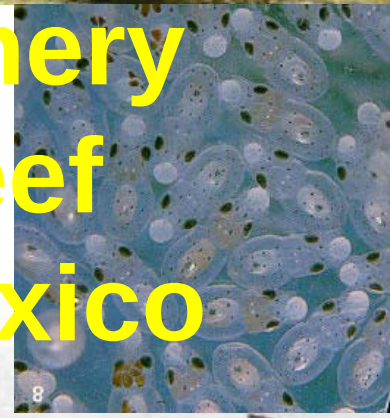


Sustainable Octopus Fishery Program in Veracruz Reef System National Park, Mexico

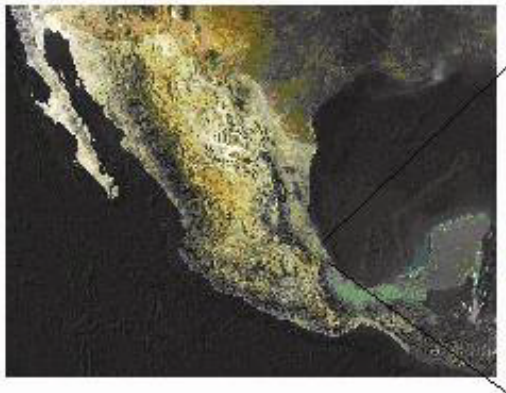
Universidad Veracruzana

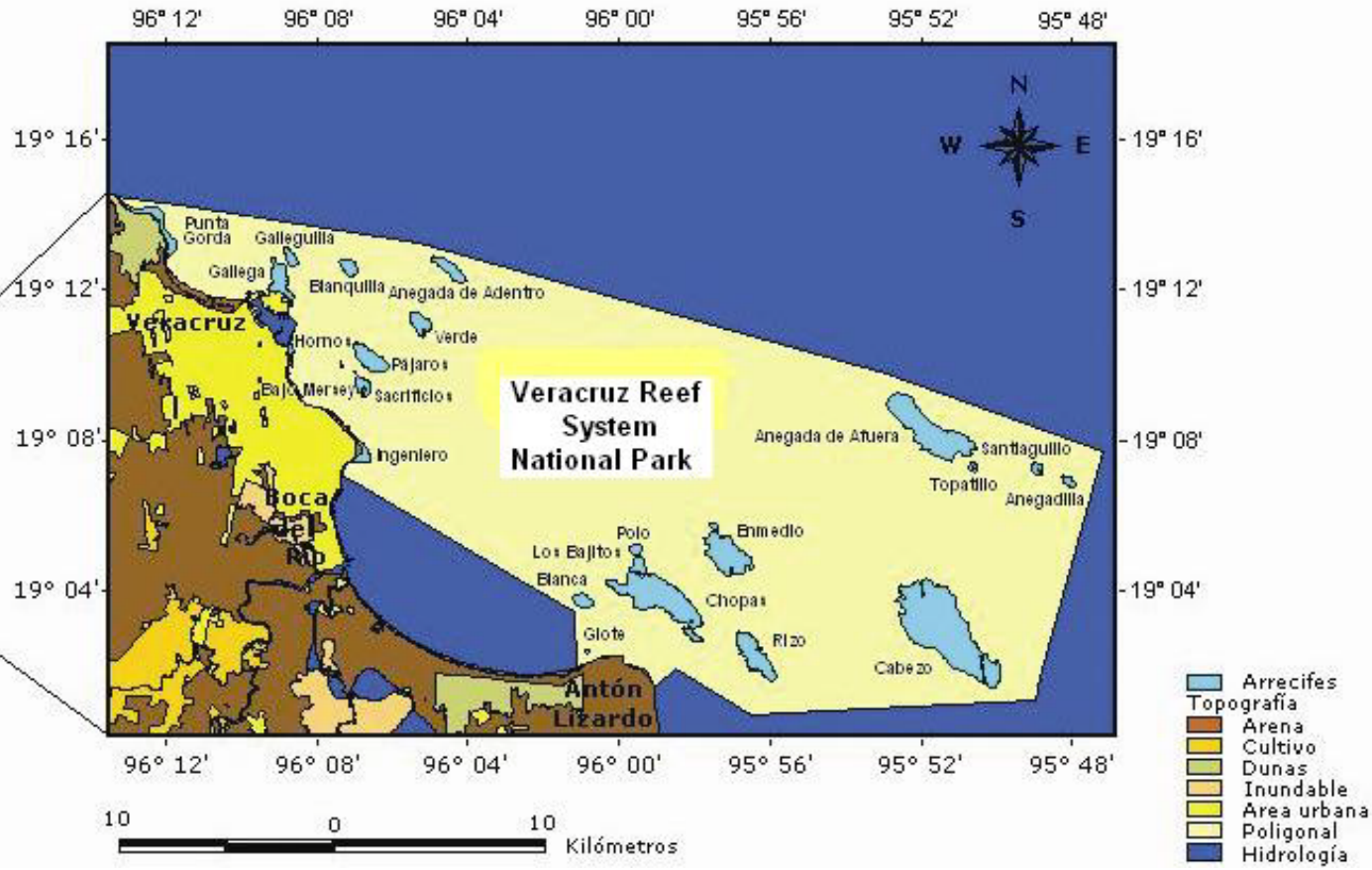
Lourdes Jiménez, Virgilio Arenas, Daniel Méndez, Gerardo Preciado,

Ana Gabriela Díaz , Mitzy Blanco

Marine Science and Fisheries Institute

Localization of Veracruz Reef System National Park





52 239 ha

23 reefs

Problematic

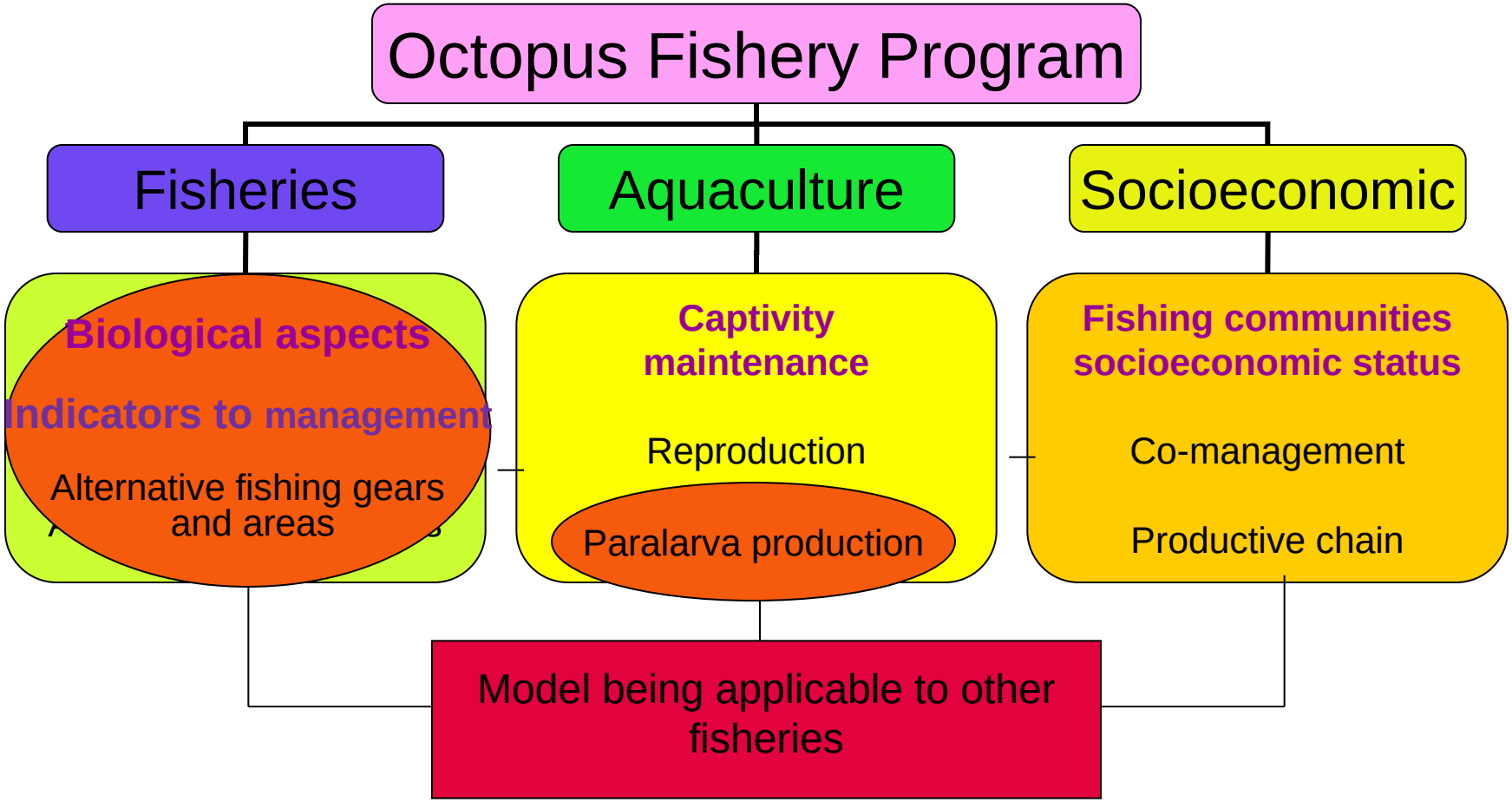
- Fishing activities are in conflicts with conservation goals
- At least a thousand families has an economic dependence from the fishing
- Artisanal fishing is not a profitable activity
- Regulations is inefficient, multispecies
- Scarce information on fish population dynamics
- Octopus fishing gear tear the coral reefs when is used to fish

Purpose of the Program

- To generate basic information on *Octopus vulgaris* resource in three areas: Fisheries, Aquaculture and Socioeconomic, useful to decision makers

- To evaluate the octopus culture as an alternative activity to reduce the fishing impact on the reefs

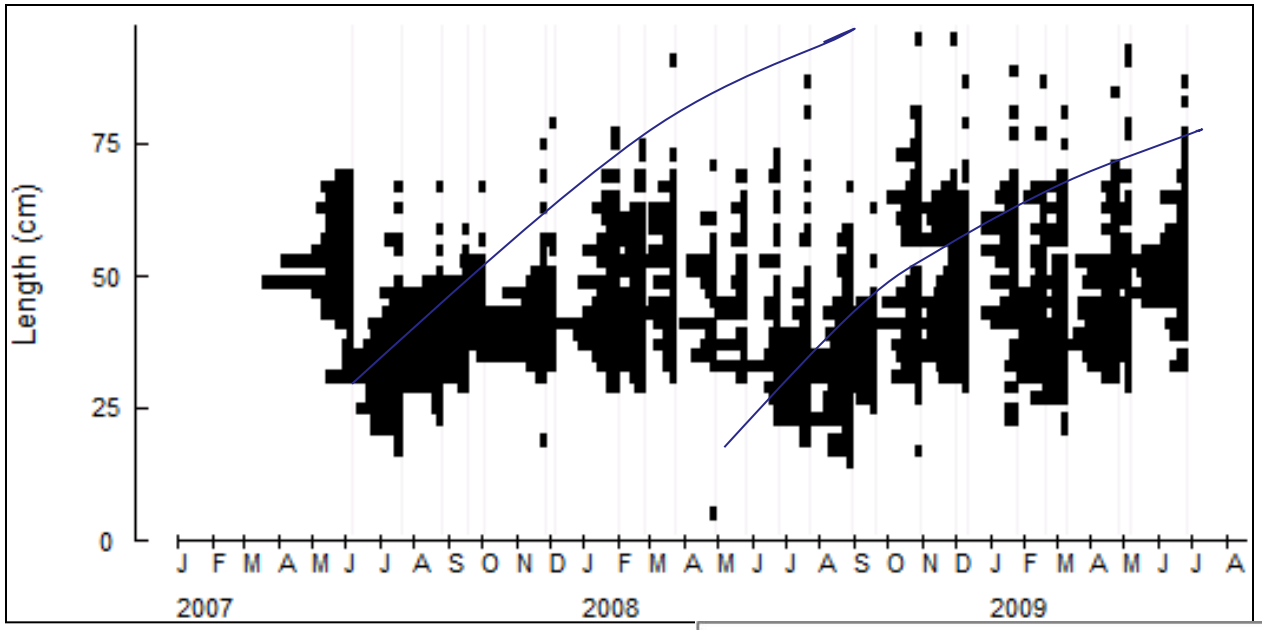
Areas and Projects



Action Plan

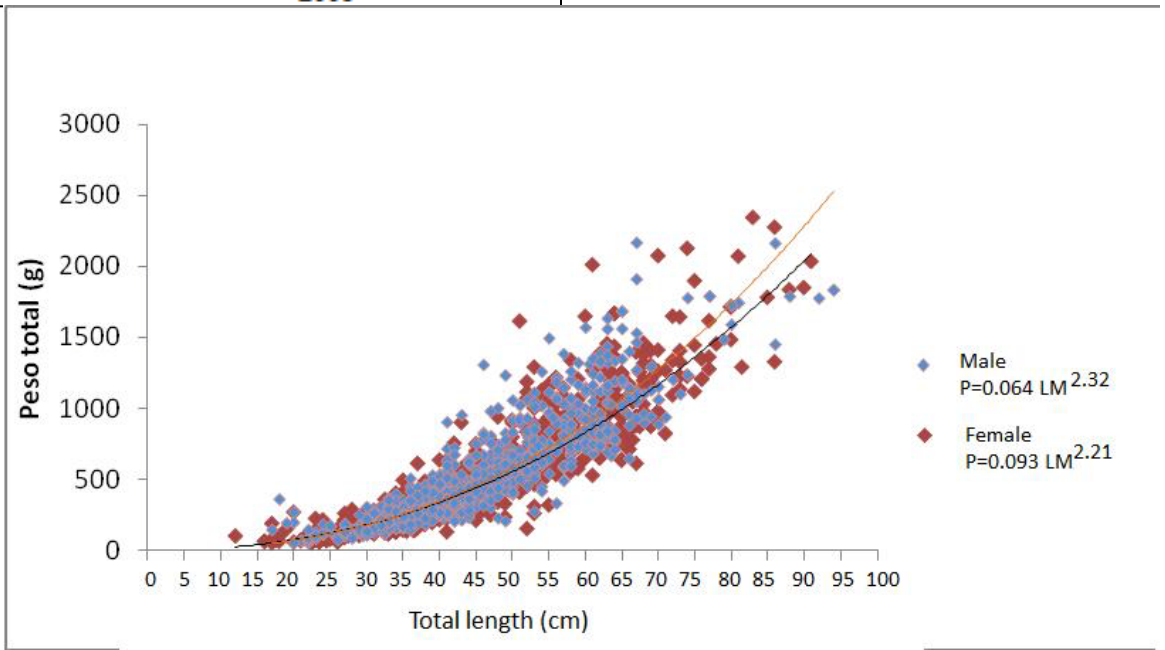
Some advance in the research

Population structure



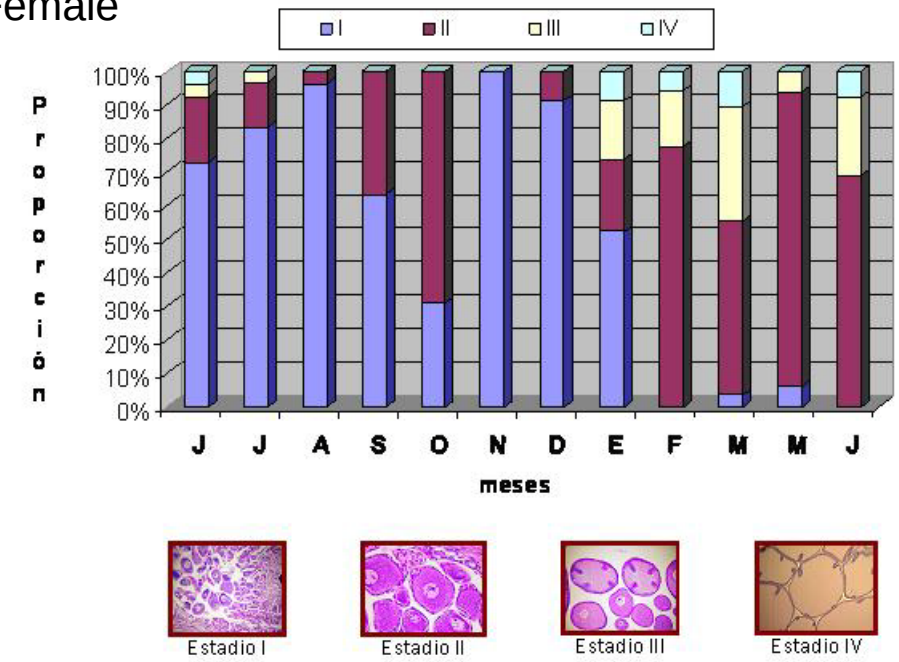
- At least two cohorts
- First capture size 9.5 cm LM
- 75 % under 11 cm LM regulation
- Age growth in progress

Length-Weigth Relationship

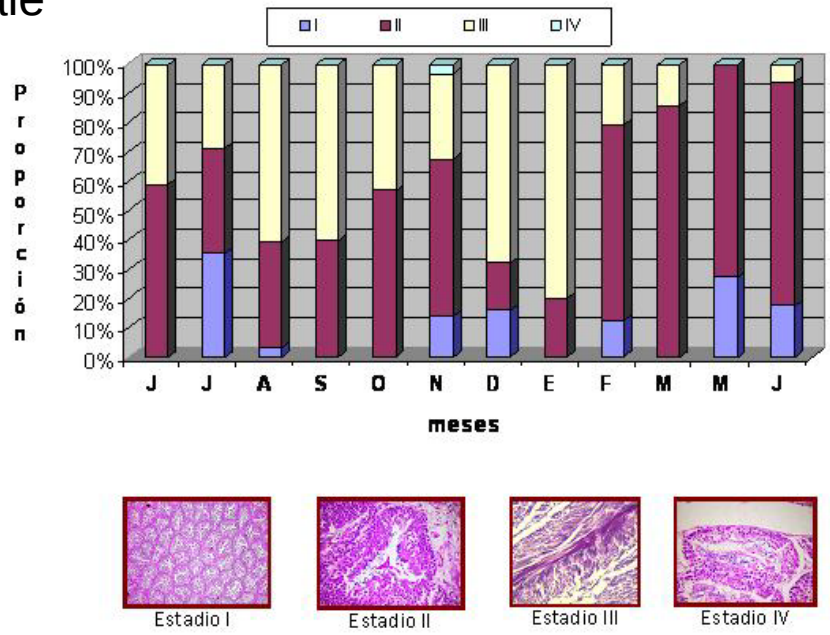


Gonad maturity cycle

Female

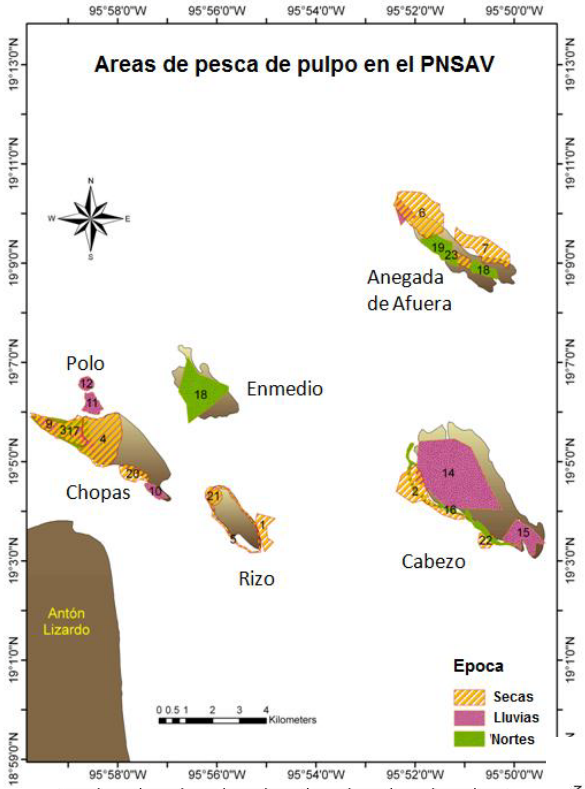


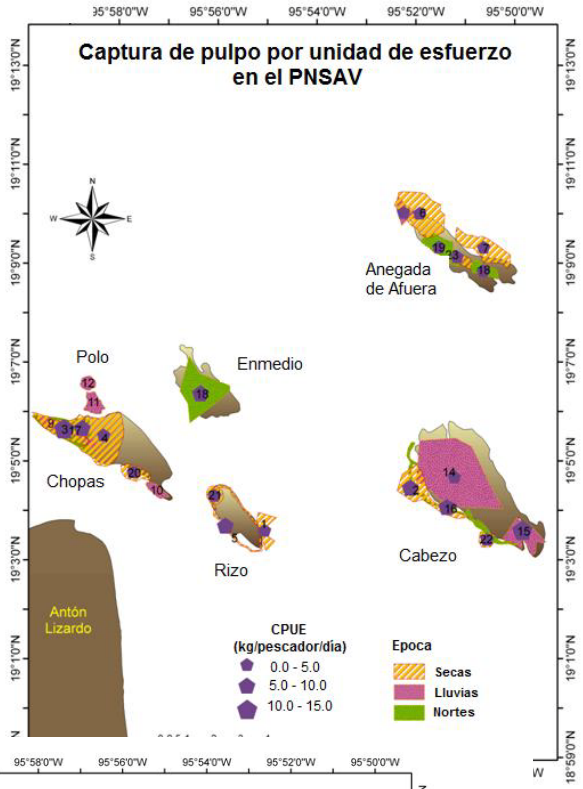
Male

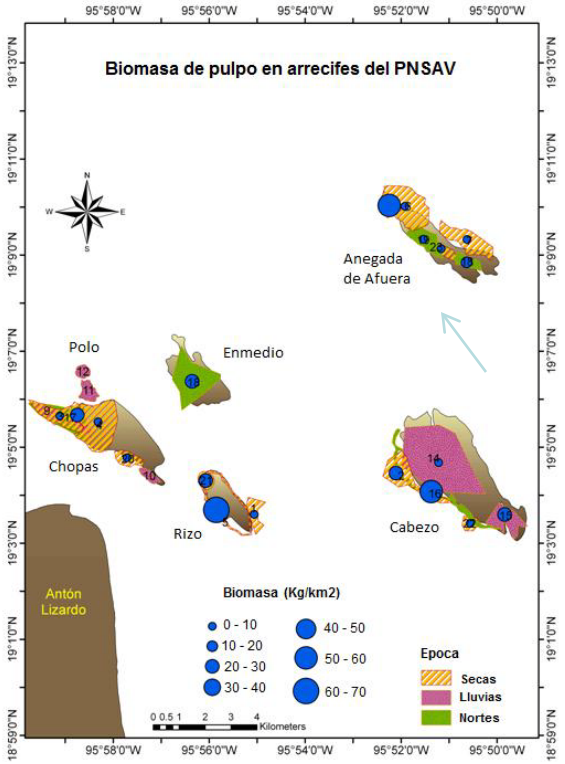


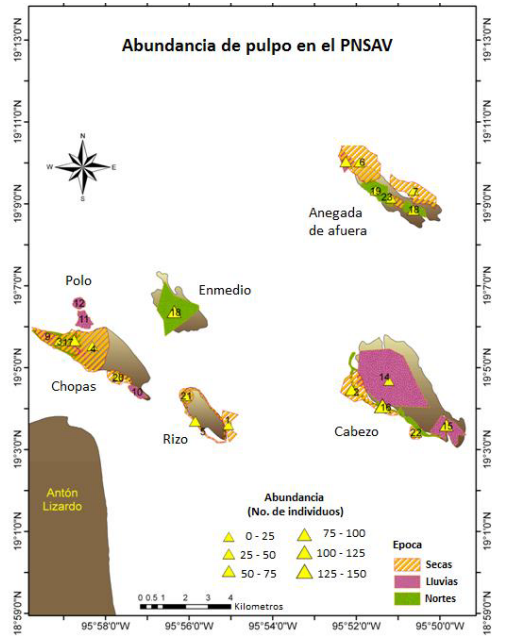
Female	Male
14 cm LM 1400 g	11 cm LM 700 g

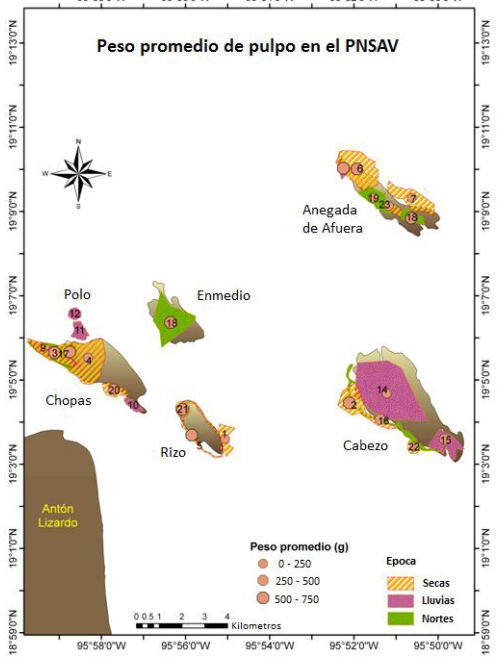
Mating January - March
Spawning July- August
Fishing close season January - June











Maps of octopus distribution and abundance useful to decision makers

23 fishing ground 0.23 to 5.44 km^2

CPUE 2.49 to 10.75 kg/fishermen/day

Relative biomass 2.97 to 67.48 kg/km^2

Octopus average weight 259 to 654 g

Hatching tested

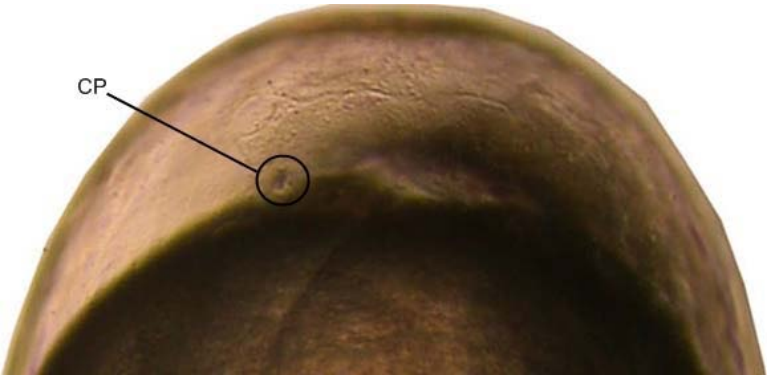
Clusters suspended maternity incubator

For paralarvae rearing mother is essential

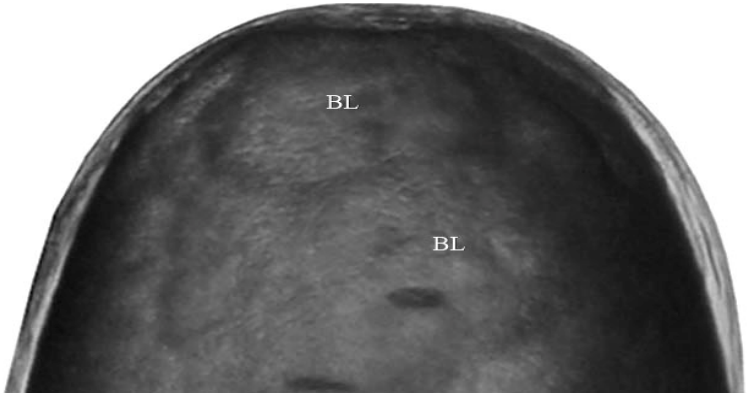
Fresas 250,000 eggs by female
Survival 95% at 14 days

Embryonic development consisted 20 stadios, 22 days, 25ºC-28ºC, 36 ppm

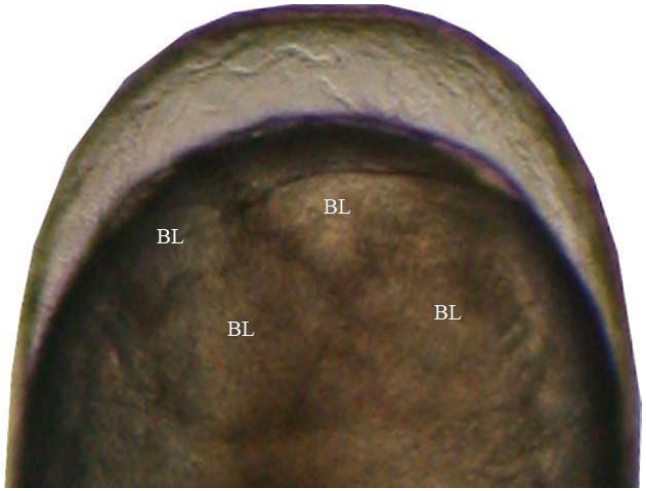
Embryonic development



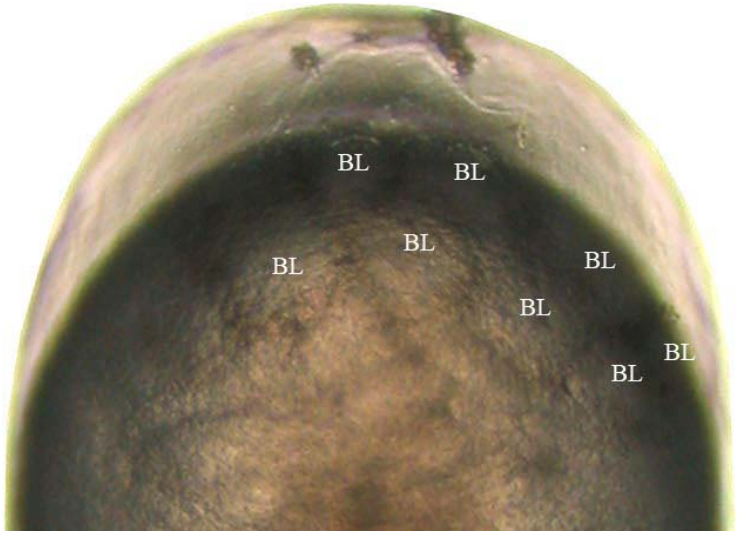
Meiosis 1 CP= Cuerpo polar



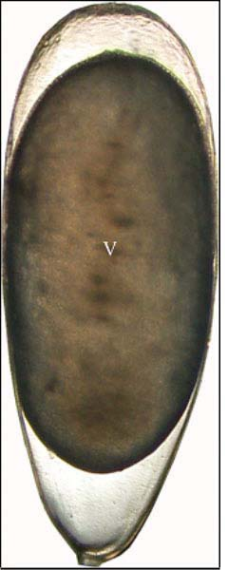
1° Segmentación BL= Blastómeros

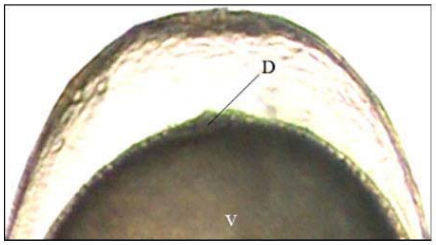


2° Segmentación BL= Blastómeros



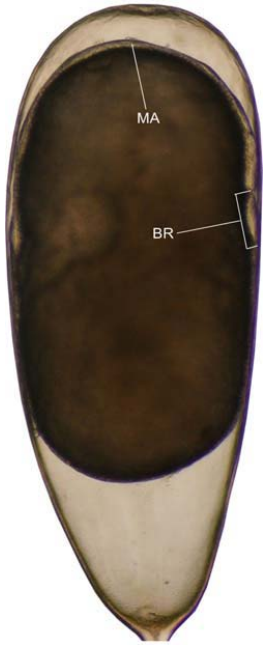
3ª Segmentación BL= Blastómeros





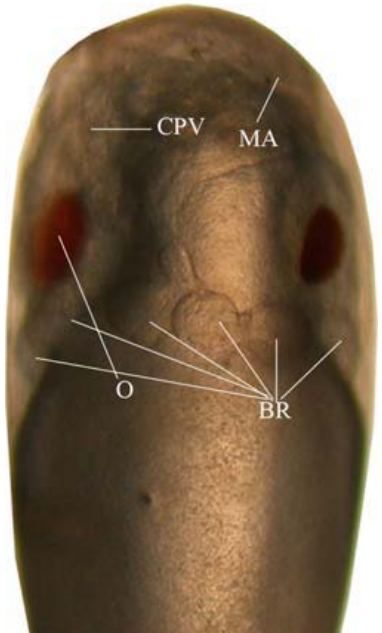
Estadio 1 V= Vitelo
D= Discoblástula

Estadio 6 V= Vitelo
BD=Blastodermo



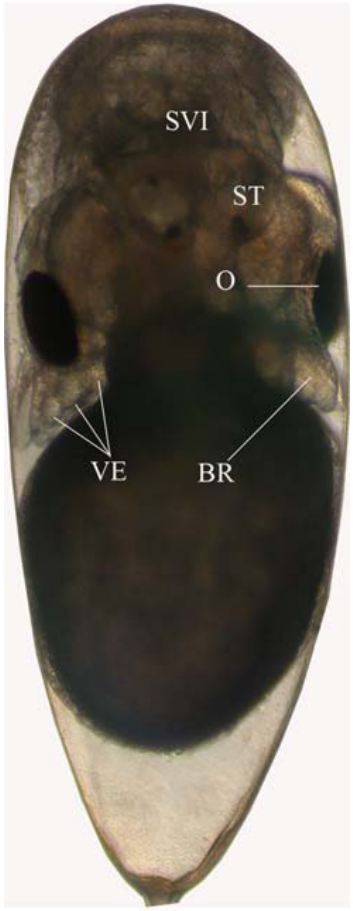
Estadio 8 MA= Manto
BR= Brazos

Estadio 9
CO= Complejo óptico
BR= Brazo
MA= Manto



Estadio 10 O= Ojos, BR= Brazos
MA= Manto, CPV= Complejo paleovisceral

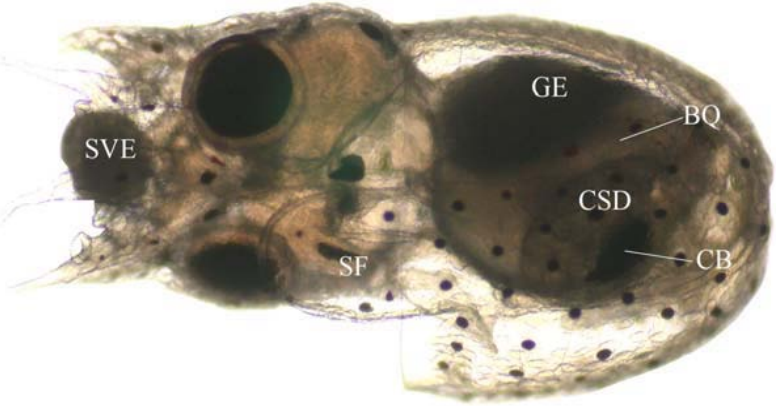
Estadio 15
BR=brazos
ST=Estatocistos
O=ojos
VE= Ventosas
SVI= Saco vitelino interno



Estadio 20 anterior a la eclosión

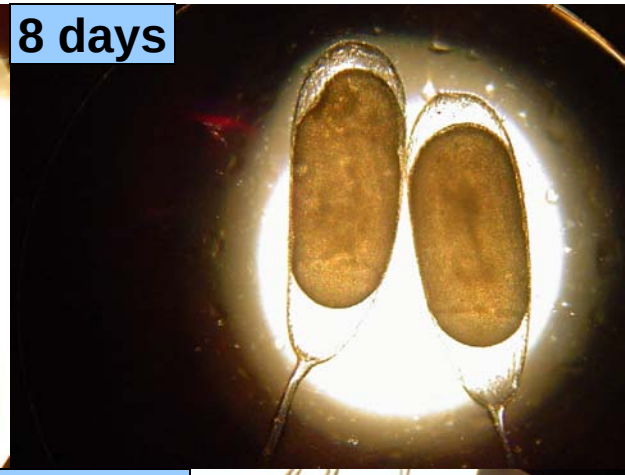
Estadio 16
CR= Cromatóforos

Estadio 18
SVE= Saco vitelino externo
SVI= Saco vitelino interno

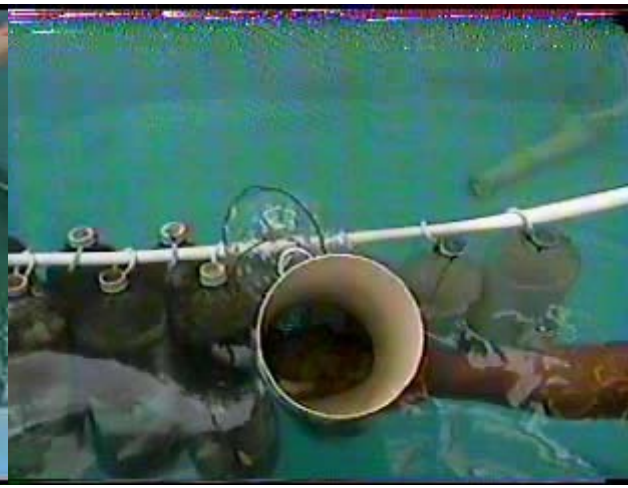


Paralarva SF= Sifón
GE= Ganglio estelar
CB= Corazón branquia
BQ= Branquias
CSD= Complejo del sistema digestivo
SVE= Saco vitelino externo

Embryonic development



Shelters types



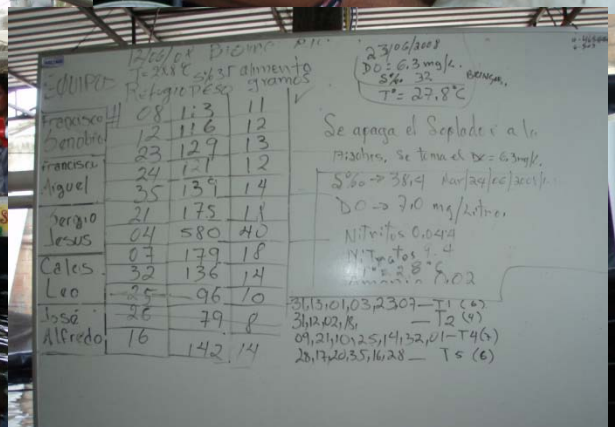
Captivity maintenance

- Octopus 150-250 g daily growth 1.5 %
- Octopus 250-500 g daily growth 1.3 %
- Octopus more than 600 g daily growth 0.71 %

Snails, squid 96 days 15 %
IC 2.68

Fish, crab 100 g 10 % 65 days
1.26 g/day

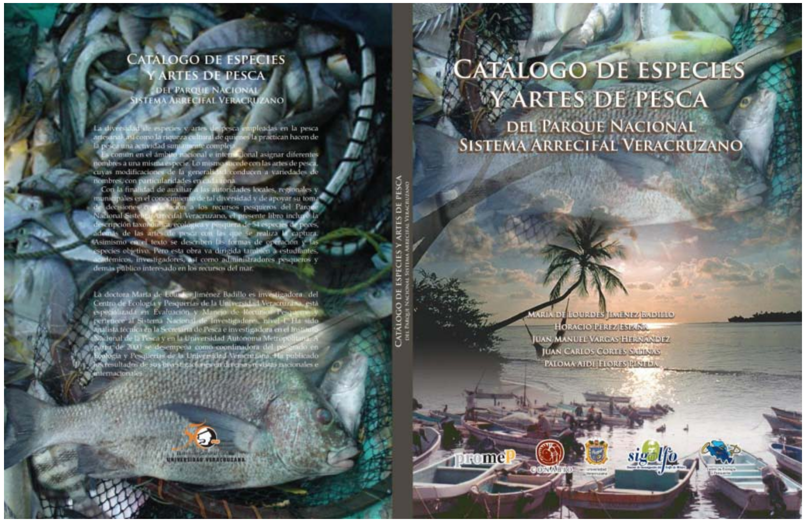
Fattening test



Fishing communities Socioeconomic status

- Veracruz residence time 3 to 79 years
- Average age 44 years, range 18 to 79
- Fishers time 1 to 71 years
- 64 % primary school
- 70 % catholics
- 60 % full-time fishers, daily profit 15 USD, time investing 12 hrs, average 3 economic dependents

- 40 % members of one organization
- 79 % open mind to productive alternatives
- 79 % conscious of the exhaustion of fishing resources
- 78 % sensitive to the meaning of the protected area
- Conscious about conserving resources for the future, but more worried about daily incomes; until livelihoods are improved they will continue violating fishing rules



CEPOMEX

Serie Acuacultura

Madurez gonádica del pulpo

Octopus vulgaris en el Golfo de México: Análisis macroscópico y microscópico

M.L. Jiménez-Badillo, R. E. del Río-Rodríguez, M.I. Gómez-Solano, A. Cu-Escamilla y D. Méndez-Aguilar

Universidad Autónoma de Campeche

Méndez Aguilar, F.D., M.L. Jiménez Badillo, y V. Arenas Fuentes, 2007. Cultivo experimental del pulpo (*Octopus vulgaris*, Cuvier, 1797) en Veracruz y su aplicación al Parque Nacional Sistema Arrecifal Veracruzano: investigaciones actuales, p. 257-274. *In:* A. Granados Barba, L. Abarca Arenas y J.M. Vargas Hernández (Eds.) Investigaciones Científicas en el Sistema Arrecifal Veracruzano. Universidad Autónoma de Campeche. ISBN 968-5722-53-6. 304 p.

17

Cultivo Experimental del Pulpo (*Octopus vulgaris*, Cuvier, 1797) en Veracruz y su Aplicación al Parque Nacional Sistema Arrecifal Veracruzano: Investigaciones Actuales

EXPERIMENTAL CULTURE OF THE OCTOPUS (*OCTOPUS VULGARIS*, CUVIER, 1797) IN VERACRUZ AND ITS APPLICATION IN THE VERACRUZ REEF SYSTEM NATIONAL PARK: CURRENT RESEARCH

F. D. Méndez Aguilar, M.L. Jiménez Badillo y V. Arenas Fuentes
Unidad de Investigación de Ecología de Pesquerías. Universidad Veracruzana

Resumen

Se presentan las primeras experiencias sobre el mantenimiento del pulpo *Octopus vulgaris* en cautiverio con miras a establecer la factibilidad para su cultivo en Veracruz. Se realizaron dos experimentos de crecimiento, estimándose tasa absoluta y específica de crecimiento (TAC y TEC), índice de conversión alimenticia (IC) y tasa de supervivencia (TS). Los valores promedio para TAC y TEC en el primer experimento fueron de 2.13 y 1.57 respectivamente, mientras que en el segundo se obtuvieron valores negativos. El IC promedio fue más eficiente en el primer experimento. Se realizaron exámenes sobre determinación externa del sexo en 46 organismos, identificando la presencia y ausencia del hectocotilo para machos y hembras respectivamente en el 100% de los casos. Se efectuaron pruebas de avivamiento de paralarvas con tres modelos de eclosionadores (maternidad, incubadora y racimos suspendidos) a partir de una puesta del medio natural. Otra prueba fue llevada a cabo a partir de una puesta obtenida en cautiverio, la cual fue incubada por la hembra llevando un registro fotográfico de la evolución de los embriones. La eclosión se logró en el segundo caso, tras trascurrir un período entre los 15 y 18 días.

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American Fisheries Society Symposium 49

The Conservation–Exploitation Paradox in a Mexican Coral Reef Protected Area

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Abstract.—The Mexico Veracruz reef system was recently declared a natural protected area. One of the most important users of this area (52,239 ha) are fishermen whose extractive activity conflicts with conservation goals. At least a thousand families depend directly on the artisanal fishery in the area, while others depend indirectly. With the objective of finding an adequate balance between exploitation and conservation of fish resources, an annual study was performed, evaluating biological, economical, and social aspects. The results showed that climatic conditions were favorable for fish only 230 d per year. A diversity of 89 finfish, 4 sharks, 2 rays, 1 lobster, and 2 octopus species were fished by 18 varieties of nets, lines, and harpoons. The catch per unit effort fluctuated between 4 and 344 kg/fishermen/d, with fishermen spending from 2 to 24 h per fishing trips, and the daily profit varied between US$2 to US$40 per fisherman. The regulations for a sustainable use of the resources are inefficient due to the scarce basic information on the dynamics of the species and the multispecies nature of the fishery making integrated management difficult. In general, artisanal fishing is not a profitable activity such that it is necessary to promote an aggregated value for fishing products. Fishermen participation in resource conservation will be viable only if the quality of their lives is increased. In this sense, octopus culture is proposed as an option to reduce the fishing effort on the reefs and to promote socioeconomic development in the fishing communities.

Introduction

Several research papers about marine reserves (Clark et al. 1989; Davis 1989; Bohnsack 1990; Roberts and Polunin 1991, 1993; J. P. Gibson, paper presented at the Fourth World Fisheries Congress, 2004) have suggested that protecting habitats in their natural state and establishing fishing closures to limiting access to spawning or nursery grounds may increase overall fishery harvest. But how long is it necessary to make that possible? While the benefits provided for the marine protected areas to fisheries is yet in debate, as Fisher et al. (2003) pointed out, human population, food demand, and pressure on artisanal fisheries are all increasing. At present, roughly 70% of fish stocks for which data are available are fully exploited or overfished (Berkes et al. 2001). Also, activities like domestic and industrial waste disposal, tourism, recreation, and maritime transportation impact the coastal areas daily, altering the environment, the biodiversity, and, consequently, the fisheries.

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Fisheries Management and Ecology, 2008, 15, 19–26

Management challenges of small-scale fishing communities in a protected reef system of Veracruz, Gulf of Mexico

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Centro de Ecología y Pesquerías, Universidad Veracruzana, Boca del Río, Veracruz, México

Abstract Socioeconomic characterisation of fishing activities in the Veracruz Reef System National Park was used to develop a management system which balances the community's livelihood, and the conservation needs of the protected area. A survey was applied to four sectors of the fishing community: the fishers, fishers' wives, retailers and local population. The survey determined their perceptions about: (1) fishing as a lifestyle; (2) economic alternatives; (3) perspectives about the future; (4) environment and (5) knowledge of the National Park as a protected area. Fishers devoted an average of 27 years fishing, investing an average of 12 h per day giving a regular income of 15–20 US$. Most interviewed (80%) were full-time fishers, with fishing the only family income source. Fishers are predominantly educated to primary school level (63%). The main problem faced by fishers and the communities were economic opportunities but 89% believed that mariculture could be an alternative income source. There was strong ecological awareness, with 75% aware of the decline in fisheries resources and 52% knowing about the role of protected areas. There was divided opinion about future perspectives. Inefficient organisation and communication between authorities and fishers were identified as obstacles to co-management. Discussion on alternative incomes and a proposal to involve fishers in co-management initiatives are presented.

KEYWORDS: fishing management, protected area, small-scale fishery, socioeconomics, Veracruz Reef System.

Introduction

Small-scale fishing is an important economic activity of the coastal communities that neighbour the Veracruz Reef System National Park. At least 1000 families depend directly on this activity, while others depend indirectly on supporting services such as marketing, processing, boat building and transportation. Around 89 fish species are caught in the area, besides sharks, rays, lobsters and octopus. Snappers, jacks, snooks, groupers, sea chub, kingfish, Spanish mackerel and banded rudderfish are the most important target fish (Jiménez, Pérez, Vargas, Cortés & Flores 2006). A decrease in the catch per unit effort was observed between 2000 and 2002 but there is no study reporting structural changes in fish populations.

Management in the study area is based on traditional top-down regulations, which include close season, size of mesh and ban of some fishing gears. Enforcement of fishery regulations and surveillance is inadequate.

The reef system was declared a marine park in 1992 but initiatives to manage it as a protected area only started in 2001. Currently, it is in the consultation and review phases. The establishment of the protected area represents a challenge for scientists, users and decision makers to one balance conservation goals whilst not eroding the livelihoods of local fishers. The administrative rules relating to fishing have not been accepted by fishers because of their reluctance to change from open access with flexible rules to limited access and prohibitions in fishing zones and gears. There is a requirement to understand the needs, perceptions and attitudes of fishers towards the environment and protected areas to predict their responses to any new management policy before it can be implemented (Gelcich, Edwards-Jones & Kaiser 2005). This needs to be coupled with projects to develop alternative income streams when considering fishery close areas or bans on fishing gear. It requires greater attention to social and economic status of the people who use and affect the fisheries, their occupations, and their perceptions of the ecosystem (Kliskey, Clarke,

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UNIVERSIDAD DE LAS AMERICAS PUEBLA

"DESARROLLO EMBRIONARIO DEL PULPO *Octopus vulgaris* (Cuvier, 1797) PROVENIENTE DEL PARQUE NACIONAL SISTEMA ARRECIFAL VERACRUZANO"

Nombre del tesista: Julio César Morales Ortega

I.D:114761

Director de tesis externo: Dra. Maria de Lourdes Jiménez Badillo

Director de tesis interno: Dr. Carlos H. Vergara Briceño

Asesor interno: M.C. Jerónimo García Guzmán

Asesor interno: M.C. Néstor Martínez Carrasco

Casa abierta al tiempo

UNIVERSIDAD AUTONOMA METROPOLITANA

UNIDAD XOCHIMILCO

DIVISION DE CIENCIAS BIOLOGICAS DE LA SALUD
DEPARTAMENTO DEL HOMBRE Y SU AMBIENTE

INFORME FINAL
DE SERVICIO SOCIAL

"ENGORDA DE PULPO (OCTOPUS VULGARIS) CON DOS DIETAS EN ANTÓN LIZARDO, VERACRUZ"

QUE PARA OBTENER EL TITULO

B I O L O G O

P R E S E N T A

APOLO HERNANDEZ URIBE

ASESORES: DRA. JIMENEZ BADILLO MARIA DE LOURDES
M. C. CASTRO MEJIA GERMAN
M. C. CASTRO MEJIA JORGE

Fisheries Area

Know

- Population structure
- Age and growth
- Gonad maturity cycle
- Geo-referenced fishing areas
- Capture per unit of effort

Unknow

- Recruitment
- Alternative fishing gears and areas

Aquaculture Area

Know

- Hatching tests
- Embryonic development
- Captivity maintenance
- Shelters to avoid cannibalism
- Fattening tests by fishermen

Unknow

- Paralarvae requirements (temperature, salinity, photoperiod)
- Nutritional requirements
- Food source cheaper
- Optimal density

Socioeconomic Area

Know

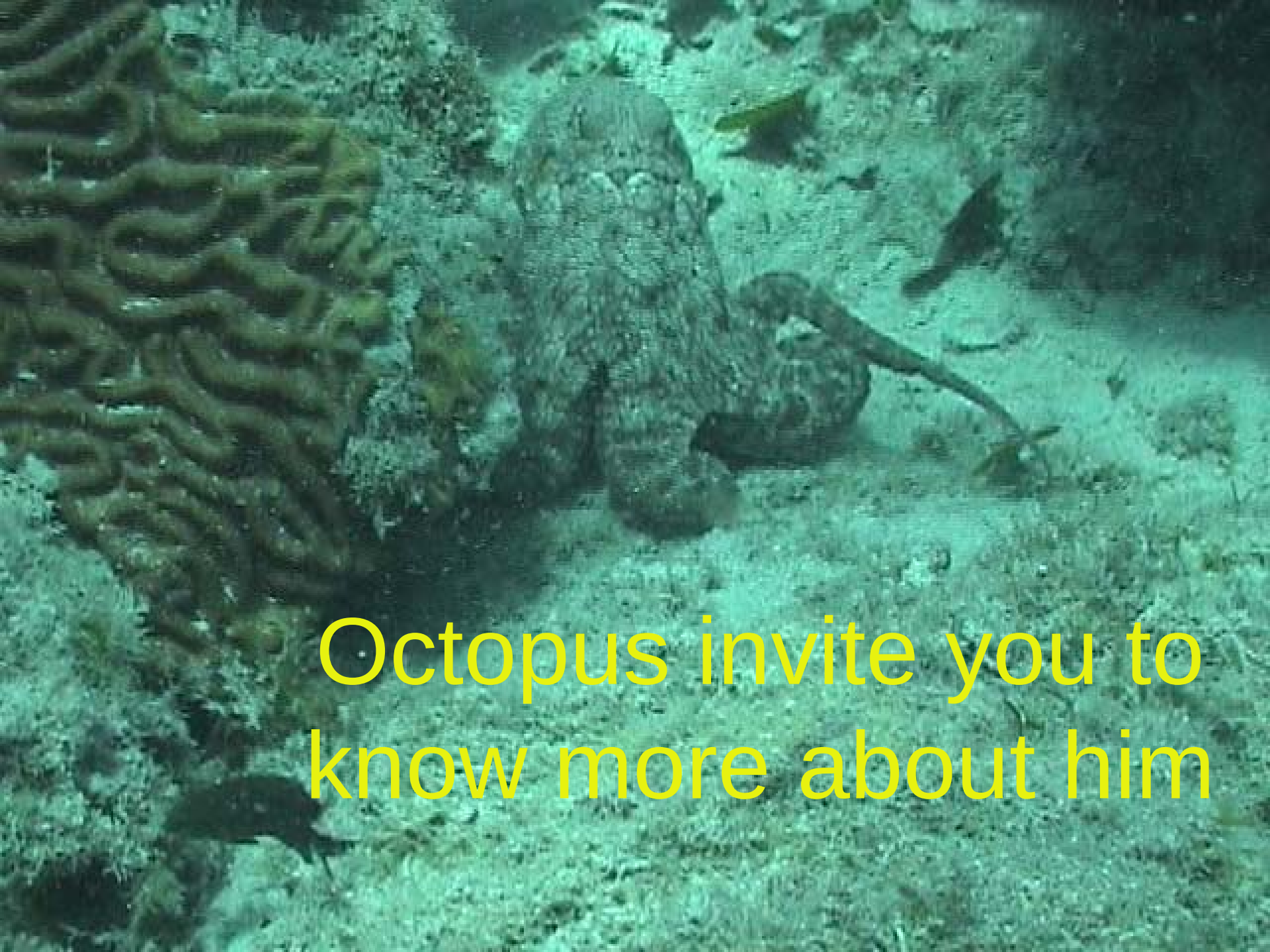
- Fishing communities characterization
- Fishermen’s perception
- Fishermen’s empirical knowledge
- Octopus culture feasibility

Unknow

- Productive chain
- Agregated value
- Exportation demand
- Paralarvae and food experiments

Goals

- To promote fishermen, authorities and academic discussion sessions on octopus fishery management based on the indicators from the research and empirical experiences
- To promote initiatives for the adoption of the resource management based in the community
- Participation of the fishermen and authorities in the management indicators definition


Octopus invite you to
know more about him