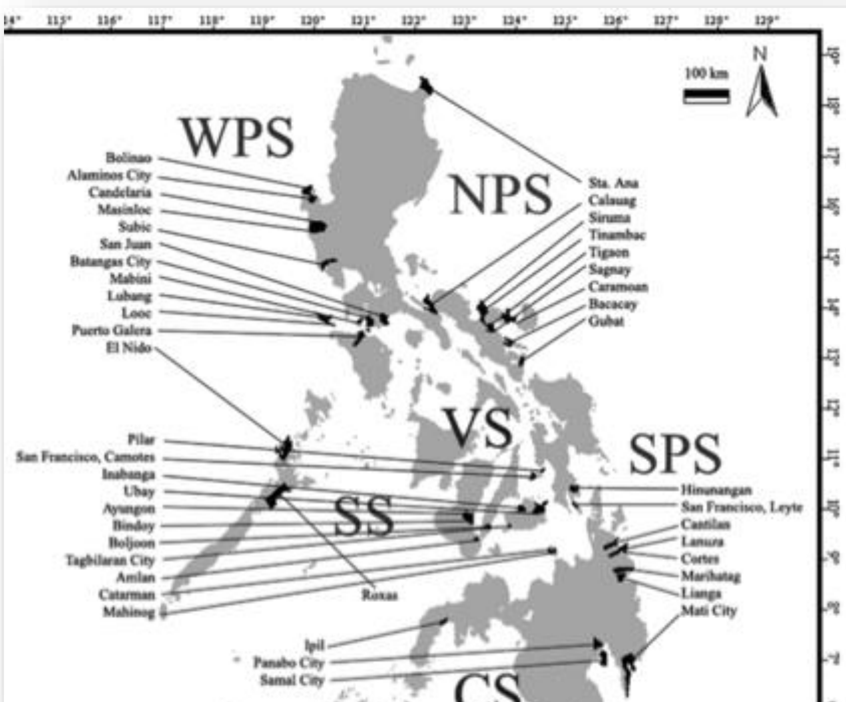
Richard N. Muallil[a,b,c,*], Samuel S. Mamauag[b], Reniel B. Cabral[d], Emerlinda O. Celeste-Dizon[e], Porfirio M. Aliño[a,b]

Study sites:



Data collection	
No. of municipalities	44
No. of provinces	21
No. fishers/town interviewed (total)	6,488
Interview period	2009 to 2013

One-on-one interview

Focus group discussion

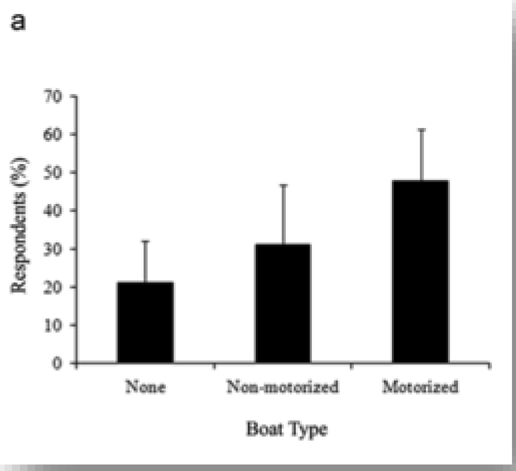
Social-ecological characteristics of SSF in the Philippines:

Table 1
Fisheries parameters used as inputs to FISHDA model.

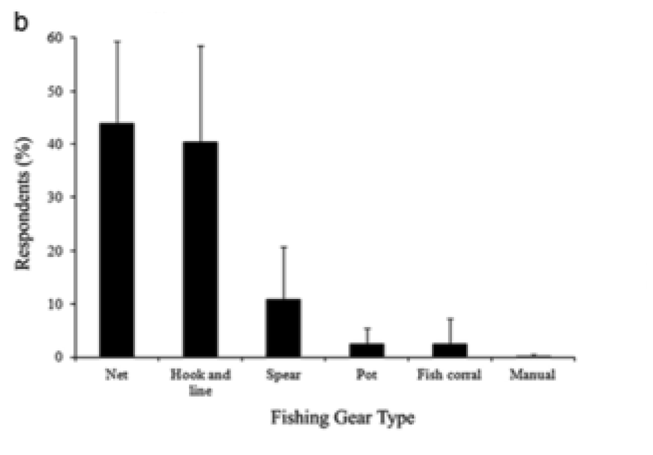
BioGeoRegion	Town	Respondents	Municipal waters (km^2)	MPA (km^2)	MPA (% of municipal waters)	Number of fishers	% of demersal species in catch composition	Catch rate (kg/day/fisher) (mean ± SD)	No. of fishing days per year	Fish price (US $ per kg)
	Ipil	195	159	0.8	0.5	1600	53.0	17.0	275	2.0
CS	Panabo City	59	36	0.5	1.4	191	86.0	3.5	267	1.9
	Samal City	94	1037	53.8	5.2	4015	65.2	4.6	270	1.9
NPS	Bacacay	159	223	4.5	2.0	1850	72.0	4.2	207	1.8
	Calauag	243	581	0.1	0.0	2924	72.0	3.3	264	2.7
	Caramoan	139	882	1.0	0.1	5000	75.0	3.8	244	1.7
	Gubat	195	451	2.4	0.5	1200	85.5	2.9	260	2.3
	Sagnay	225	170	1.4	0.8	220	17.0	4.4	278	2.0
	Siruma	182	1014	19.9	2.0	1330	66.0	5.5	270	1.4
	Sta. Ana	202	1494	1.0	0.1	2745	32.0	15.0	204	1.9
	Tigaon	70	32	0.6	1.9	72	29.0	3.3	254	1.9
	Tinambac	89	199	1.0	0.5	2252	45.4	5.7	167	1.8
SPS	Cantilan	132	252	0.6	0.2	6348	63.8	6.1	208	1.8
	Cortes	80	287	1.1	0.4	687	83.3	3.0	248	2.0
	Hinunangan	151	181	1.2	0.7	582	69.3	2.0	152	2.1
	Lanuza	141	148	0.6	0.4	720	43.3	2.5	165	2.2
	Lianga	129	238	0.9	0.4	680	54.0	13.0	206	2.1
	Marihatag	118	147	1.5	1.0	462	70.0	3.2	188	2.0
	Mati City	219	1222	5.8	0.5	2000	57.4	10.2	251	2.2
SS	Roxas	203	1260	85.7	6.8	2000	71.0	8.3	255	4.8
VS	Amlan	175	43	0.1	0.2	536	13.9	3.7	247	2.2
	Ayungon	198	114	1.0	0.9	1650	45.0	7.0	256	2.2
	Bindoy	144	81	1.1	1.4	931	28.0	3.3	261	2.0
	Boljoon	176	109	0.2	0.2	750	31.8	3.3	226	2.0
	Catarman	87	276	0.9	0.3	1200	19.0	8.2	186	1.9
	Inabanga	179	163	0.1	0.1	5000	67.1	2.2	274	2.2
	Mahinog	47	154	0.3	0.2	1000	60.0	3.6	171	2.6
	Pilar	175	301	2.5	0.8	1242	48.0	2.7	239	2.0
	San Fran. Camotes	180	899	0.4	0.0	3205	37.9	4.9	237	1.6
	San Fran. S. Leyte	137	116	0.1	0.1	425	46.7	2.0	143	1.8
	Tagbilaran City	167	51	0.1	0.2	6000	43.1	4.6	247	2.5
	Ubay	167	232	1.5	0.6	1495	80.0	3.1	236	2.0
WPS	Alaminos City	91	199	16.6	8.3	1979	90.8	2.4	240	1.4
	Batangas City	100	354	0.1	0.0	1121	44.7	2.5	199	1.7
	Bolinao	105	863	1.1	0.1	4202	91.3	3.7	227	1.3
	Candelaria	116	212	2.5	0.0	1000	44.0	3.7	192	2.1
	El Nido	115	1612	543.0	33.7	3000	66.7	6.4	245	1.1
	Looc	133	1487	70.0	4.7	888	82.5	5.1	241	1.8
	Lubang	103	1143	70.0	6.1	834	30.7	6.8	240	1.2
	Mabini	107	196	3.4	1.7	772	30.0	5.1	221	1.9
	Masinloc	77	209	77.7	37.2	1320	27.1	16.5	166	1.5
	P. Galera	104	118	10.0	8.5	333	35.6	4.8	168	2.2
Average		147	442	230	30	1,850	54	5.3	226	2.0

* Conversion rate used was US $1 = PhP 45.

Boat ownership



Major fishing gear

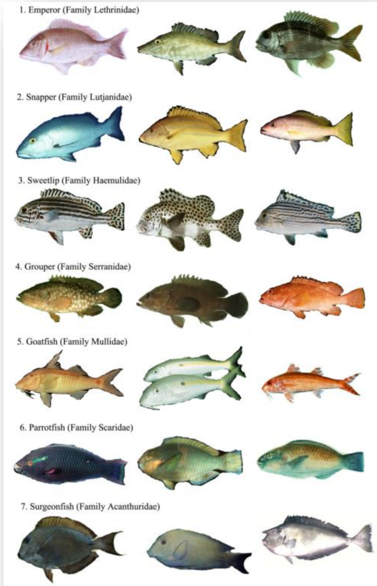


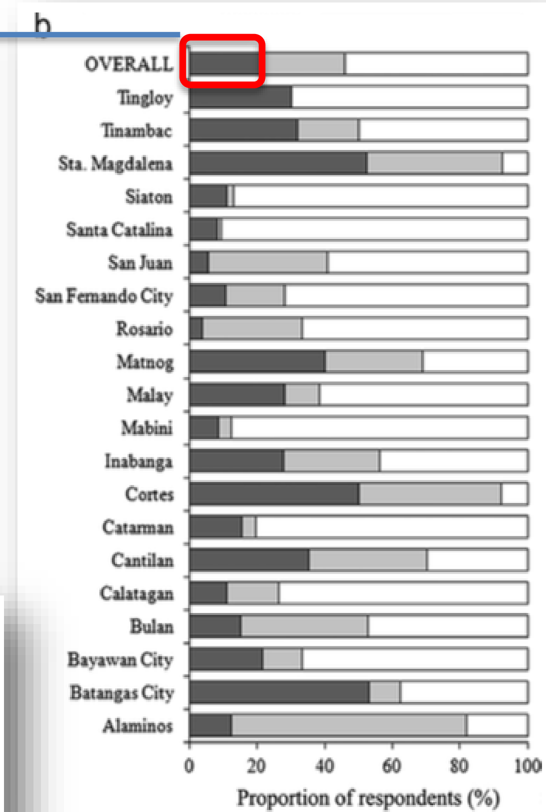
Major catch composition

dark gray, reef associated demersal
light gray, non-reef demersal

white, pelagic

Coral reef fishes





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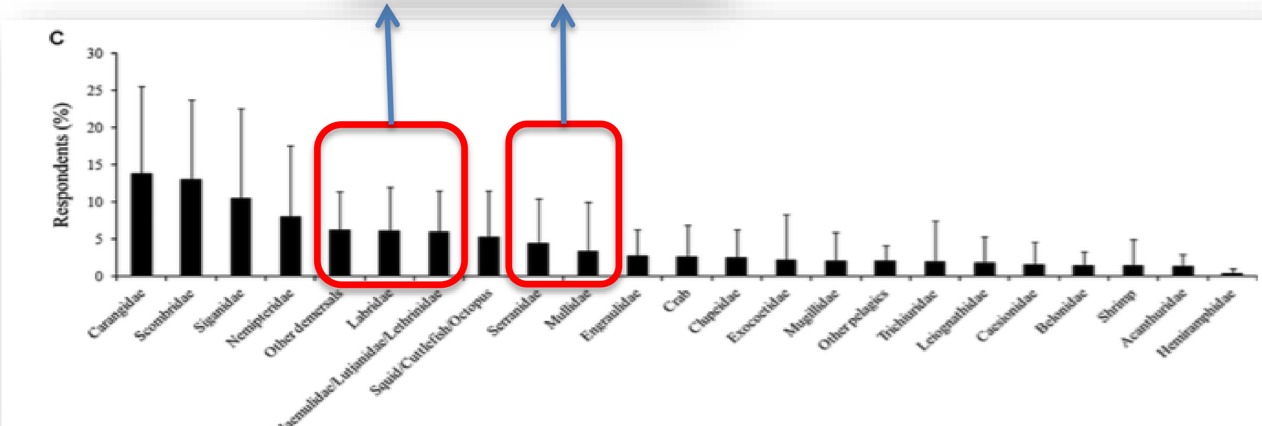

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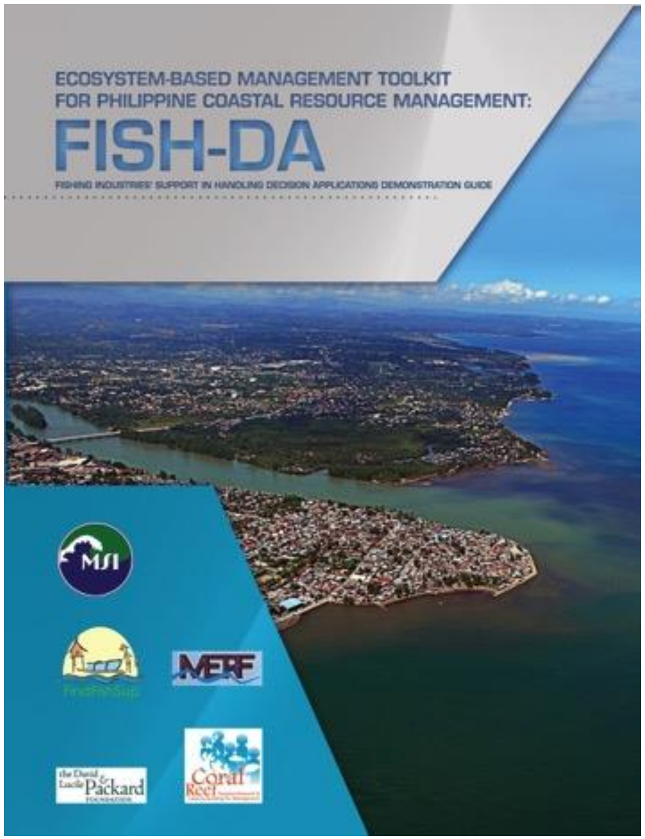
Analyses



FISH-DA

Fishing Industries' Support in Handling Decision Applications

-Licuanan et al., 2007

Features:

❖Communications and decision support tool for illustrating trade-offs

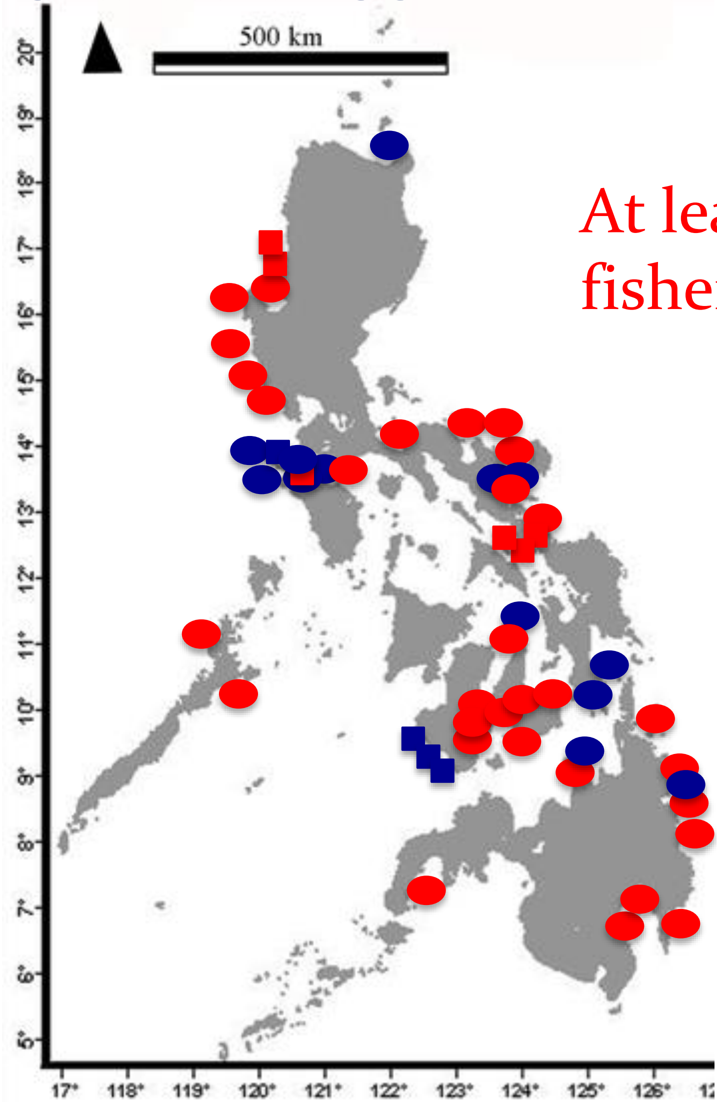
❖Coarse approximation

❖Uses simple equations to get estimates of fisheries "carrying capacities"

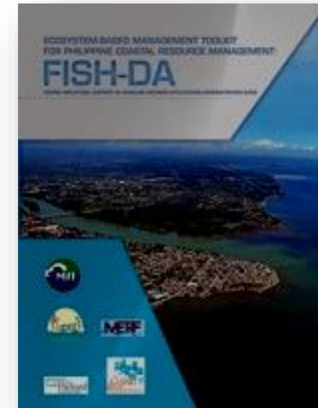
❖Fewer data requirements compared to other tools

❖Free version of FISH-BE (Fisheries Information for Sustainable Harvests and Bio-Economic model (Licuanan et al. 2007)

Status of SSF in the Philippines



At least 68% of coastal fisheries are unsustainable!!



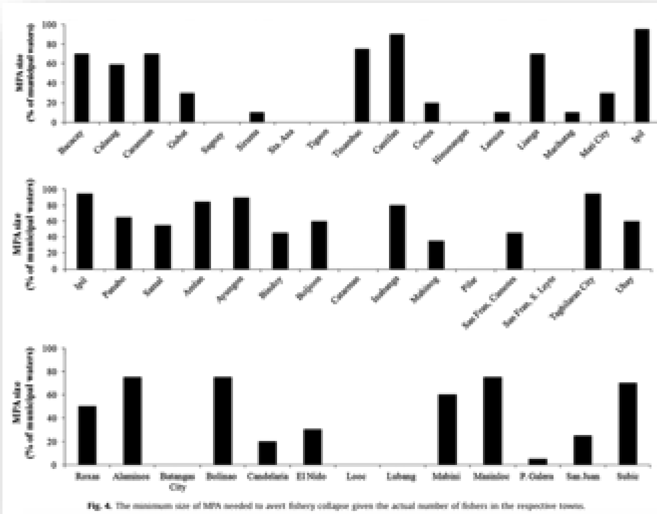
● Sustainable
● Unsustainable
} Muallil et al., 2014

■ Sustainable
■ Unsustainable
} Additional data

R.N. Muallil et al. / Marine Policy 44 (2014) 212–221

To achieve sustainable fisheries:

Size of MPAs needed (percent of municipal waters)

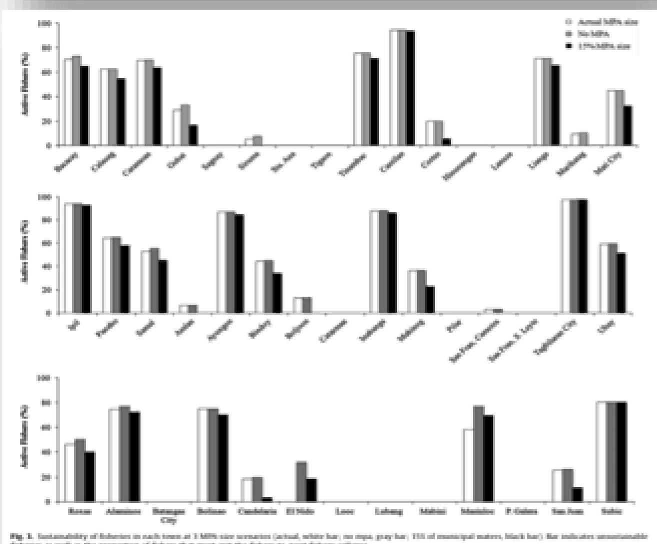


Establish very large MPAs

i.e. at least 58% of the municipal waters must be protected!!

(current MPAs in the Philippines cover only about 3% of municipal waters)

Active fishers that must stop fishing (%)

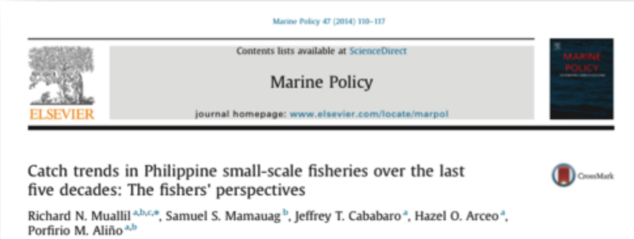


Reduce considerable fishing effort

i.e. at least 53% of active fishers must stop fishing

- Actual MPA size
- No MPA
- 15% MPA size

Study 1b. Catch trends in Philippine small-scale fisheries over the last five decades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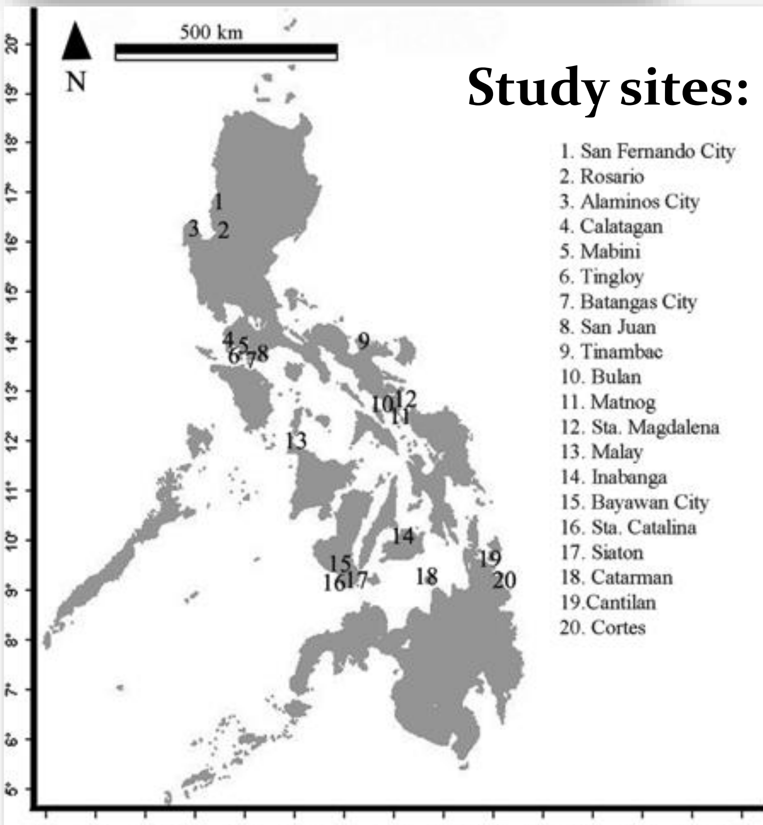
Catch trends in Philippine small-scale fisheries over the last five decades: The fishers' perspectives

Richard N. Muallil[a,b,c,*], Samuel S. Mamauag[b], Jeffrey T. Cababaro[a], Hazel O. Arceo[a], Porfirio M. Aliño[a,b]



Data collection	
No. of municipalities	20
No. of provinces	10
No. fishers/town interviewed (total)	3,446
Interview period	Feb to Oct 2013

One-on-one interview

Focus group discussion

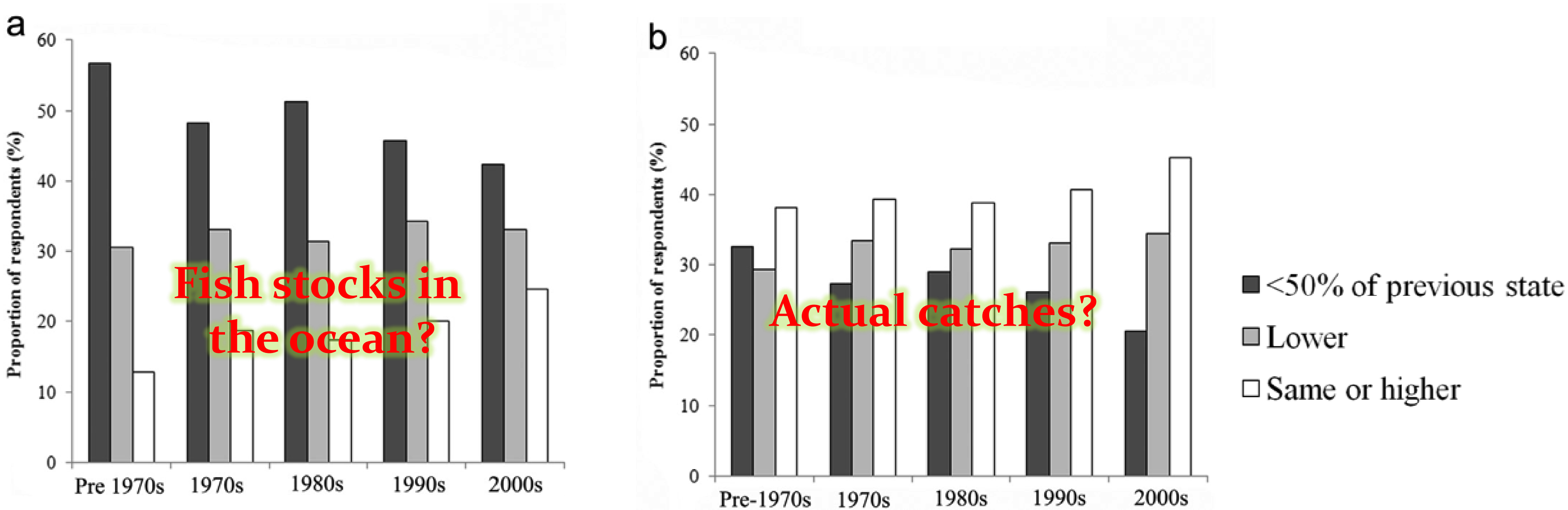
Main questions asked:

1. How are current catches compared to *past catches (i.e. 1st year in the fishery)?

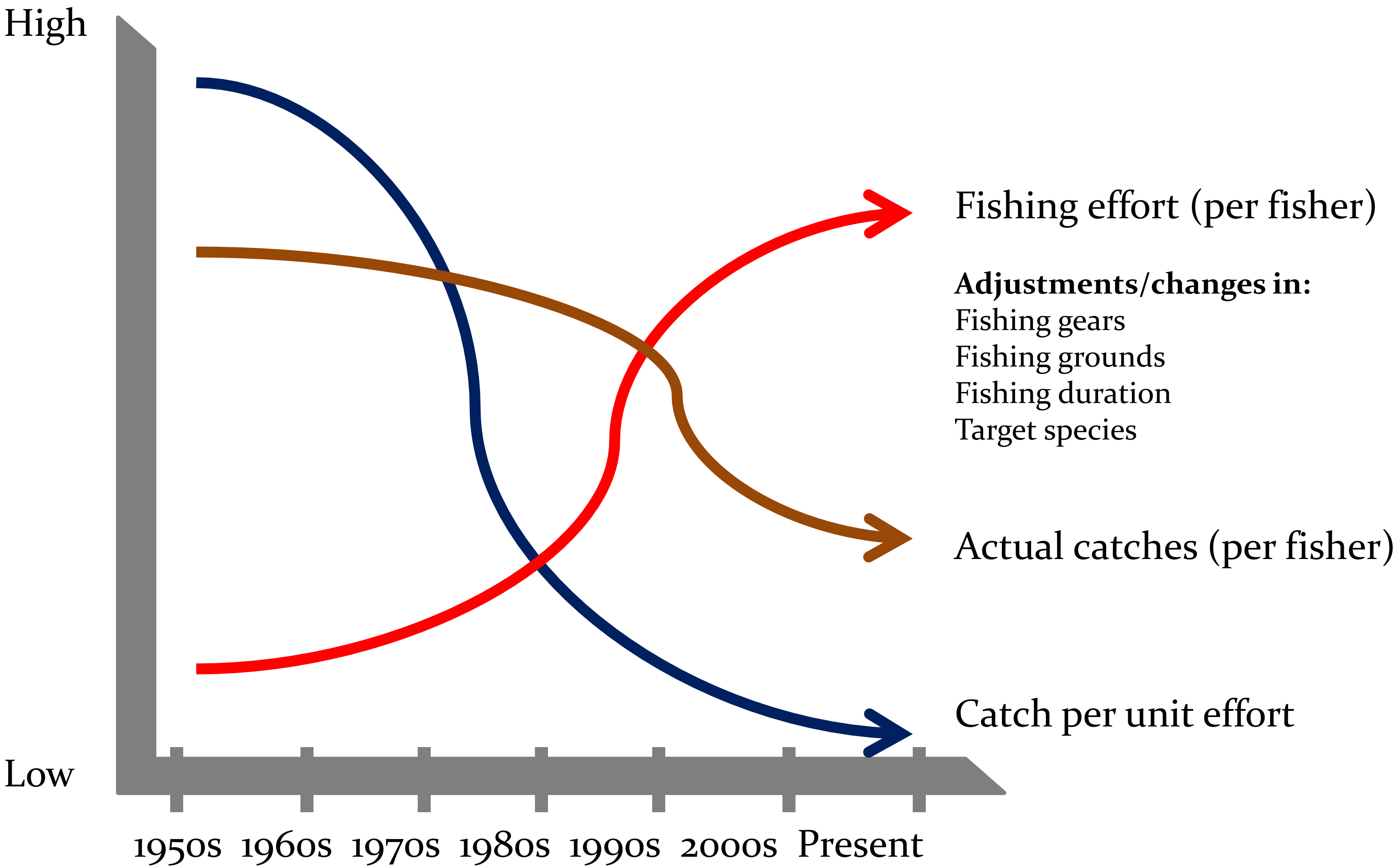
❖ Qualitative estimate

2. Current catches (in kg/trip) **versus *past catches** (in kg/trip)

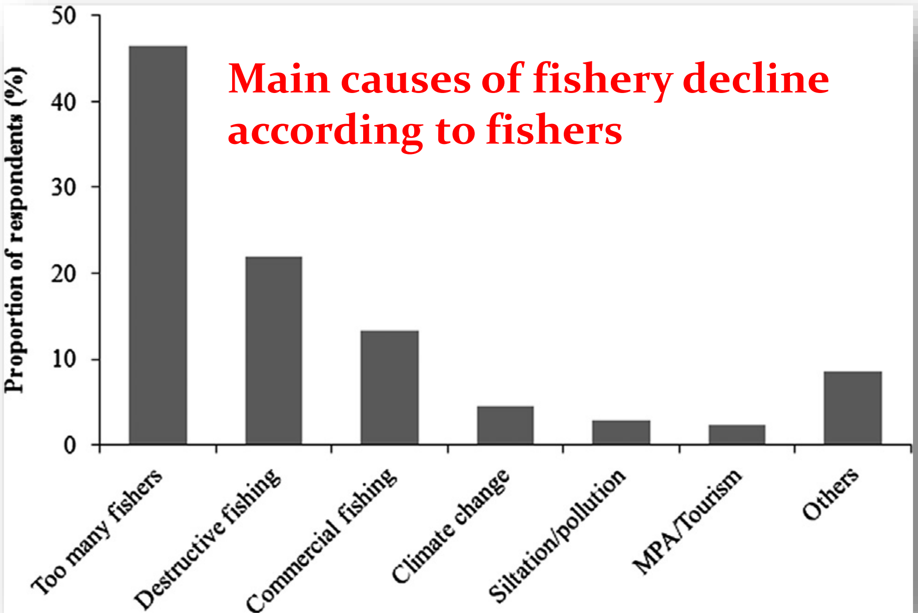
❖ Quantitative estimate

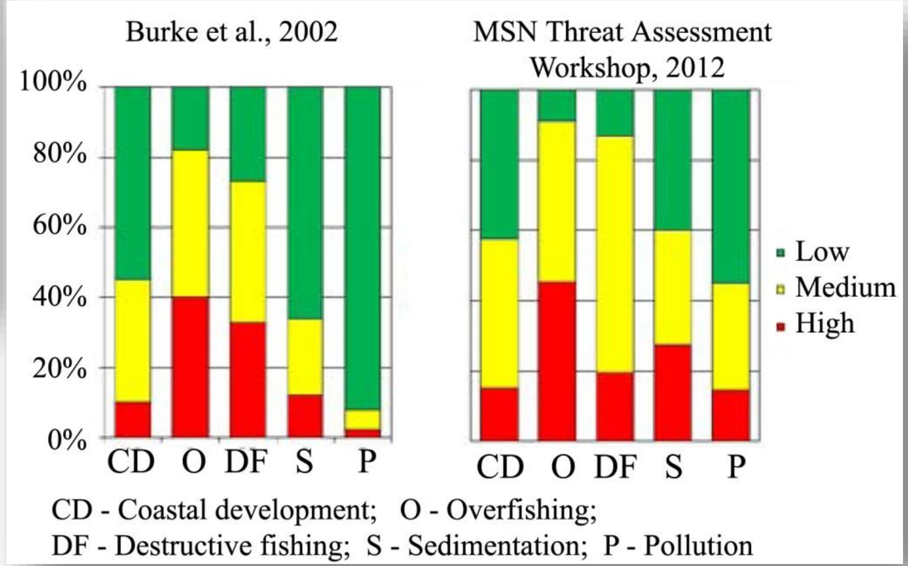


Summary: catch trends over the last 5 decades.



Major threats in Philippine SSF:
overfishing and destructive/illegal fishing





Modified from: Philippine State of the Coral Triangle Report, 2012

Study 2: Fishing pressure alleviation: Ecological

Main objectives:

- ❖ To describe the community assemblages of commercially important coral reef fishes inside and outside MPAs.
- ❖ To determine the social-ecological factors that affect MPA effectiveness for conservation of commecially important coral reef fishes.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Community assemblages of commercially important coral reef fishes inside and outside marine protected areas in the Philippines

CrossMark

Richard N. Muallil [a,b,c,*], Melchor R. Deocadez [b], Renmar Jun S. Martinez [a,b], Samuel S. Mamauag [b], Cleto L. Nañola Jr. [d], Porfirio M. Aliño [a,b]

[a] Marine Science Institute,[1] University of the Philip
[b] Marine Environment and Resources Foundation,
[c] Mindanao State University – Tawi-Tawi College
[d] University of the Philippines Mindanao, Mintal,

HIGHLIGHTS

- Assessed assemblages of commercially i
- More diverse, higher fish density and la
- Low density and highly restricted spatia
- More, larger, well-distributed all over th
- Other fishing regulation initiatives in ad

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Title: The effectiveness of community managed marine protected areas for conservation of commercially important coral reef fishes in the Philippines

Article Type: Original Research Paper

Keywords: Marine protected areas; Coral reef fishes; Sustainable fishing; Fish biomass; Coral Triangle

Corresponding Author: Mr. Richard N. Muallil, M.S.

Corresponding Author's Institution: The Marine Science Institue, University of the Philippines

First Author: Richard N. Muallil, M.S.

Order of Authors: Richard N. Muallil, M.S.; Melchor Deocadez; Renmar Jun Martinez; Hazel Arceo; Wilfredo Campos; Samuel Mamauag; Cleto Nañola; Porfirio Aliño

Abstract: The Philippines has the most number of community managed marine protected areas (MPAs) in the world. However, questions have beend raised as to their e
conservation and fisheries management, especially in the face of ... ependent
coastal population. We assessed the effectiveness of 58 MPAs in ... ion of
seven commercially important coral reef fish families: Acanthuri ... enus),
Haemulidae, Labridae (subfamily Scarinae only), Lethrinidae, Lu ... idae. The
highest fish biomass (mean±S.E. 25.5±5.8 kg/500m2) was recor ...), oldest
and well enforced (i.e. protected for >20 years) Tubbataha Reefs ... MP),
which is a remote coral reef complex found in the Sulu Sea bioge ... iomass as
the "unfished" level, we found that only 7% of the 57 surveyed c ... n be
considered "developing", i.e. more than 50% of the TRNMP level ... e "fully
exploited", i.e. 25-50% of the TRNMP level, and 68% of the MPAs ... ss than
25% of the TRNMP level. All of the reefs outside MPAs were eith
"overexploited" (84%). Excluding TRNMP, fish biomass inside M ... ly neither
among the six biogeographic regions of the Philippines nor betw ... efs. Size
and age of MPAs did not show significant relationship with fish biomass. For reefs outside MPAs, fish biomass was highest in the Sulu Sea and lowest in the Visayan Seas biogeographic region. Fish biomass was signifcantly higher on island reefs. Overall, this study shows the poor conditions of commercially important coral reef fishes, which is indicative of high fishing pressure. Recommendations to improve the effectiveness of MPAs and other initiatives that would alleviate fishing pressure on coral reefs are discussed.

Study 2a. Community assemblages of commercially important coral reef fishes inside and outside marine protected areas.


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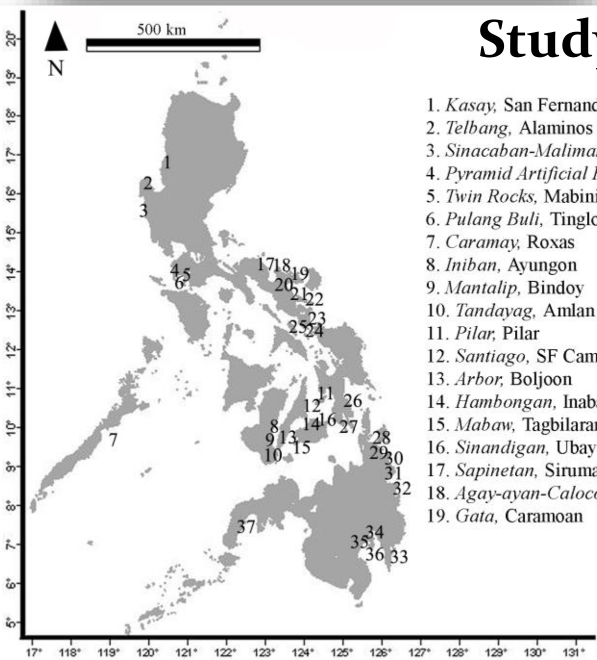
Community assemblages of commercially important coral reef fishes inside and outside marine protected areas in the Philippines

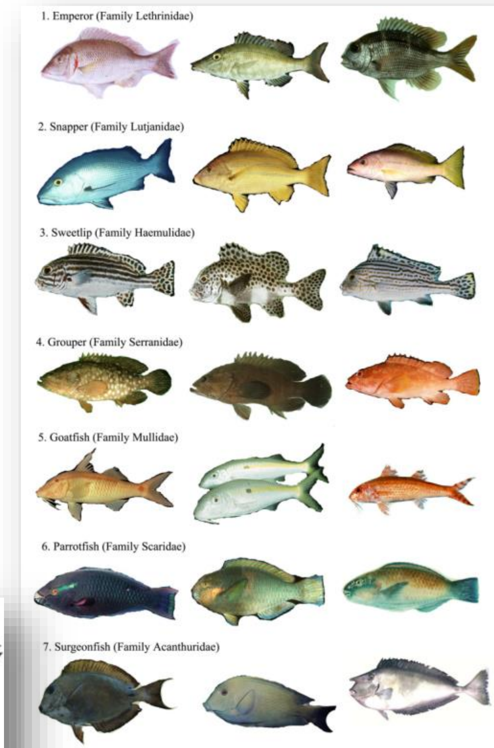
Richard N. Muallil[a,b,c,*], Melchor R. Deocadez[b], Renmar Jun S. Martinez[a,b], Samuel S. Mamauag[b], Cleto L. Nañola Jr.[d], Porfirio M. Aliño[a,b]

Study sites:



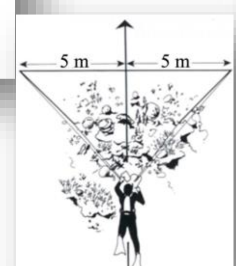
1. *Kasay*, San Fernando City
2. *Telbang*, Alaminos City
3. *Sinacaban-Malimanga*, Candelaria
4. *Pyramid Artificial Reef*, Calatagan
5. *Twin Rocks*, Mabini
6. *Pulang Buli*, Tingloy
7. *Caramay*, Roxas
8. *Iniban*, Ayungon
9. *Mantalip*, Bindoy
10. *Tandayag*, Amlan
11. *Pilar*, Pilar
12. *Santiago*, SF Camotes
13. *Arbor*, Boljoon
14. *Hambongan*, Inabanga
15. *Mabaw*, Tagbilaran City
16. *Sinandigan*, Ubay
17. *Sapinetan*, Siruma
18. *Agay-ayan-Caloco*, Tinambac
19. *Gata*, Caramoan
20. *Tigaon*, Tigaon
21. *Atulayan*, Sagnay
22. *Uson*, Bacacay
23. *Bagacay*, Gubat
24. *Subic*, Matnog
25. *Butag*, Bulan
26. *San Pablo*, Hinunangan
27. *Punta*, San Francisco
28. *Ayoke*, Cantilan
29. *Lanuza*, Lanuza
30. *Uba*, Cortes
31. *Umangon*, Marihatag
32. *Cagana*, Lianga
33. *Tamisan*, Mati City
34. *Cagangohan*, Panabo City
35. *Sanipaan*, Samal 1
36. *Dapia*, Samal 2
37. *Buluan*, Ipil

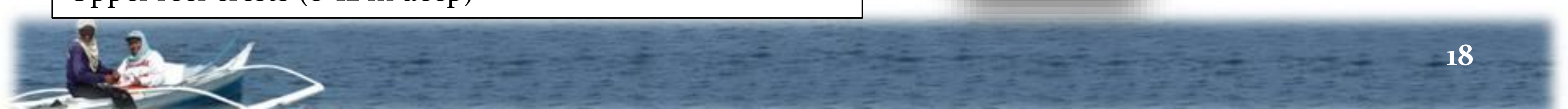
Families considered:



Survey method:

Fish visual census (English et al., 1997); 8-12 transects (L = 50m; W = 10m) per site; Half of transects inside MPAs
Upper reef crests (8-12 m deep)

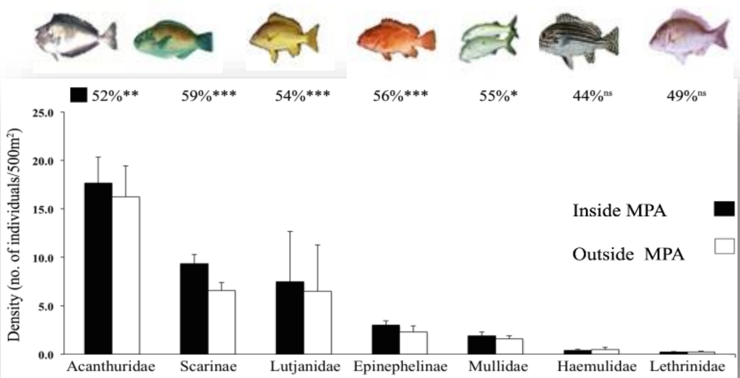




Results: More, larger and more diverse fish communities inside MPAs.

Number of species recorded: **114**

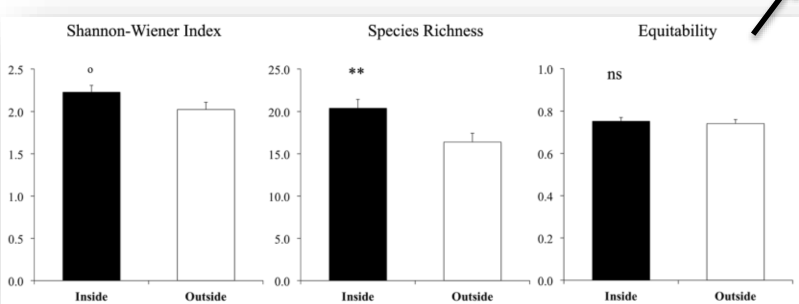
Acanthuridae, 33; Scarinae, 27; Lutjanidae, 17; Epinephelinae, 16; Mullidae, 9; Haemulidae, 6; Lethrinidae, 6.



Statistics: *Generalized linear models (Poisson distribution)*

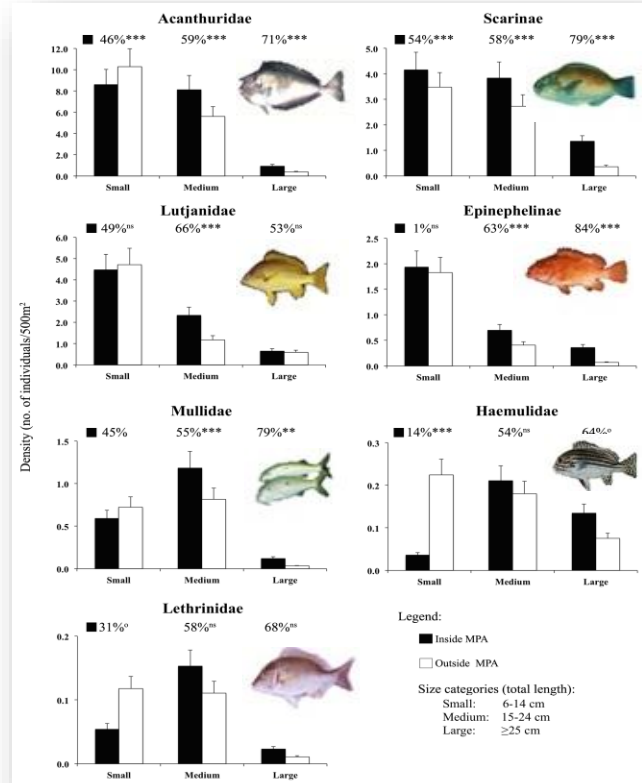
Larger fish has higher reproductive output!

Dominated by few species only!



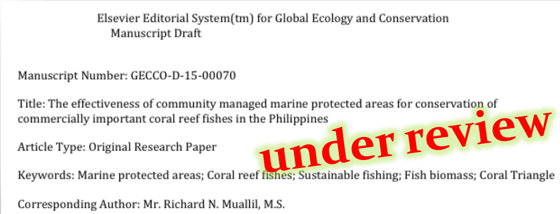
More diverse = More resilient

Statistics: *Shannon-Wiener index of diversity (to compare fish diversity)*
Paired T-test (to compare overall fish diversity indices)



P values: ***, P<0.001; **, P<0.01; *, P<0.05; o, P<0.1; ns, not significant.

Study 2b. Factors affecting MPA effectiveness for conservation of commercially important coral reef fishes.


Elsevier Editorial System(tm) for Global Ecology and Conservation
Manuscript Draft

Manuscript Number: GECCO-D-15-00070

Title: The effectiveness of community managed marine protected areas for conservation of commercially important coral reef fishes in the Philippines

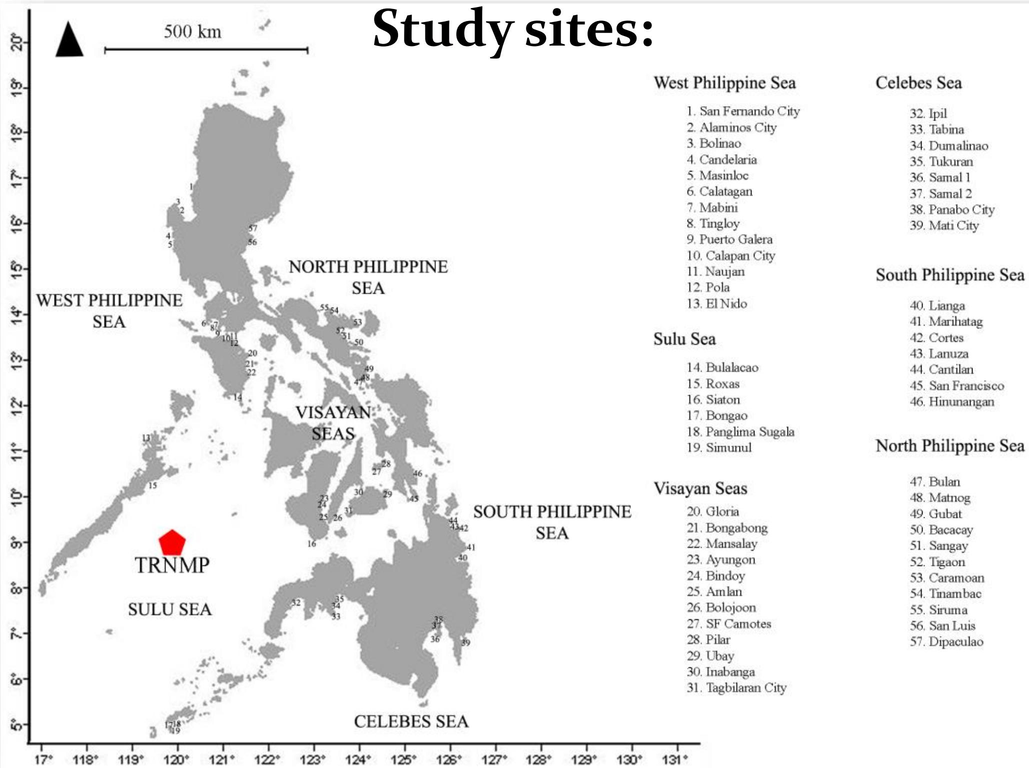
Article Type: Original Research Paper

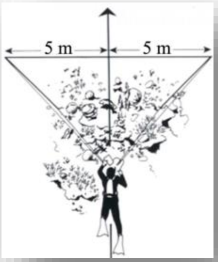
Keywords: Marine protected areas; Coral reef fishes; Sustainable fishing; Fish biomass; Coral Triangle

Corresponding Author: Mr. Richard N. Muallil, M.S.

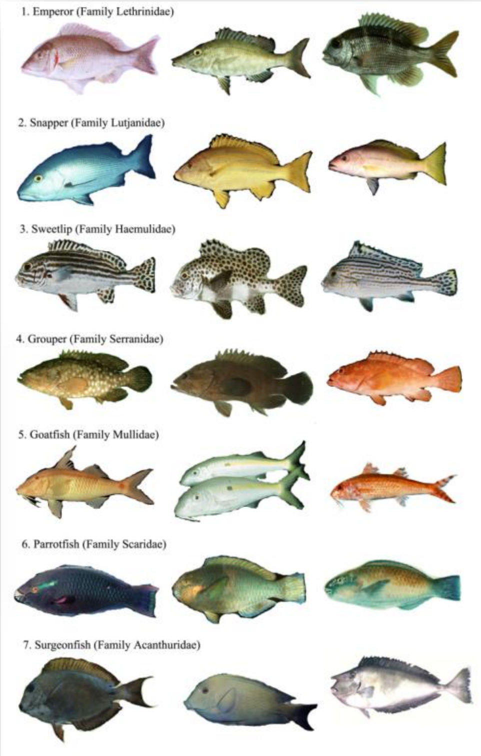
under review

Study sites:



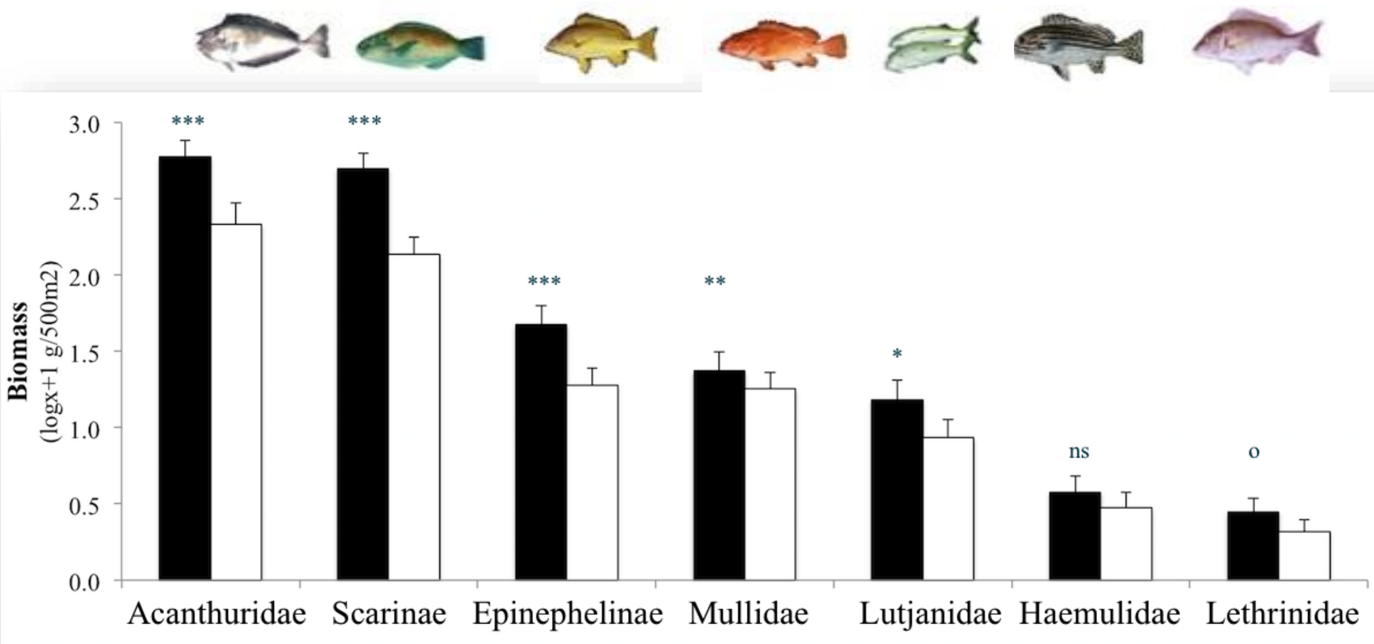


Families considered:



Survey method:
Fish visual census (English et al., 1997); 4-12 transects (L = 50m; W = 10m) per site; Half of transects inside MPAs; Upper reef crests (8-12 m deep)

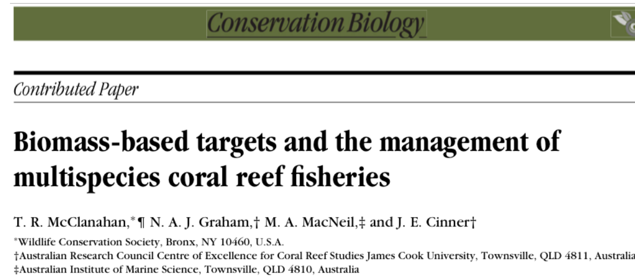
Results: Significantly higher fish biomass inside MPAs



P values: ***, P<0.001; **, P<0.01; *, P<0.05; o, P<0.1; ns, not significant.

Muallil 2015. PhD Dissertation

Methods: Levels of exploitation


Conservation Biology

Contributed Paper

Biomass-based targets and the management of multispecies coral reef fisheries

T. R. McClanahan,*¶ N. A. J. Graham,† M. A. MacNeil,‡ and J. E. Cinner†

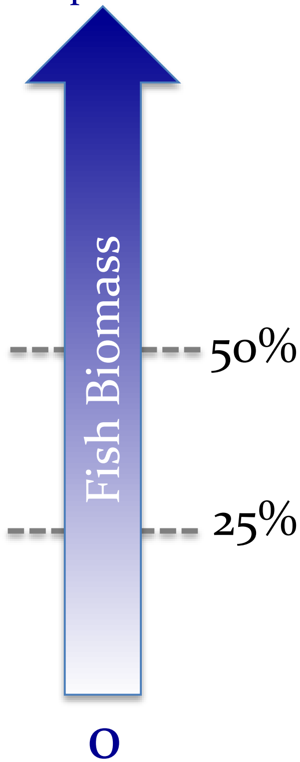
*Wildlife Conservation Society, Bronx, NY 10460, U.S.A.

†Australian Research Council Centre of Excellence for Coral Reef Studies James Cook University, Townsville, QLD 4811, Australia

‡Australian Institute of Marine Science, Townsville, QLD 4810, Australia

Maximum Biomass

"Unfished" or pristine coral reefs



Above B_{MMSY} — Lightly exploited

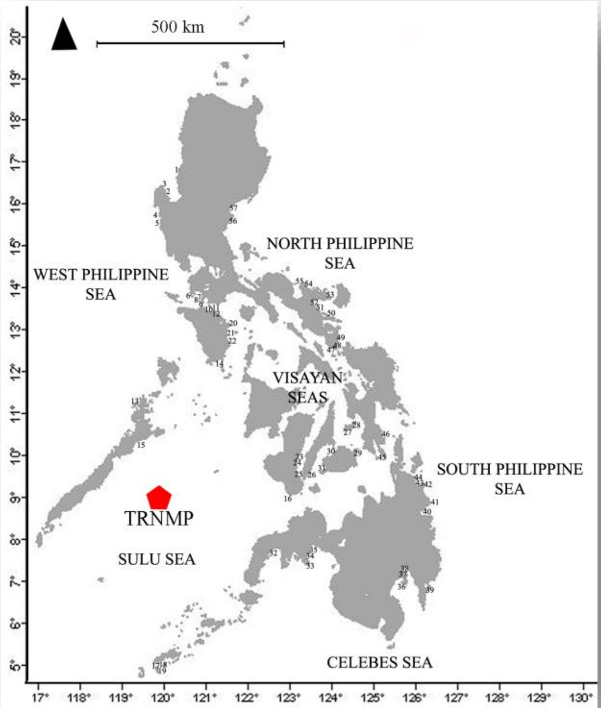
Within B_{MMSY} — Fully exploited

Below B_{MMSY} — Over-exploited

B_{MMSY} – Biomass at maximum sustainable yield for multispecies coral reef fisheries.

Tubbataha Reef National Marine Park (TRNMP):

The most pristine/most enforced MPA in the Philippines.



TRNMP profile:

Nationally managed (NIPAS)
Established: 1988

Total size: 33,200 ha

Location: Sulu Sea, far from human settlements. No fishing activity!

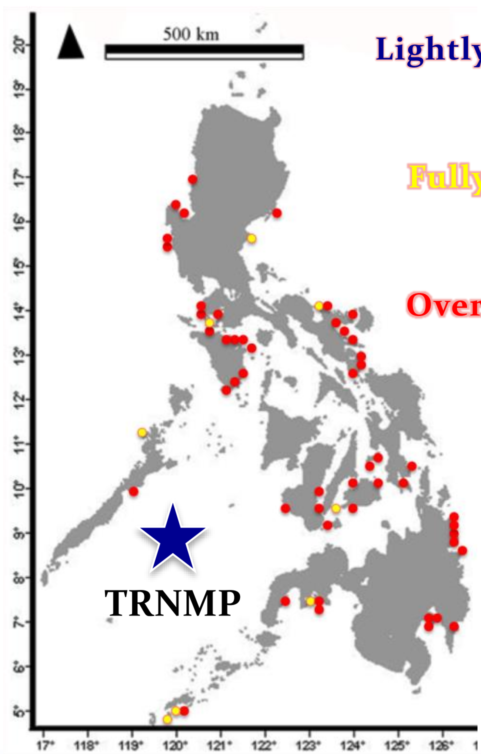
Fish biomass (commercially important species only)**: 51.1 mt/km²**

Fish biomass inside and outside locally managed MPAs in the Philippines

★ TNRMP = **51.1 mt/km²**

Mean: 11.8% of TRNMP level

Outside MPAs



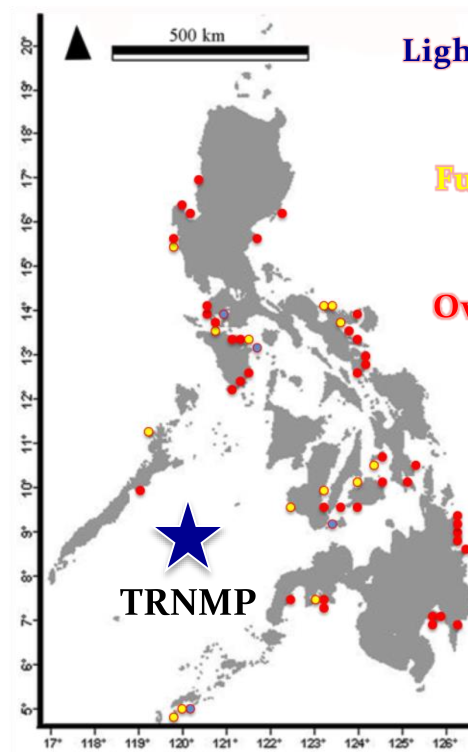
Lightly exploited
0%

Fully exploited
16%

Over-exploited
84%

Mean: 22.0% of TRNMP level

Inside MPAs



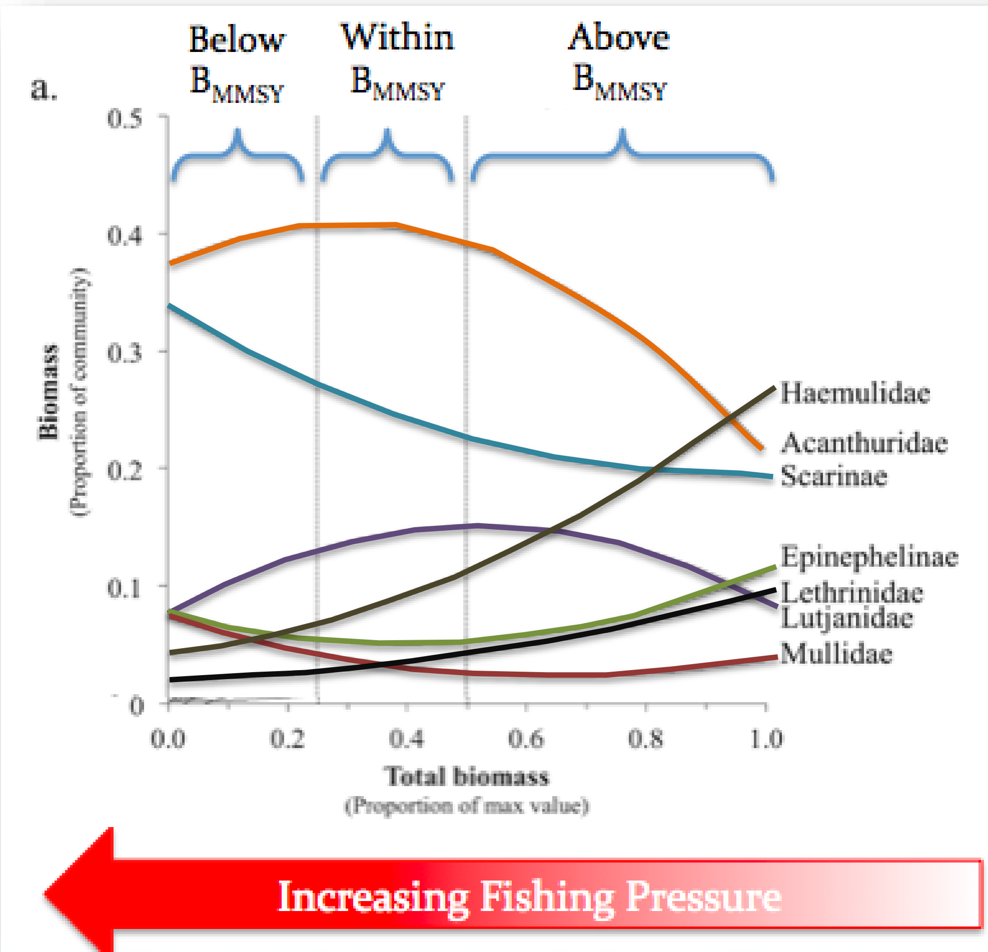
Lightly exploited
7%

Fully exploited
25%

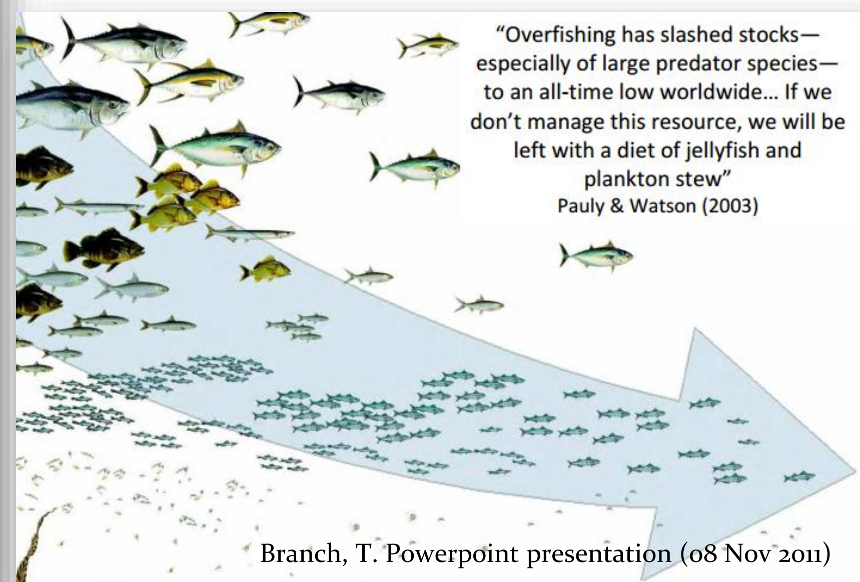
Over-exploited
68%

Evidence of “fishing down the food webs” in Philippine coral reef fisheries

Pauly and Watson, 2003



Lower trophic **Acanthuridae** and **Scarinae** dominate the reefs in the Philippines and their proportion (including **Mullidae**) increases as total fish biomass decreases.



Study 3: Fishing pressure alleviation: Social

Main objectives:

- To demonstrate how incentives or low catches can motivate fishers to exit the fishery.
- To demonstrate how different socioeconomic factors affect fishers' behavior in terms of their attachment to the fishery or fishing effort exerted.

Fisheries Research 111 (2011) 74–81

Contents lists available at ScienceDirect

Fisheries Research

journal homepage: www.elsevier.com/locate/fishres

Willingness to exit the artisanal fishery as a response to scenarios of declining catch or increasing monetary incentives

Richard N. Muallil[a,b,c,*], Rollan C. Geronimo[a,b], Deborah Cleland[d], Reniel B. Cabral[b,e], Maria Victoria Doctor[b], Annabelle Cruz-Trinidad[b,f], Porfirio M. Aliño[a,b,*]

[a] Marine Science Institute, University of the Philippines Diliman, 1101 Quezon City, Philippines
[b] Marine Environment and Resources Foundation, Inc., Marine Science Institute, University of the Philippines Diliman, 1101 Quezon City, Philippines
[c] Mindanao State University – Tawi-Tawi
[d] Fenner School of Environment and Soci
[e] National Institute of Physics, University
[f] ADB Knowledge Management Project, c/

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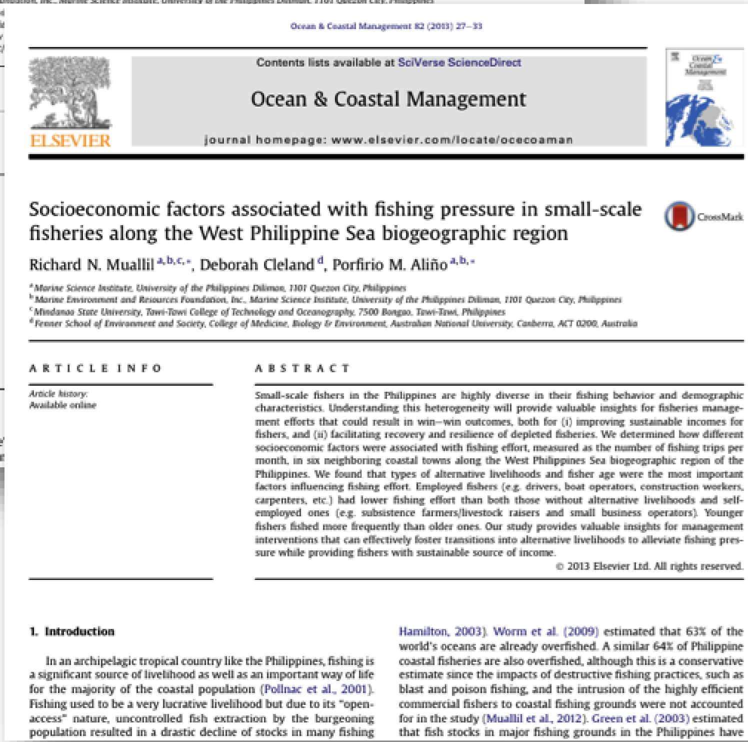
Accepted 22 June 2011

Keywords:
Small-scale fishers
Poverty
Fishing pressure
Socioeconomic factors
Alternative livelihood

1. Introduction

Fish stocks in the Philippine
drastically reduced to less than



Ocean & Coastal Management 82 (2013) 27–33

Contents lists available at SciVerse ScienceDirect

Ocean & Coastal Management

journal homepage: www.elsevier.com/locate/ocecoaman

Socioeconomic factors associated with fishing pressure in small-scale fisheries along the West Philippine Sea biogeographic region

Richard N. Muallil[a,b,c,*], Deborah Cleland[d], Porfirio M. Aliño[a,b,*]

[a] Marine Science Institute, University of the Philippines Diliman, 1101 Quezon City, Philippines
[b] Marine Environment and Resources Foundation, Inc., Marine Science Institute, University of the Philippines Diliman, 1101 Quezon City, Philippines
[c] Mindanao State University, Tawi-Tawi College of Technology and Oceanography, 7500 Bongao, Tawi-Tawi, Philippines
[d] Fenner School of Environment and Society, College of Medicine, Biology & Environment, Australian National University, Canberra, ACT 0200, Australia

ARTICLE INFO

Article history:
Available online

ABSTRACT

Small-scale fishers in the Philippines are highly diverse in their fishing behavior and demographic characteristics. Understanding this heterogeneity will provide valuable insights for fisheries management efforts that could result in win–win outcomes, both for (i) improving sustainable incomes for fishers, and (ii) facilitating recovery and resilience of depleted fisheries. We determined how different socioeconomic factors were associated with fishing effort, measured as the number of fishing trips per month, in six neighboring coastal towns along the West Philippines Sea biogeographic region of the Philippines. We found that types of alternative livelihoods and fisher age were the most important factors influencing fishing effort. Employed fishers (e.g. drivers, boat operators, construction workers, carpenters, etc.) had lower fishing effort than both those without alternative livelihoods and self-employed ones (e.g. subsistence farmers/livestock raisers and small business operators). Younger fishers fished more frequently than older ones. Our study provides valuable insights for management interventions that can effectively foster transitions into alternative livelihoods to alleviate fishing pressure while providing fishers with sustainable source of income.

1. Introduction

In an archipelagic tropical country like the Philippines, fishing is a significant source of livelihood as well as an important way of life for the majority of the coastal population (Pollnac et al., 2001). Fishing used to be a very lucrative livelihood but due to its "open-access" nature, uncontrolled fish extraction by the burgeoning population resulted in a drastic decline of stocks in many fishing

Hamilton, 2003). Worm et al. (2009) estimated that 63% of the world's oceans are already overfished. A similar 64% of Philippine coastal fisheries are also overfished, although this is a conservative estimate since the impacts of destructive fishing practices, such as blast and poison fishing, and the intrusion of the highly efficient commercial fishers to coastal fishing grounds were not accounted for in the study (Muallil et al., 2012). Green et al. (2003) estimated that fish stocks in major fishing grounds in the Philippines have

Study 3a. Willingness to exit the fishery as a responses to declining catch or increasing monetary scenarios.


Fisheries Research 111 (2011) 74–81

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Willingness to exit the artisanal fishery as a response to scenarios of declining catch or increasing monetary incentives

Richard N. Muallil[a,b,c,*], Rollan C. Geronimo[a,b], Deborah Cleland[d], Reniel B. Cabral[b,e], Maria Victoria Doctor[b], Annabelle Cruz-Trinidad[b,f], Porfirio M. Aliño[a,b,*]

Data collection	
No. of municipalities	6
No. of provinces	3
No. fishers interviewed (total)	662
Interview period	Apr 2009 to Jan 2010

Study sites:

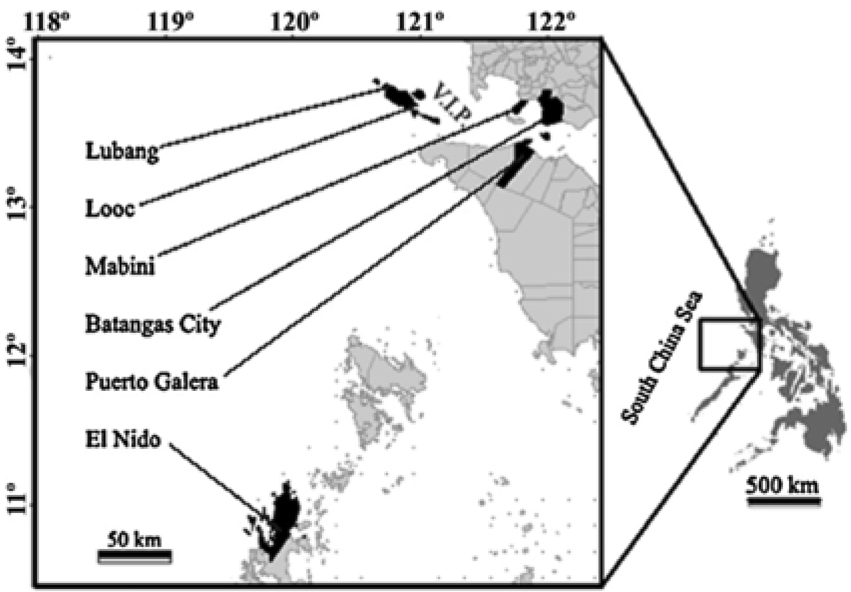


Fig. 1. The geographic location of the six study sites and the Verde Island Passage. (V.I.P.)

One-on-one interview

Focus group discussion

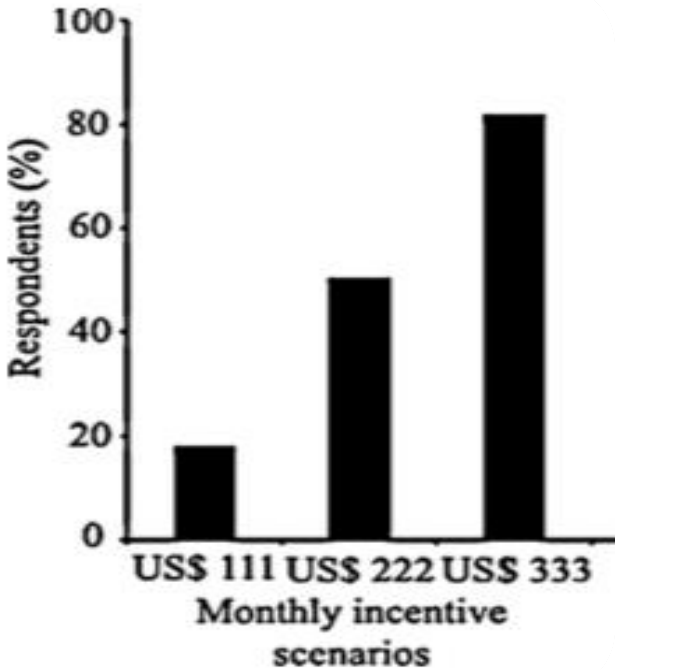
Main questions asked:

Would you completely stop fishing if:

a. Given monthly incentives of:

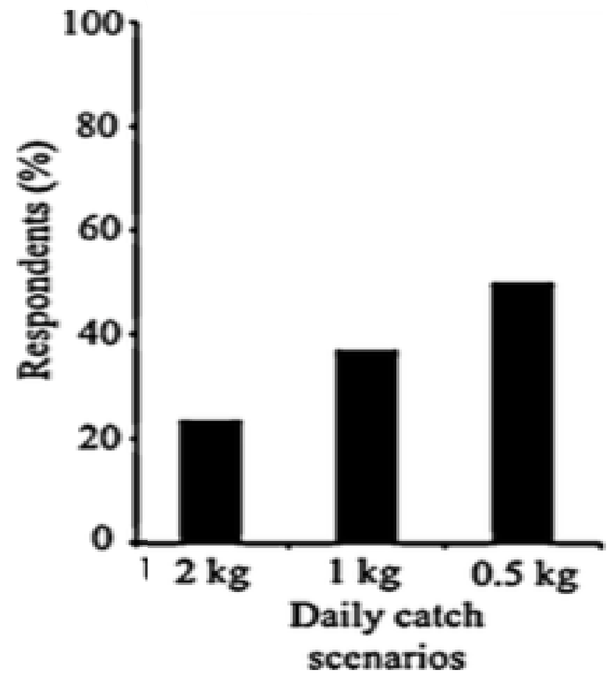
P 5,000, P 10,000, P 15,000

YES



b. Daily catches have fallen to:

2 kg, 1 kg, 0.5 kg



Results: Factors affecting fishers' decisions:

Increasing monetary incentives

Monetary incentive scenario	Predictor	Coefficient	S.E.	Wald's X^2	Odds ratio	P
US$111	Constant	−1.463	0.454	10.398	NA	0.001***
	Fishing days 2	−0.142	0.323	0.193	0.868	0.661
	Fishing days 3	−0.909	0.364	6.221	0.403	0.013**
	Diagnostic tests					
	Hosmer–Lemeshow	X^2 = 1.329	df = 8	P = 0.995		
	AUC[a]	0.768				
US$222	Constant	0.429	0.286	2.255	NA	0.133
	Education 2	−0.526	0.215	5.952	0.591	0.015**
	Years in the fishery 2	−0.381	0.244	2.443	0.683	0.118
	Years in the fishery 3	−0.482	0.241	4.000	0.617	0.046**
	Diagnostic tests					
	Hosmer–Lemeshow	X^2 = 11.446	df = 8	P = 0.178		
	AUC[a]	0.676				
US$333	Constant	2.176	0.297	53.633	NA	0.000***
	Years in the fishery 2	−0.965	0.333	8.398	0.381	0.004***
	Years in the fishery 3	−0.919	0.327	7.907	0.399	0.005***
	Diagnostic tests					
	Hosmer–Lemeshow	X^2 = 4.791	df = 8	P = 0.780		
	AUC[a]	0.652				

Declining catches

Catch scenario	Predictor	Coefficient	S.E.	Wald's X^2	Odds ratio	P
0.5 kg	Constant	0.621	0.263	5.597	NA	0.018**
	Fishing days 2	−0.031	0.247	0.016	0.969	0.900
	Fishing days 3	−0.604	0.254	5.659	0.547	0.017**
	Years in the fishery 2	−0.354	0.244	2.116	0.702	0.146
	Years in the fishery 3	−0.880	0.239	13.523	0.415	0.000***
	Diagnostic tests					
	Hosmer–Lemeshow	X^2 = 4.945	df = 8	P = 0.763		
	AUC[a]	0.670				
1 kg	Constant	−0.277	0.348	0.631	NA	0.427
	Age 2	0.464	0.251	3.420	1.591	0.064*
	Age 3	0.013	0.348	0.001	1.013	0.970
	Fishing days 2	0.358	0.265	1.832	1.431	0.176
	Fishing days 3	−0.274	0.278	0.969	0.760	0.325
	Years in the fishery 2	−0.487	0.253	3.721	0.614	0.054*
	Years in the fishery 3	−1.252	0.289	18.833	0.286	0.000***
	Diagnostic tests					
	Hosmer–Lemeshow	X^2 = 9.224	df = 8	P = 0.3237		
	AUC[a]	0.720				
2 kg	Constant	−0.727	0.364	4.002	NA	0.045**
	Fishing days 2	0.292	0.298	0.967	1.340	0.326
	Fishing days 3	−0.426	0.323	1.741	0.653	0.187
	Years in the fishery 2	−0.707	0.285	6.162	0.493	0.013**
	Years in the fishery 3	−1.135	0.300	14.364	0.321	0.000***
	Diagnostic tests					
	Hosmer–Lemeshow	X^2 = 10.054	df = 8	P = 0.261		
	AUC[a]	0.757				

[a] Area under the receiver operating characteristics curve.
*** Significant at P = 0.01.
** Significant at P = 0.05.
* Significant at P = 0.1.

Fishers who are unwilling to exit the fishery:

1. longer in the fishery
2. fish more often

"Fishing has become an important way of life"

Synthesis:

Carrying capacity

Fish Biomass

B_{MMSY}

UnSustainable

Fish stocks

Fishing

Unsustainable

Time

1950s 1990s present

2 Alleviate fishing pressure:

a. Ecological (MPAs)

- ❖More and larger MPAs all over the country
- ❖Protect entire uninhabited reefs (i.e. entire island/shoals).
- ❖Protect healthier and ecologically important reefs (i.e. larval sources and sinks).
- ❖Establish MPA networks (ecological and social).
- ❖Strict enforcement of MPAs.

b. Social(Fishing effort)

❖Economic assistance, capacity building and IECs

❖Put conditionality (i.e. Conditional Cash Transfers or CCT) such as to reduce fishing effort, exit the fishery and participate in coastal resource management activities.
❖Target those more willing to exit the fishery or exerting high fishing effort.
❖Prioritize CCT and IEC in areas with lack of alternative options. Capacity building programs in areas with more alternative options.

❖Reduce fishing effort on vulnerable species (i.e. coral reef fishes).

❖Gear regulation, buy-out gears that catches large volume coral reef fishes (bottomset long lines, bottomset gillnets) especially from those fishing near MPAs.
❖Replace gears with those catching pelagic and other non-coral reef associated fishes. Provision of fishing technology, i.e. boats, may also be considered.

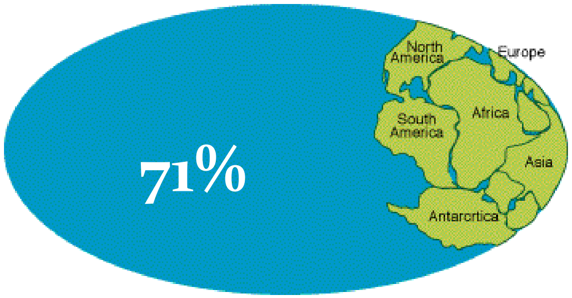
Considerations:

- ❖Behavior of fishers
- ❖Poverty and lack of alternative options.
- ❖Too many fishers potentially displaced.
- ❖Limited funds and poor (environmental) governance.

1 Eradicate destructive/illegal fishing activities

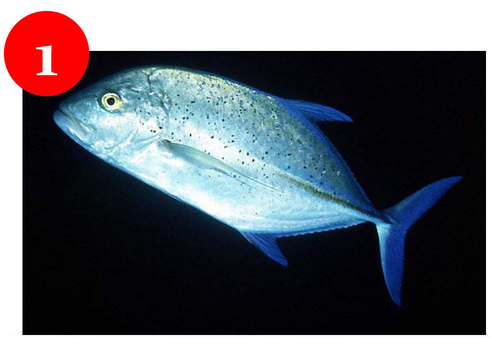
Potential for sustainable SSF:

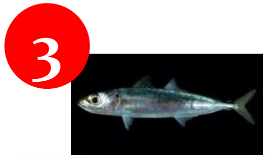
The ocean is huge and fish are very prolific!



http://legacy.mos.org/oceans/planet/

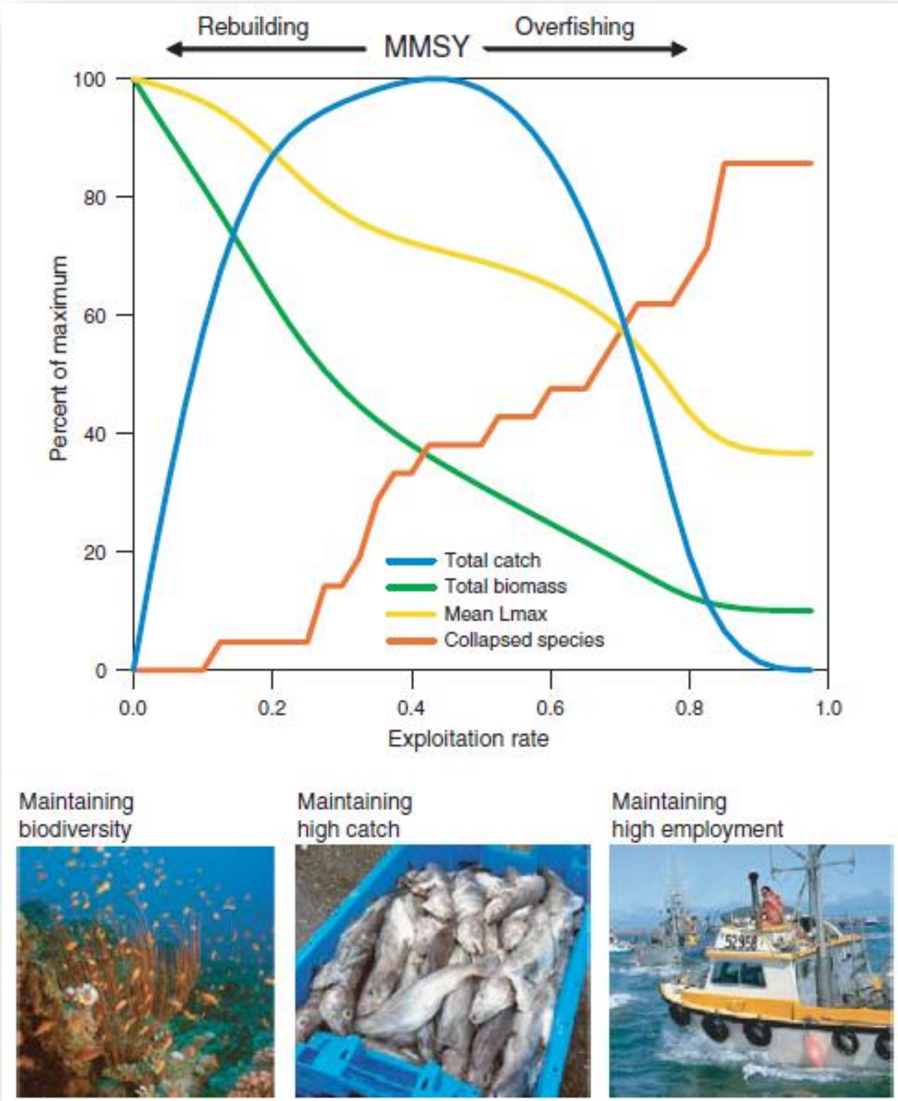
Species	Max Length	No. of Eggs	
		Min	Max
1. *Caranx melampigus*	117 cm FL	49,700	4,270,000
2. *Auxis thazard thazard*	65 cm FL	200,000	1,370,000
3. *Decapterus macrosoma*	35 cm	68,000	106,000
4. *Plectropomus leopardus*	120 cm	457,900	?
5. *Siganus canaliculatus*	30 cm	42,253	1,000,000





FishBase

Management options and objectives:



Rebuilding Global Fisheries
Boris Worm, *et al.*
Science **325**, 578 (2009);
DOI: 10.1126/science.1173146

FGD with fishers at Cabra island, Lubang, Occidental Mindoro
April 24, 2015

FISH-BE WITH YOU!!

Acknowledgement

Dissertation committee:

Porfirio M. Aliño, Ph.D.
Hazel O. Arceo, Ph.D.
Wilfredo L. Campos, Ph.D.
Cesar L. Villanoy, Ph.D.
Aletta T. Yñiguez, Ph.D.

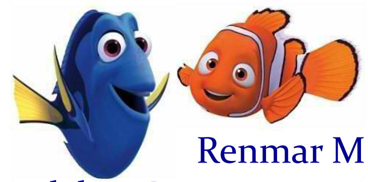
Marine Science Institute

Super Perry & the COMECO lab
(Coral Reefs and Community Ecology)

Marine Environment and Resources Foundation

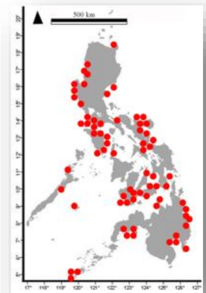
Mindanao State University – Tawi-Tawi College of Technology and Oceanography

My fishy buddies:



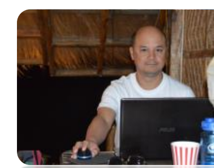
Melchor D.

Renmar M.



To the wonderful people we met/worked with during the surveys all over the country. Special thanks (and best wishes) to the fishers!!

Family, Friends & God Almighty



Doc Sam
Boss, Uncle, Friend, Kuya, Father and Lolo

Major funders: