



# INTERNATIONAL CONFERENCE

On Coastal Ecosystems  
Towards and Integrated Knowledge  
for an Ecosystem Approach for Fisheries

## PROGRAM / ABSTRACT



June 26 - 29, 2006

Campeche, Campeche. Mexico

## **ORGANIZING COMMITTEE**

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**T. DO CHI.** Laboratoire d'Écosystèmes Lagunaires CNRS-Université Montpellier II (France)  
**R. LAE.** Institut de Recherche pour le Développement, IRD (France)  
**G. VIDY.** Institut de Recherche pour le Développement, IRD (France)

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**J. MENDO.** Universidad Agraria 'La Molina' (Peru)  
**M. WOLFF.** Center for Tropical Marine Ecology, ZMT-Bremen (Germany)

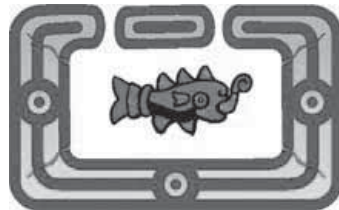
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**INTERNATIONAL CONFERENCE**

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**ON COASTAL ECOSYSTEMS:  
TOWARDS AN INTEGRATED KNOWLEDGE  
FOR AN ECOSYSTEM APPROACH  
FOR FISHERIES**

**PROGRAM AND ABSTRACTS**



**ICCE**

Campeche, Campeche. Mexico

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The Organizing Committee wish to express their sincere thanks to Instituto Nacional de Antropología e Historia (Centro INAH-Campeche), Secretaría de Turismo, Gobierno del Estado de Campeche who provided support in various aspects of the Conference.

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## Conference Information

Throughout the world there is a growing commitment to the conservation of coastal ecosystems, such as bay systems, lagoons and estuaries, because of their widely recognized social, cultural, economic and ecological importance. Most of these systems have been degraded, however, through pollution, fishery and habitat destruction, and it is imperative to find ways for their sustainable use, conservation and/or restoration. Fisheries development has until recently focused on the technical improvement of fishing gears and vessels, fish detection and positioning systems as well as on fish processing. In most cases the effective fishing power has increased and stocks are being pushed beyond their optimal harvest levels. Overfishing is not the only threat to these ecosystems, however. Climate variation and global warming together with extreme weather events (hurricanes, heavy rains) are additional factors impacting these ecosystems and their resources. Economic factors (market prices for fishing targets, subsidies given to the fishermen by the government among others) as well as regional management policies such as quota, closed seasons, no take areas, communal management regulations etc.) add to the complexity of the issue of sustainable management of these systems. It thus clearly appears that we need more integration and to move towards an ecosystem approach for fisheries (EAF). We need to elaborate operational frameworks, to develop integrative approaches at the ecosystem level, and to define innovative reference points to bridge scientific results with society's needs.

### The conference will contribute to:

- Present scientific evidence of recent trends and impacts of EAF on estuarine, coastal lagoon and shallow bay fisheries management.
- Review existing knowledge and quantitative tools to further develop integrative approaches for the assessment of the exploitation level and health status of coastal ecosystems.
- Evaluation of current management measures of living aquatic resources, considering the impacts of natural changes and human activities on these.

### Themes

- 1. Assessment of fisheries impact.** Assessment of the impacts of fishing on exploited and unexploited components of the ecosystems based on the analyses of fisheries parameters (fishing effort, CPUE, yield )
- 2. Environmental dynamics.** Linkages between environmental processes (tidal flow, river discharge, etc.) and fish resources with a quantification of climate change or environmental variability and their biotic effects, (e.g. regime shifts) as well as the quantification of habitat modification induced by fisheries and/or other anthropogenic sources.



- 3. Biological and ecological indicators.** Selection or building of integrative indicators in order to evaluate and monitor the “integrity” of coastal environments, at the population, community or ecosystem levels. Special attention will be paid on indicators synthesizing the structure and the functioning of these ecosystems over time and space. Comparative approaches will be particularly considered, as will be the effects of different factors on these indicators (e.g. fisheries vs pollution or fisheries vs climate or a combination). The session will consider how the indicators have been or should be applied to different types of littoral ecosystems or fisheries. This could be addressed from a population to a community level approach.
- 4. Models as tools for fisheries management.** Application of fish-based models to estuarine and coastal lagoon fisheries management issues. IBMs and ecosystem-based models will be used for testing ecological theories in this particular context. The session will also consider suitable what approaches would be suitable for the validation of models.
- 5. Integrated management.** Strategies and measures to be developed to mitigate the threats and to avoid environmental crisis. This includes policy options for a better conservation of aquatic biodiversity, management and conservation, parks and protected areas, legislation to review or reinforce, technical solutions including marketing and business, awareness, public education.

**ORAL PRESENTATION.** The language of the symposium is English, however oral presentations could be in English or Spanish. Inerpreters service (English to Spanish and viceversa) will be ofered during all oral presentations.

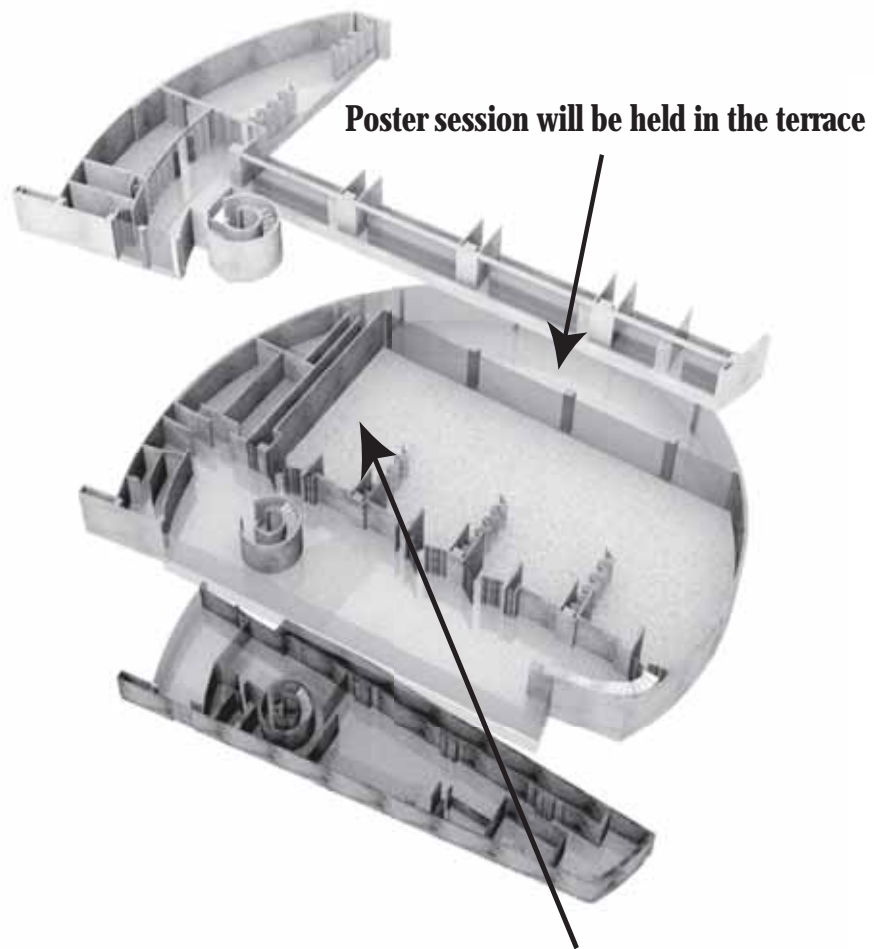
Due to the large size of our meeting room and the excellent projection facilities, all presentations must be on PowerPoint files. Please contact your session chariperson as soon as you arrive at the Conference. All speakers must come to registration desk and make arrangements to download their presentations onto the Conference's laptop computer (MS Windows). This must be done at least one half day before the session in which your presentation is scheduled so that we can be certain that there are no problems in projecting your graphics files.

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**POSTERS SESSION.** All posters will be mounted on the morning and just for the poster session day. Posters should be up by Tuesday 27 morning and removed at night (20:00). You are requested to be close to your poster during the poster session on Tuesday 27 June (17:00-19:00), and we encouraged to be close to your poster during morning and afternoon breaks, to enable anyone who wishes to discuss your particular poster topic, to find you and do so!. You will have good opportunity / exposure during the conference, and we believe that this will give you the widest audience. Also, all the poster will be show continously during the conference in a PowerPoint presentation. Please provide us with 3 PowerPoint slides per poster at the registration desk.



## CONVENTION CENTER CAMPECHE XXI



**Oral sessions will be held in Room 1 (First Level)**





### CONFERENCE AT A GLANCE

	Sunday 25	Monday 26	Tuesday 27	Wednesday 28	Thursday 29
<b>8:00 - 9:30</b>		<b>Registration</b>			
<b>9:30 - 10:30</b>		<b>Opening Ceremony</b>	<b>Plenary Conference</b> Dr. Mouillot	<b>Plenary Conference</b> Dr. Wolff	<b>Plenary Conference</b> Dr. S. Blaber
<b>10:30 - 11:45</b>		<b>Plenary Conference</b> Dr. Wakida	<b>Session 4 Environmental dynamics</b> Chair: Dr. L. Ayala	<b>Session 8 Biological and ecological indicators</b> Chair: Dr. F. Arreguín	<b>Session 12 Integrated management</b> Chair: Dr. J.C. Seijo
<b>11:45 - 12:00</b>		Coffee break	Coffee break	Coffee break	Coffee break
<b>12:00 - 13:15</b>		<b>Session 1 Assessment of fisheries impact</b> Chair: Dr. Solana	<b>Session 5 Environmental dynamics</b> Chair: Dr. L. Ayala	<b>Session 9 Models as tools for fisheries management</b> Chair: Dr. F. Arreguín	<b>Closing Ceremony</b>
<b>13:15 - 14:45</b>		Lunch	Lunch	Lunch	<b>Farewell Lunch</b>
<b>14:45 - 15:30</b>	Organizing Committee Meeting (EPOMEX)	<b>Plenary Conference</b> Dr. Lluch Belda	<b>Plenary Conference</b> Dr. F. Arreguín	<b>Plenary Conference</b> Dr. J.C. Seijo	
<b>15:30 - 16:45</b>		<b>Session 2 Assessment of fisheries impact</b> Chair: Dr. Mendo	<b>Session 6 Biological and ecological indicators</b> Chair: Dr. Do Chi	<b>Session 10 Models as tools for fisheries management</b> Chair: Dra. S. Salas	
<b>16:45 - 17:00</b>		Coffee break	Coffee break	Coffee break	
<b>17:00 - 18:15</b>		<b>Session 3 Environmental dynamics</b> Chair: Dr. Lae	<b>Session 7 Biological and ecological indicators</b> Chair: Dr. Do Chi	<b>Session 11 Integrated management</b> Chair: Dra. S. Salas	
<b>18-15-19:15</b>			<b>Poster Session</b>		
<b>20:00</b>		<b>Welcome Reception</b>			



## PROGRAM

- **SUNDAY 25, 2006**

15:30 - 16:45 Organizing Committee Meeting  
(*EPOMEX*)

- **MONDAY 26, 2006**

8:00 - 9:30 Registration

9:30 - 10:30 **Opening Ceremony**

**10:30 - 11:45 Plenary Conference:**

**Research on the Main Fisheries in the Gulf of Mexico:  
The Case of Brown Shrimp in the Northeast  
of Mexico and Octopus in the Yucatan Peninsula**

*A. T. Wakida-Kusunoki*, Instituto Nacional de la Pesca (Mexico)

11:45 - 12:00 Coffee Break

**12:00 - 13:15 Session 1**  
**Theme 1: Assessment of fisheries impact**  
*Chair: R. Solana*

12:00 - 12:15 Natural and Fishing Processes Behind the Collapse of the Pink Shrimp, (*Farfantepenaeus duorarum*), Fishery on the Southern Gulf of Mexico  
*F. Arreguín-Sánchez, M. Zetina-Rejón, M. Ramírez-Rodríguez, and V. H. Cruz-Escalona*

12:15 - 12:30 Analysis of the Fishing Effort Allocation of the Trawl Fishery in the Campeche Bank  
*I. Páramo Romero, and S. Salas Márquez*

12:30 - 12:45 Fishing Impact on Structure and Function on the Continental Shelf ecosystem of the Coasts of Jalisco and Colima, Mexico  
*V.H. Galván Piña, F. Arreguín Sánchez, J. A. Rojo Vázquez, E. Godínez Domínguez, and B. Aguilar Palomino*

12:45 - 13:00 Spatial Distribution of Catchability for the Red Grouper, *Epinephelus morio*, Fishery on the Campeche Bank, Mexico  
*J. A. López-Rocha, and F. Arreguín-Sánchez*



13:00 - 13:15 The Implications to Management of the Relationship between the Spatial Extent of MPAs, and Management Regime Outside of MPAs. A Yield-per-recruit, Egg Production-per-recruit, and SSB-per-recruit Model of a Sedentary Invertebrate Fishery  
*W. Le Quesne, J.G. Shepherd, and S.J. Hawkins*

13:15 - 14:45 Lunch

**14:45 - 15:30 Plenary Conference:**

**Large Scale Environmental Variability Impacts  
on Fisheries Populations**

*D. Lluch Belda, Centro Interdisciplinario de Ciencias Marinas -IPN (Mexico)*

**15:30 - 16:45 Session 2**

**Theme 1: Assessment of fisheries impact**

*Chair: Dr. Mendo*

15:30 - 15:45 Spiny lobster (*Panulirus argus*) stock assessment in the Yucatan coast, Mexico  
*V. Ríos, and C. Monroy*

15:45 - 16:00 Exploring Effects of Changing Harvest Rates in the Brown Shrimp Sequential Fishery of the Western Gulf of Mexico Accounting for Interdependent Ecosystems  
*V.H. Cruz-Escalona, F. Arreguin-Sánchez, and M. Zetina-Rejón*

16:00 - 16:15 Analysis of the Pacific Red Snapper (*Lutjanus peru*) Small-scale Fishery in a Multispecific Context: An Assessment and Management Proposal  
*J. G. Díaz-Uribe, and M. A. Cisneros-Mata*

16:15 - 16:30 Preliminary Evaluation of the Fishing Purineo Method in the La Joya-Buenavista Lagoon, Southern Mexico  
*S. Ramos-Cruz, and V.H. Martínez-Magaña*

16:30 - 16:45 Incidental Fishing in the Artisanal Shrimp Fishery of Chabihau Lagoon, Yucatan, Mexico  
*S. Leal, and M.A. Cabrera*

16:45 - 17:00 Coffee break

**17:00 - 18:15 Session 3**

**Theme 2: Environmental dynamics**

*Chair: Dr. Lae*

17:00 - 17:15 Variations of the American Oyster *Crassostrea virginica* Populations from Different Coastal Lagoons of the Gulf of Mexico and a Management Proposal  
*E. Baqueiro Cárdenas, D. Aldana Aranda, H. Rodríguez Sánchez, and A. Pavón*



- 17:15 - 17:30 Dynamic on a Tropical Estuarine System: A Benthic Community Case from the Celestun Coastal Lagoon  
*N.A. Hernandez-Guevara, D. Pech, and P.L. Ardisson*
- 17:30 - 17:45 Juvenile Fish in Estuaries: A Hotspot in an Ecosystem Approach of Coastal Resource Sustainable Exploitation  
*G. Vidy*
- 17:45 - 18:00 Monitoring Climate Change Impacts in Patos Lagoon Estuary (32° 05' S, 52° 10' W), Southern Brazil, Through the Brazilian Long-Term Ecological Research Program  
*J. Vieira, and A. Garcia*
- 18:00 - 18:15 Environmental Influence on Maturity Stage Spatial Distribution of Whitemouth Croaker (*Micropogonias furnieri*) Along an Estuarine Gradient  
*A.J. Jaureguizar, I. Militelli, and R. A. Guerrero*

20:00 **Welcome Reception**

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• **TUESDAY 27, 2006**

**9:30 - 10:15 Plenary Conference:**

**Assessing Changes in Coastal Biodiversity:  
A Multifaceted Conceptual Framework**

*D. Mouillot, Université Montpellier II (France)*

**10:30 - 11:45 Session 4**

**Theme 2: Environmental dynamics**

*Chair: Dr. L. Ayala*

- 10:30 - 10:45 Striped Weakfish Population Structure in the Uruguayan Coastal Zone, Environmental Influence on its Inter-annual Variability  
*A. J. Jaureguizar, R.A. Guerrero*
- 10:45 - 11:00 Habitat Use for Growth and Recruitment of Pacific Yellowleg Shrimp *Farfantepenaeus Californiensis* (Decapoda, Penaeidae) on the Continental Shelf and Adjacent Agiabampo Lagoon, Mexico  
*W. Valenzuela-Quiñónez, E.A. Aragón-Noriega, and H.M. Esparza Leal*
- 11:00 - 11:15 Fish Ecology and Terrestrial Carbon Use in the Coastal Zone: Implications for Demersal Fish Production  
*A. Darnaude, M. Harmelin-Vivien, and C. Salen-Picard*



11:15 - 11:30 Linkage Among Climatic Variation and Artisanal Fisheries Behavior of Common Snook (*Centropomus undecimalis*) in Tropical Atlantic Coast  
*M. Perera-García, and M. Mendoza-Carranza*

11:30 - 11:45 Effects of the 1997-1998 ENSO Event on the Demersal Fish Communities from the Continental Shelf from Jalisco and Colima, Mexico  
*J.A. Rojo-Vázquez, E. Godínez-Domínguez, G. Lucano-Ramírez, and S. Ruiz-Ramírez*

11:45 - 12:00 Coffee break

**12:00 - 13:15 Session 5**  
**Theme 2: Environmental dynamics**  
*Chair: Dr. L. Ayala*

12:00 - 12:15 Spatial and Temporal Distribution of Estuarine-dependant Fishes in the Savannah River Estuary, USA  
*C. A. Jennings, and R. S. Weyers*

12:15 - 12:30 Relationship Between type of Bottoms and Spatial Distribution of the Red Grouper (*Epinephelus morio*), in the Campeche Bank, Mexico  
*M. Albañez-Lucero, and F. Arreguín-Sánchez*

12:30 - 12:45 Construction of a Fisheries Model Incorporating Climate Variability for the Stocks of *Haliotis* spp. (Abalone) in Baja California, Mexico  
*F. Keyl, D. B. Lluch Cota, and M. Wolff*

12:45 - 13:00 Community Patterns of Trematodes of *Cerithidea pliculosa* in Celestun, Yucatan, Mexico  
*R. Rodríguez Olayo, and M.L. Aguirre-Macedo*

13:00 - 13:15 Coupling Several Formalisms to Integrate Several Knowledges in a Model of a Stressed Estuary  
*R. Duboz*

13:15 - 14:45 Lunch

**14:45 - 15:30 Plenary Conference:**

**Fisheries Management and the Need of Improving  
Scientific Advice: Breaking Old Ideas and Taken New Challenges**

*F. Arreguín-Sánchez, Centro Interdisciplinario de Ciencias Marinas -IPN (Mexico)*



**15:30 - 16:45 Session 6****Theme 3: Biological and ecological indicators***Chair: Dr. Do Chi*

- 15:30 - 15:45 Relationship Between Benthic Community Characteristics and Habitat Quality in Celestun Coastal Lagoon  
*D. Pech, N.A. Hernandez-Guevara, and P.L. Ardisson*
- 15:45 - 16:00 Comparative Fish Schools Morphology, Swimming Speed and Behaviour in Two Shallow Water Lagoon Channels, Observed at Short Range by Multibeam Sonar  
*P. Brehmer, P.I. Caballero Pinzon, J. Guillard, and P. Bach*
- 16:00 - 16:15 Trophic Level at a Microscale: the Southeast of Veracruz Artisanal Fisheries Analysis  
*L. Abarca-Arenas, R. Ronzón-Rodríguez, and E. Valero-Pacheco*
- 16:15 - 16:30 The Helminth Infracommunities of the Fiddler Crab (*Uca thayeri*) as Bioindicators of Chemical Pollution of Coastal Lagoons of Yucatan, Mexico  
*M.L. Aguirre-Macedo, N. Argáez-García, J. Cerón-Gómez, S. Guillen-Hernández, G. Gold-Bouchot, and V.M. Vidal-Martínez*
- 16:30 - 16:45 The Helminth Infracommunities of the Checkered Puffer (*Sphoeroides testudines*) and the Jenny Mojarra (*Eucinostomus gula*) as Bioindicators of Chemical Pollution of Coast of Yucatan, Mexico  
*V. M. Vidal-Martínez, M.L. Aguirre-Macedo, G. Gold-Bouchot*
- 16:45 - 17:00 Coffee break

**17:00 - 18:15 Session 7****Theme 3: Biological and ecological indicators***Chair: Dr. Do Chi*

- 17:00 - 17:15 Using Indicators to Assess the Impact of Hyperhalinity and Fishing on Fish Catches Application to the Gambia and the Sine Saloum Estuaries  
*R. Lae, and J.M. Ecoutin*
- 17:15 - 17:30 Title Spatial Patterns of Mangrove Shoreline Fish Communities of Guadeloupe (French West Indies) in Relation with Environmental Variables  
*A. Vaslet, Y. Bouchon-Navarro, C. Bouchon, and M. Louis*
- 17:30 - 17:45 Functionnal Diversity of Taxonomically Diverse Communities in Relation to Environmental Variables  
*S. Villéger, J. Ramos Miranda, D. Flores Hernández, D. Mouillot, and A. Sosa López*
- 17:45 - 18:00 Elasmobranchs in Shrimp Trawl Fishing in North of Veracruz, Mexico  
*J.L. Oviedo Perez, L. González Ocaranza, J.A. Pech Paat, A.J. Valdez Guzmán, A. Torres Gracida, and E. A. López Vargas*



- 18:00 - 18:15 Elasmobranch Fishery in Central Area Veracruz state, Mexico  
*J.L. Oviedo Perez, L. González Ocaranza, A.J. Valdez Guzmán, L. Fernández Suárez,  
 E.A. López Vargas, L.E. Martínez Cruz, and C. Reyes Velázquez*

**18:15 - 19:15 POSTER SESSION**

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• **WEDNESDAY 28, 2006**

**9:30 - 10:15 Plenary Conference:**

**Models as Tools for Managing Fisheries**

*M. Wolff*, Center for Tropical Marine Ecology-ZMT (Germany)

**10:30 - 11:45 Session 8**

**Theme 3: Biological and ecological indicators**

*Chair: Dr. F. Arreguín-Sánchez*

- 10:30 - 10:45 Simple Indicators and Procedures for the Management of Benthic Resources within the Chilean System of Territorial User Rights for Fisheries (TURF)  
*W. Stotz, L. Caillaux, and D. Lancellotti*
- 10:45 - 11:00 Habitat Specific Growth Rates and Condition Indices for the Sympatric Soles Populations of *Solea solea* (Linnaeus, 1758) and *S. senegalensis* Kaup 1858, in the Tagus Estuary, Portugal, Based on Otolith Daily Increments and RNA: DNA Ratio  
*C. Vinagre, V. Fonseca, A. Maia, R. Amara, and H. Cabral*
- 11:00 - 11:15 Ecological Indicators for Assessing Consequences of Marine Protected Areas at the Scale of Fish Communities: Examples from Contrasted Ecosystems  
*D. Pelletier, J. Ferraris, J. Claudet, and D. Mouillot*
- 11:15 - 11:30 Functional and Structural Indicators for the Assessment of Ecological State in Tropical Coastal Wetlands: Preliminary Results  
*A. Fierro Cabo, and S. Jimenez Hernandez*
- 11:30 - 11:45 Comparison of Two Methods to Determine the Maturity Period in Penaeid Shrimps (Decapoda, Penaeidae)  
*E.A. Aragón-Noriega, and W. Valenzuela-Quiriones*
- 11:45 - 12:00 Coffee break



**12:00 - 13:15 Session 9****Theme 4: Models as tools for fisheries management***Chair: F. Arreguín-Sánchez*

- 12:00 - 12:15 A Catch Forecast Model for the Peruvian Scallop (*Argopecten purpuratus*) Based on Estimators of Spawning Stock and Settlement rate  
*M. Wolff, M. Taylor, and J. Mendo*
- 12:15 - 12:30 Trophic Modeling of Eastern Boundary Current Systems: A Review and Prospectus for Solving the "Peruvian Puzzle"  
*M. Taylor, and M. Wolff*
- 12:30 - 12:45 Evaluating the Impact of Artisanal and Recreative Fishing Upon the Dynamics of a Sea Bream Population (*Diplodus sargus*) Around the Banyuls Reserve (Mediterranean)  
*M. Verdoit-Jarraya, D. Pelletier, H. Drouineau, S. Mahevas, J.S. Kolusniewski, and P. Lenfant*
- 12:45 - 13:00 Ecosystem-based Qualitative Analysis to Examine the Response of the Northern Gulf of California Biological Community to Specific Management Practices Oriented to Diminish the Fishing Pressure on Certain Resources  
*A. Espinoza-Tenorio, G. Montaña-Moctezuma, and I. Espejel*
- 13:00 - 13:15 Trophic Structure, Flows of Energy and Maturity of the Ecosystem of the Tabasco Continental Shelf, Mexico  
*E. Cabrera-Neri, M.J. Zetina-Rejón, and F. Arreguín-Sánchez*
- 13:15 - 14:45 Lunch

**14:45 - 15:30 Plenary Conference:****Considerations for a Parsimonious Bio-economic Approach to Ecosystem Based Fisheries Management***J.C. Seijo, Universidad Marista de Mérida (Mexico)***15:30 - 16:45 Session 10****Theme 4: Models as tools for fisheries management***Chair: Dra. S. Salas*

- 15:30 - 15:45 The Acoustic Multifrequency Approach as a Help to the Description of the Ecosystems' Components  
*A. Lebourges-Dhaussy, and J. Guillard*
- 15:45 - 16:00 *In situ* Observations for Management Purposes of Pelagic Fish Resources in Three Shallow Water Lagoons  
*P. Brehmer, T. Do Chi, T. Laugier, F. Laloe, D. Mouillot, and I.P. Caballero*





- 16:00 - 16:15 Sustainable and Participative Plan of the Shrimp Fisheries of the Saloum estuary (Senegal)  
*H. Diadiou, and A. Kane*
- 16:15 - 16:30 Cognitive Mapping as a New Methodological Tool for the Study of a Coral-Reef Ecosystem Submitted to a Major Increase of Human Impacts  
*D. Poignonec, J. Ferraris, S. Sarramegna, and G. Gontenelle*
- 16:30 - 16:45 Biological Survey of Fish Assemblages in a Protected Area Located in a Mangrove Estuarine Zone: the Bamboung Bolong (Sine Saloum, Sénégal)  
*J.J. Albaret, M. Simier, and L. Tito de Moraes*
- 16:45 - 17:00 Coffee break

**17:00 - 18:15 Session 11**  
**Theme 5: Integrated management**  
*Chair: Dra. S. Salas*

- 17:00 - 17:15 An Anthropic Twist to Ecosystem Approach to Fisheries  
*E. González, H. Trujillo, and E. Yáñez*
- 17:15 - 17:30 Application of a Dynamic Mass-balance Model for Exploring Ecosystem Impact of Harvesting Small Pelagic Species of the West Florida Shelf  
*B. Mahmoudi, C. Walters, S Mackinson, M. Vasconcellos and L. Vidal-Hernandez*
- 17:30 - 17:45 Linkage Between Nutrient Loading and Fish Abundance in Tampa Bay, Florida  
*C. Guenther, and B. Mahmoudi*
- 17:45 - 18:00 Evaluation of Shrimp *Pandalus platyceros* in Deep Waters of the West Coast of Baja California, Mexico  
*E. Sánchez-Juárez*
- 18:00 - 18:15 Fish for the Future: An Assessment of Fishery Conservation Policies in the Philippines  
*M.R. Campos*

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• **THURSDAY 29, 2006**

**9:30 - 10:15 Plenary Conference:**

**Integrated Management  
and Tropical Coastal Fisheries**

*S. Blaber, CSIRO Marine & Atmospheric Research (Australia)*



**10:30 - 11:45 Session 12****Theme 5: Integrated management***Chair: Dr. J.C. Seijo*

- 10:30 - 10:45 The Evolution of the Brown Shrimp *Farfantepenaeus aztecus* Fishery and its Management in the Northeast Mexico  
*A. T. Wakida-Kusunoki, R. Solana.Sansores, and A. González Cruz*
- 10:45 - 11:00 Socio-economic Characterization of Coastal Communities to Establish Regions and Promote Development from Fishing Communities' Perspective  
*F. R. Escartín Hernández, G. Morales, M. Nava, D. Huerta, M. Garduño, and J. Villanueva*
- 11:00 - 11:15 From Abundance to Scarcity of Fishing Resource: Sociacultural and Economic Scheme of Artisanal Fishermen of Yucatan  
*J. Fraga*
- 11:15 - 11:30 Public Policies for the Coastal-marine Zone of Mexico: Proposal  
*E. Rivera-Arriaga, I. Azuz-Adeath, and P. Muñoz-Sevilla*
- 11:30 - 11:45 Sustainable Development of a Community-based Spiny Lobster Fishery in Baja California, Mexico: A Case of Successful Management  
*A. Vega*
- 11:45 - 12:00 Coffee break
- 12:00 - 13:15 Closing Ceremony**
- 13:15 - 15:30 Farewell Lunch



## ABSTRACTS

**RESEARCH ON THE MAIN FISHERIES IN THE GULF OF MEXICO:  
THE CASE OF BROWN SHRIMP IN THE NORTHEAST  
OF MEXICO AND OCTOPUS IN THE YUCATAN PENINSULA**

*A. T. Wakida-Kusunoki\*, and R. Solana Sansores*

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The brown shrimp *Farfantepenaeus aztecus* and the octopus *Octopus maya* are the main fishing resources of the Mexican coasts of the Gulf of Mexico and the Caribbean Sea. The fishery of brown shrimp is sequential because the stock is captured in coastal lagoons, mainly in Laguna Madre and open sea. This characteristic produce that the management and the proposition of the administration objectives are difficult to put forward and conduct. The research on the management of this fishery resource aims to propose management measures to increase the yield per recruit due to the drastic changes in the commercialization of the shrimp, mainly in the reduction of the prices. In the case of the Octopus resource, this is a coastal fishery that is carried out from Campeche to Quintana Roo, therefore its management is under a regional perspective and the research conducted by the INP (National Institute of Fishing) is to evaluate the resource to determine the level of the population and to propose the quota of capture. This new research plan and proposals for the resources management has been achieved using a strategy of participation and consultation with the stake holders. In this work, we present the activities and results of the research obtained by the INP in these fisheries.

Keywords: Sequential fishery, coastal lagoons, resource management, yield per recruit, Laguna Madre

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## LARGE SCALE ENVIRONMENTAL VARIABILITY IMPACTS ON FISHERIES POPULATIONS

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Effects of environmental variation on the abundance, distribution and other population characteristics of many marine organisms have been perceived long ago (Baer, Ljungman, Peterson, Ekman, others). However, they have been implicitly regarded as noise when dealing with population dynamic levels and processes along time, partly because they have been considered minor as compared to the effects of harvesting and also because identifying them requires much more information along time. Most widely known examples of long term effects of environmental variation on the abundance and distribution of fisheries species are those of small pelagic fishes (herring, sardines, anchovies), particularly sensitive to such variations. Since the pioneering work of Kawasaki during the early 1980s, evidence has been building up showing that long term variations of many populations occur simultaneously, thus implying global variation. At present, not only small pelagic fishes populations have been shown to go through this large scale abundance changes, but also a large number of species. The presentation reviews some of these cases, together with a brief revision of large scale environmental variation at several time scales and some of the mechanisms that have been proposed to link the environment change to population variation.

Keywords: Abundance changes, fish species, environmental variation

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## **ASSESSING CHANGES IN COASTAL BIODIVERSITY: A MULTIFACETED CONCEPTUAL FRAMEWORK**

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The overall goal of coastal management is to sustain the ability of coastal ecosystems to provide goods and services such as fisheries, tourism, aesthetic and cultural values, upon which human welfare depends. This has been challenging in the recent decades because coastal ecosystems are facing ever increasing human pressures through fishing, aquaculture, recreational activities, demographic increase and consequences of global change. These various human impacts are greatly responsible for an increasing rate of loss in biodiversity and dramatic shifts in the relative abundances of remaining species. As a feedback, these alterations of the diversity and structure of marine communities can disrupt the ecological functions performed by species assemblages. Fish biodiversity is obviously critical in this respect. Depending on user groups, cultural and historical environments, services rendered by fish diversity may be multiple, and also provide a multidimensional standpoint. Investigations to seek factors controlling biodiversity are certainly useful but they mainly consider only one facet of biodiversity: the species richness. Over the last two decades, biodiversity has been described as a multifaceted conceptual framework embracing multiple forms of biological variation including taxonomic, genetic and phenotypic diversity within communities. Beyond theoretical frameworks, it is now important to determine components of biodiversity which provide meaningful insights into ecosystem functioning and what is their sensitivity to environmental factors and human-induced perturbations. Comparative performance of taxonomic-based and trait-based biodiversity indicators is evaluated.

Keywords: Fish biodiversity, species assemblages, taxonomic indices, human perturbations, biodiversity indicators

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## **FISHERIES MANAGEMENT AND THE NEED OF IMPROVING SCIENTIFIC ADVICE: BREAKING OLD IDEAS AND TAKEN NEW CHALLENGES**

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In many countries the practices of management fish stocks follows traditional ways based on single-species models representing population dynamics of an exploited stock. However, despite of some powerful statistical developments, many times measures taken with a given objective do not result as expected. There are several reasons; some deep rooted concepts resulting in erroneous or biased representation of the reality, the recognition of large amounts of biomasses consumed by predators, frequently as much, or more, than captured biomass, that single-species approach is not enough to represent variation in biomass, and the recognition of the effects of climate and species interdependence at the ecosystem level. Scientists must revisit some old concepts frequently used in management practices, because traditional assumptions could yield in stock depletions. Such as the case of “to leave fish reproduce at least one time in their life”, strongly associated with the misinterpretation of the importance of fecundity as key factor to maintain the stability of the stocks and the need to ensure survival of old females. Constant catchability assumption is another concept that originates bad estimations of fishing mortality., and the assumption of a constant natural mortality yields underestimation of recruitment and overestimation of adults. All these concepts must be revisited and modified because the consequence could be that we are advising fisheries to overfishing. By the other hand, ecosystem based management has been considered as highly relevant since fish stocks share resources with other elements of the ecosystem, and because the biomass of target species could be strongly impacted by forcing factors or predation, being the main components of natural mortality. In this context, ecosystem based fisheries management has been suggested as an appropriated approach to improve scientific advice for management in addition to single stock-based assessments. Ecosystem based approach to fisheries management can support at the present, time and space dynamic modeling of the fisheries in the context of the ecosystem. Under this framework we can evaluate viable scenarios of management in terms of fishing practices, the impact of fishing on the ecosystem, species conservation and stock recovering, considering social, economic and ecosystem health indicators. All the above concepts are discussed and illustrated with real examples of Mexican fisheries, where the consequences of the application of new approaches are highlighted. The main conclusion is that fisheries scientist must develop a strong effort to test old methods giving a place to new hypotheses.

Keywords: Stock depletions, fecundity, ecosystem management, dynamic modelling, ecosystem health indicators

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## MODELS AS TOOLS FOR MANAGING FISHERIES

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A brief summary is given on the development of fisheries models over the past 100 years. It is shown, how model development is rooted in ecological theories on the functioning of populations and ecosystems, which have undergone paradigmatic shifts over the past decades. The concept of equilibrium states of populations and ecosystems has been confronted with that of ever changing states of biotic entities, and the role of environmental vs. biological forcing („bottom-up, top-down“) in determining population sizes and harvest potentials of aquatic resources is hotly debated. Depending on type of resource (long-lived, short-lived; tropical, temperate; fish, invertebrate etc.), data availability, level and kind of training of fisheries modeller, a diverse set of models are presently being applied for the management of fisheries. These range from deterministic single species pool models, over age structured matrix models, combined, climate-fisheries models, multispecies fisheries (VPA) to ecosystem-based (EwE-type) models, among others. While in recent years the ecosystem-based modelling approach has gained much ground worldwide, as it allows to model the resource in its ecosystem context and to explore the effect of resource use on the ecosystem, this approach has as yet not much left academic circles to be used as a standard tool for fishery management. While the diversity and complexity of mathematical approaches to population and ecosystem modelling have greatly increased over time (also as a response to the increased computing power available) general concepts of how fisheries administration and management should be approached, have also undergone paradigmatic shifts: the “community-based management model” as a form of involving all stakeholders in the planning, decision making and monitoring process of the fishery appears promising to avoid problems such as over fishing, under-reporting, clandestine fishing and lack of enforcement of fisheries laws.

Keywords: Virtual population analysis, ecosystem based models, fisheries management

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## CONSIDERATIONS FOR A PARSIMONIOUS BIO-ECONOMIC APPROACH TO ECOSYSTEM BASED FISHERIES MANAGEMENT

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The paper presents use and non-use values of fisheries ecosystems to human well being, and discusses methods for assessing them. A simple bio-economic framework for estimating the benefits and costs of applying the ecosystem approach to fisheries is also discussed. In extending beyond single species approaches to management, creating an operational and multidisciplinary system of indicators and corresponding reference points is the fundamental step, and should avoid premature assumptions as to what constitute critical factors or interrelationships. In a fishery where flexible switching of target species can occur seasonally by both artisanal and industrial fleets, exploitation by species is likely to be a function of catch rates and markets, and vessels will switch between resources in response to demand and resource availability. Such a situation calls for a bioeconomic approach, while building in ecological safeguards. These may include seasonal closures during periods of reproductive aggregation, technical measures to avoid capture of unwanted or charismatic species, and permanent closed areas in particular areas of sensitivity such as nursery grounds and critical habitats. The paper also identifies some of the main issues that can be foreseen in applying the ecosystem approach to fisheries (EAF) in developing coastal States, among them: (i) changes in management measures to implement an EAF may lead to conflicts with stakeholders, and requires consultation in developing the EAF for specific resources, (ii) data collection requirements for management by ecosystem components would be greater than for a few target species, (iii) developing coastal states face difficulties in implementing adequate single species data collection, hence collecting adequate scientific evidence for management following a detailed ecosystem approach, seems improbable. Managing fisheries in an ecosystem context, while also taking account of uncertainties in environmental, social and economic components, demands the development of simple approaches for data-limited situations.

Keywords: Ecosystem approach, benefits and costs of EAF, use and non-use values of fisheries ecosystems, fisheries indicators, EAF in developing coastal states.

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## INTEGRATED MANAGEMENT AND TROPICAL COASTAL FISHERIES

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Coastal fisheries throughout the world are affected by a very broad range of human activities including industry and agriculture, construction of dams, dredging, mangrove loss, residential development and organic and inorganic pollution, as well as by fishing itself. For this reason it is impractical that any fishery should be managed in isolation, as has usually been the case in the past, and the logical consequence and imperative is the inclusion of fisheries management into comprehensive management plans that seek to integrate all human activities in the coastal zone. Furthermore, increasing scientific knowledge has assisted a shift in current thinking among biologists and fisheries managers towards the management of fisheries in an ecosystem context. Such management requires knowledge of organisms and processes not traditionally studied by fisheries scientists and a multidisciplinary approach. Integrated management plans for coastal area developments are being formulated in many countries, but whether they can be translated into practical and beneficial outcomes remains the important question. For integrated management of the coastal zone to be effective, two critical features are required: firstly, a thorough understanding of the relevant technical aspects of biology, physical processes and biogeochemistry; and secondly, there has to be in existence a framework of organisational and institutional capability. Hence apart from scientific knowledge, giving substance to an integrated plan requires relatively complex financial, political and administrative structures that may be beyond the national capacities of many countries, particularly those in the developing world. The extent to which integrated management has been successful in a tropical coastal fisheries context is illustrated using a number of examples from both developed and developing countries, taking into account issues of food security and the role of community-based management.

Keywords: Integrated management, coastal, fisheries, tropical

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## Abstract – 007 Poster

**ASSESSMENT OF FIVE FISHERIES FROM THE SOUTHEAST OF VERACRUZ  
FOR THE YEARS 1999 TO 2004***R. Ronzón-Rodríguez\*, L. Abarca-Arenas, and E. Rodríguez-Luna*

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For 1997, the fisheries of Veracruz constitute the 13% of the national total and the 41% for the Gulf of Mexico, situating the state in the third position on a national scale. In the period 1999 at 2004, the fisheries of the municipalities of Cosoleacaque, Pajapan, Agua Dulce, Minatitlán and Coatzacoalcos sustained a few more than 1,000 fishermen, organized in 54 cooperatives, which for this period captured species of economic interest, both of marine fish and freshwater fish, as well as crustaceans. The used arts of fishing were hook lines, nets, and . For Agua Dulce, Minatitlán and Coatzacoalcos, the capture up to 2004 constituted around of 1,805 tons, whith an income of \$41,993,824. The highest commercially important species corresponded to families like Carangidae (jurel), Scombridae (peto, gulf sierra y bonito), Centropomidae (snook), Trichiuridae (largehead hairtail), Mugilidae (mullet), Cichlidae (tilapia), Guerreidae (mojarra) and crustaceans of the families Palaemonidae (crayfish) and Portunidae (blue crab). For the municipalities of Coatzacoalcos and Pajapan the trend showed a considerable increase for 2002. In the municipality de Agua Dulce the biomass captured increased for the same year, but in general, the behavior was constant along the studied period. For Minatitlán, data of fishing for year 2002 do not exist but the general trend is to be constant over the years. For the municipality of Cosoleacaque, the fishing decreased in the year 2000, remaining stable towards the rest of the period of study. Even though some municipalities have diversified their captures, the trend is towards a decrease of the total biomass. Even though some municipalities have diversified their captures, the tendency is towards a diminution of the total biomass. It is probable that the environmental deterioration along with a possible overfishing are the causes of this diminution.

Keywords: Artisanal fisheries, Mexico, Veracruz

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## Abstract – 009 Oral

**MEASURING ACUSTIC-TARGET FORCE OF TWO SPECIES  
OF THE LUTJANIDAE AND HAEMULIDAE FAMILY  
(*Pargo criollo*, *Lutjanus analis* and *Ronco amarillo*, *Haemulon sciurus*)**

*E.O. Linares<sup>1\*</sup>, P.I. Caballero Pinzon<sup>2</sup>, J. Guillard<sup>3</sup>, L. Sierra<sup>4</sup> and J.L. Hernández<sup>1</sup>*

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<sup>3</sup>INRA (Mexico), <sup>4</sup>Facultad de Biología (Costa Rica)

Results of a year and half study are presented (2000-2001) for obtaining the equations of TS (Target Strength)-longitude about two species of commercial fish (*Pargo criollo*, *Lutjanus analis* and *Ronco amarillo*, *Haemulon sciurus*) in Golfo de Batabanó-Cuba. The measurements were executed in Puerto Esperanza (Pinar del Río, Cuba) and Xcalak (Peninsula de Yucatan, Mexico) in places of shallow and clear waters with weak current according to the methodology described by Hdez-Corujo *et al.*, 1998. A Dual Beam Echosounder with digital transducer DT 5000 was used, and frequency of 129 Khz. The depth that the fish were measured was 3 m. The equation obtained for *Haemulon sciurus* was  $TS = 21.9 \log L - 69.2$ , for  $R^2 = 0.56$ ,  $r = 0.75$  and reference value calculated to make it comparable with other authors of  $b_{20} = -66.38$  in a sample of 13 fish, while for *Lutjanus analis* was  $TS = 21.7 \log L - 69.2$ , for  $R^2 = 0.66$ ,  $r = 0.81$  and  $b_{20} = -65.68$  in a sample of 11 fish. These equations can be including for calculation of widespread equation of TS-longitude of the tropical species in the Caribbean areas.

Keywords: Target strength, echosounder, shallow water, tropical species

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## Abstract – 010 Poster

**CHOOSING GEARS FOR A BETTER MANAGEMENT:  
THE CASE OF MULLET FISHERIES IN GUARATUBA BAY, BRAZIL**

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Depending on the gear used by fishers, higher or lower are the impacts produced by fishery activities. In the present work, it were analyzed the mullet fisheries performed at the Guaratuba Bay, Southern of Brazil (25o52'S; 48o39'W), aiming to evaluate the positive and negative attributes associated to each kind of gear. In this region, small-scale fisheries act on three mullet species: *Mugil platanus*, *M. curema* and *Mugil sp*, the last of them formerly known as *M. gaimardianus*. There are seasonal changes in the use of the gears: autumn is the period when a higher number of fish gears – from a total of six types – is used. Amongst them, beach seine requests more people than the others to be performed. In spite of it, their values of catch per unit of effort are less important than those from other gears. Indeed, in beach seine rays and bony fish other than mullets, and even turtles, are found as by-catch. Normally these low-price individuals are rejected, because fishers prefer mullets. Rejection of by-catch is just one of the problems associated to beach seine: large fish, most common in beach seine than in the other gears, frequently have mature ovaries, which are sold at the local market as ova. It results an economical difference between male and female, or between young and adult individuals, but also many risks to conservation. Mature mullets are more abundant in autumn (*M. platanus* and *M. curema*) or in summer and spring (*M. curema* and *Mugil sp*), being caught by beach seine with no control of size or number. In order to reduce the catching of mature individuals, it would be necessary to take a legal measure limiting the period of fisheries. This kind of legal measure should consider the attributes of the gears.

Support by National Council for Scientific and Technological Development (CNPq), Brazil.

Keywords: Mullet, by-cath, CPUE

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## Abstract – 023 Poster

**ESTIMATION OF CATCH PER UNIT EFFORT (CPUE) FROM MEXICAN SNOOK  
( *Centropomus poeyi* ) IN ALVARADO LAGOON, VERACRUZ, MEXICO***R.M. Lorán Núñez\*, F. R. Martínez Isunza, and A.J. Valdez Guzmán*

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Mexican snook is an important commercial species within the fisheries of the Gulf Mexico, nevertheless little is known about it, hence the interest of this work, which consisted on monthly samplings in the Alvarado lagoon, which were more intense from June to August and lasted six to ten days. The obtained information covers data to estimate Catch per Unit Effort (CPUE), secondarily registered morphometric data, and the results were; 283 journeys, 223 Mexican snook measured and 163 common snook (*Centropomus undecimalis*). Catch per Unit Effort was estimated as kilograms per day per fisherman. The Catch per Unit Effort from months with higher catch were June, with 1.7 Kg/day/fisherman for Mexican snook and 2.45 for common snook, July, with 2.5 for Mexican snook and 0.5 for common snook, and August, decreased to 1.8 for Mexican and 0.5 for common. The CPUE averaged was 1.14 for Mexican snook, meanwhile common snook presented 0.8, which the added value were 1.95. Growth parameters estimated assuming that organisms belong to a same stock, were:  $L_{\infty}$  116.0, to  $-0.8955$  and  $k$  0.32. With these parameters natural mortality, total mortality and mortality caused from fishing were estimated. As 0.457 for natural mortality, total 0.939, and fishing mortality 0.4749. Total mortality obtained indicate that the resource was moderately exploited. In accordance with the fishery statistics, and the fishermen comments, and Fuentes study (1973) as historical base, the catch of this resource has decreased.

Keywords: *Centropomus poeyi*, CPUE, Alvarado, Veracruz

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## Abstract – 027 Oral

**ANALYSIS OF THE FISHING EFFORT ALLOCATION  
OF THE TRAWL FISHERY IN THE CAMPECHE BANK***I. Páramo Romero\*, and S. Salas Márquez*

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This research aims to identify the fishing effort allocation of trawl boats in the Campeche Bank, as well as to understand the factors that determine the observed patterns. To do so, catch and effort data sets from an observer program promoted by the National Fisheries Institute were used. This data includes catch records discriminated by species and detailed information of the sets for one fishing season (1997-1998). Data set comprises all boats operating in the Bank during that time. From a total of 49 species caught, seven of them covered 92 % of the catches, from which four groups were identified as main targets through multidimensional scaling analysis. The results show that the spatial allocation of fishing effort in the Campeche Bank by the trawl fleet is not random. Given the fact that all boats hold the same technical characteristics the Captain decision may have an important contribution on this allocation. Three zones with high frequency of sets were identified within the studied area. Analysis between zones and within each zone show differences in the allocation patterns of boats effort by zone. Among the factors identified as relevant in the allocation of spatial fishing effort are: distance of fishing grounds in each zone from the base deck, CPUE obtained in each area and the presence of species of high value in a marginal proportion. Finally a discussion on fishing behaviour and the different implications in policy management for this fishery is included.

Keywords: Fishing effort allocation, trawl fishery, Campeche Bank

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## Abstract – 033 Poster

**ESTUARINE FISHERIES IN SOUTH AFRICA:  
A NEED FOR ALTERNATIVE MANAGEMENT MEASURES***P. Cowley\**

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Estuaries along the ca. 3000 km coastline of South Africa lie in three biogeographical zones, namely subtropical, warm temperate and cool temperate. Although the fish communities within each zoogeographic region are fairly distinct, results from estuarine fishery surveys have revealed that the catch composition is dominated by few species (e.g. *Pomadasy commersonnii* and *Argyrosomus japonicus*) that are heavily targeted by recreational and subsistence line fishers along most of the coastline. Currently exploited fish resources are managed by way of size and bag limit restrictions. Evidence clearly suggests that these traditional methods are ineffective because the legislated bag limits are rarely attained and a large portion of the retained catch is below the minimum legal size limit. In addition to a lack of compliance by all fishery sectors, law enforcement capacity is inadequate. This paper reviews current knowledge on the biology and life history of, and fisheries for, these dominant species, focusing on management implications. Recent studies on the movement behaviour of *P. commersonnii* and *A. japonicus* have unequivocally defined their dependence on estuarine habitats, particularly during their early life-history stages. Consequently, temporarily resident estuarine fish populations represent small-scale stocks that are extremely vulnerable to localized over-exploitation. Area management by way of estuarine protected areas or no offtake zones may mitigate the collapse of the currently over-exploited stocks and provide managers with fishery independent abundance information. Further research to address this need should be prioritized.

Keywords: Estuarine fisheries, movement behaviour, management, South Africa

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## Abstract – 038 Poster

**GROWTH PARAMETERS OF *Farfantepenaeus aztecus*  
IN THE ALVARADO COAST, VERACRUZ, MEXICO***J.A. Pech Paat*<sup>1\*</sup>, *M. Gallardo Cabello*<sup>2</sup>, and *L. Gonzalez Ocaranza*<sup>2</sup><sup>1</sup>Instituto Nacional de la Pesca (Mexico), <sup>2</sup>ICMyL-UNAM (Mexico)

Individual average growth parameters of the populations of brown shrimp *Farfantepenaeus Aztecus* in Alvarado, Veracruz were updated with data collected in open sea in 2003. The Petersen, Bhattacharya and Cassie methods were utilized with size frequency data and the Ford-Walford for the estimation of the Von Bertalanffy growth model parameters. In addition the natural mortality was calculated by the Pauly method and the total mortality by the Beverton and Holt method. The catchability coefficient and the exploitation rate were also obtained. The constant of growth obtained were: Petersen:  $K = 0.1972$ ;  $L_{\infty} 202.24$ ;  $T_0 -0.9920$ ;  $A_{95} 15.1927$ . Bhattacharya:  $K = 0.1387$ ;  $L_{\infty} 243.069$ ;  $T_0 -1.2979$ ;  $A_{95} 21.6$ . Cassie:  $K = 0.1652$ ;  $L_{\infty} 248.884$ ;  $T_0 -0.66$ ;  $A_{.95} 18,1356$ . The values obtained for the natural mortality were: Petersen 0.3081; Bhattacharya 0.2325 and Cassie 0.25896. To the Total mortality: Petersen 0.299; Bhattacharya 0.3035; Cassie 0.3772. The catchability coefficient was:  $q = 0.000256268$ , and the Fishing mortality (F) from the annual effort was 0.83916 and to the month effort 0.0931. The exploitation rate was  $E = 0.783$ .

Keywords: parameters, growth, shrimp brown

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## Abstract – 039 Oral

**FISHING IMPACT ON STRUCTURE AND FUNCTION ON THE CONTINENTAL SHELF ECOSYSTEM OF THE COASTS OF JALISCO AND COLIMA, MEXICO**

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*E. Godínez Domínguez*<sup>1</sup>, and *B. Aguilar Palomino*<sup>1</sup>

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A trophic model based on Ecopath was constructed to describe the structure and flows of biomass within an ecosystem inhabiting the continental shelf off the central coasts of Mexico, particularly along the coasts of Jalisco and Colima states. The model consisted of 38 functional groups: 22 fishes, 9 invertebrates and one group each of marine mammals, birds and turtles; zooplankton, phytoplankton, dead fish (bycatch) and detritus. Detritus, phytoplankton and zooplankton positively impact most groups via the food web, including those exploited by fishing. The most important negative impacts were by sharks as top predator on higher trophic levels groups. Observed model behaviors suggest an important role of “top down” processes in controlling ecosystem flows. Regarding ecosystem flows, 24.8% goes to detritus, 18.9% represents energetic cost via respiration, 17.6% is exported (mainly fishing) and 38.6% goes to consumption. The net production of the system was calculated as 1327 t km<sup>-2</sup> year<sup>-1</sup>. Six discrete trophic levels were identified, having a relatively high average transfer efficiency of 19.6%. The trophic model was validated and observed trends in the data on four trophic groupings were reasonably well represented. The predicted optimum fishing strategy was to increase the fishing effort by the gill net fleet some 10%, to triple that by the diving fleet and to decrease the trawl fleet effort by 10%. Such a scenario is coherent with the actual status of exploited resources. The hypothesis that the fleets significantly interfere with one another was rejected. The possibilities that target species compete with each other and that fishing affects the overall ecosystem were supported.

Keywords: Fishing impact, trophic model, Ecopath, ecosystems, continental shelf

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## Abstract – 041 Oral

**SPATIAL DISTRIBUTION OF CATCHABILITY FOR THE RED GROUPER,  
*Epinephelus morio*, FISHERY ON THE CAMPECHE BANK, MEXICO***J. A. López-Rocha\**, and *F. Arreguín-Sánchez*

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The red grouper fishery is currently overfished and management measures have been taken to revert this situation unsuccessfully. Previous studies indicate that catchability is one of the key parameters in population dynamics since it reveals catch efficiency. It is also well known that the red grouper is strongly associated to the bottoms and that a seasonal reproductive aggregation occurs involving a spatial dynamics, which impact fishing success. Catchability reaches its maximum values when fishes are aggregated on the north-eastern region of the continental shelf of Yucatan; decreasing after the reproductive season when fishes moves to other areas. In this contribution we characterize the spatial distribution of the catchability-at-length. For this we used records of length distributions of commercial catches and effort data. Results were as expected showing higher values during reproductive aggregation. We discuss the utility of this information for management purposes.

Keywords: Red grouper, catchability, spatial distribution, Gulf of Mexico

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## Abstract – 043 Oral

**NATURAL AND FISHING PROCESSES BEHIND THE COLLAPSE  
OF THE PINK SHRIMP, *Farfantepenaeus duorarum*),  
FISHERY ON THE SOUTHERN GULF OF MEXICO**

*F. Arreguín-Sánchez\*, M. Zetina-Rejón, M. Ramírez-Rodríguez, and V. H. Cruz-Escalona*

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The pink shrimp (*Farfantepenaeus duorarum*) fishery in the Campeche Bank, Mexico, was the most important fishery in the Mexican Gulf of Mexico for decades. At early 70's, annual catch of this species were about 22,000 t per year, however currently annual yields are around 1,000t. There were several hypotheses trying to explain why this fishery collapses, mentioning habitat degradation, impacts of fishing and of the oil industry, erroneous management practices among others. In this contribution we present the results of several years of research in which we show processes of different nature and how their resulted in the collapse. The combination of long and short term environmental effects, natural catastrophic events, fishing intensity and indirect effects of the oil industry, changes in ecosystem structure, the particular characteristics in regional oceanography dynamics; besides of the lack of prevention by stakeholders, were the different aspects that contributed with the collapse. Our conclusions suggest that the pink shrimp stock cannot be recovered through isolated management measures on the fishery. Other fisheries could be managed jointly with shrimp to promote partial recovery, but long term environmental effects appears to be the most relevant aspect limiting the recovery of the stock. We strongly suggest limitation of the access to the fishery attempting to sustain current levels of biomass, move fishers to other activities within the fishing sector, prevent human impacts on critical coastal habitats and adapt measures to changes observed in stock abundance.

Keywords: Pink shrimp, collapse, Gulf of Mexico

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## Abstract – 056 Poster

**FISH RESPONSE TO PROTECTION IN COASTAL ECOSYSTEMS:  
A FUNCTIONAL GROUP APPROACH***JA Tomasini <sup>\*1</sup>, N. Casalta<sup>1</sup>, JM Culioli<sup>2</sup>, and D. Mouillot<sup>1</sup>*<sup>1</sup> Université Montpellier II (France),<sup>2</sup> Réserve Naturelle des Bouches de Bonifacio – Office de l'Environnement de la Corse (France)

The study was aimed at examining CPUE (catch per unit effort) changes from 2000 to 2004 in a marine protected area (Réserve Naturelle des Bouches de Bonifacio – South Corsica, France). This reserve, surface area of which has been increased from about 4400 ha in 1982 to 80000 ha in 1999, displays zones with different protection levels (professional and recreational fishing allowed, only professional fishing allowed, no-take areas). The originality of the study was that CPUE were not estimated at the species level but at the functional group level. Functional groups are defined as species exhibiting similar function, similar effects on ecosystem processes or similar responses to environmental pressures. As functions performed by fish species are not directly measurable, these were grouped into functional groups, in a roundabout way, from the values of their ecomorphological traits related to some functions. In this study, 16 functional groups out of 19 found were taken in consideration. The reserve was divided into five areas and effects of area x year, area, and year on functional group CPUE were analysed by performing two-factor ANOVA. Probably ecosystems are functionally more dependent on functional groups than on species and depending on whether functional groups respond more or less favourably to various protection levels can give useful information to manage MPA and sustainable development.

Keywords: Fish, functional groups, marine reserve

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## Abstract – 063 Oral

**THE IMPLICATIONS TO MANAGEMENT OF THE RELATIONSHIP BETWEEN THE SPATIAL EXTENT OF MPAs, AND MANAGEMENT REGIME OUTSIDE OF MPAs. A YIELD-PER-RECRUIT, EGG PRODUCTION-PER-RECRUIT, AND SSB-PER-RECRUIT MODEL OF A SEDENTARY INVERTEBRATE FISHERY**

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Understanding the role of MPAs in fisheries management needs to take into account the management regime in operation outside of any MPAs. Furthermore it has been suggested that MPAs may be of particular benefit for managing site attached species where relative fecundity increases with age, as it is possible to protect old large females that produce a proportionally larger number of eggs than their contribution to population SSB. A population model is presented to examine the relationship between yield-per-recruit (YPR), egg production-per-recruit (EPR) and SSB-per-recruit (SSB-PR) over a range of management options for a fishery targeting sedentary invertebrates. The range of management options examined includes the proportion of the area covered by MPAs, and the minimum landing size (MLS) and fishery mortality (F) operating outside of MPAs. The model assumes that the population is homogeneously distributed with a mixed larval pool, and a length fecundity term is included. Uncertainty about stock-recruitment relationships has led to the proposal that management regimes should aim to conserve a set minimum proportion of the unexploited level of egg production. For a given level of egg production to be conserved, YPR is maximised with a MLS only and no MPA. However including MPAs increases the stability of the stock in the face of uncertainty about biological parameters and the ability of management to accurately control the level of F outside MPAs. The qualitative nature of this result is considered to be robust in its implications for management of site attached species.

Keywords: Marine protected area, minimum landing size, yield-per-recruit, egg production, relative fecundity

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## Abstract – 067 Oral

**SPINY LOBSTER (*Panulirus argus*) STOCK ASSESSMENT  
IN THE YUCATAN COAST, MEXICO***V. Ríos\*, and C. Monroy*

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In this paper were conducted spiny lobster (*Panulirus argus*) stock assessments in the Yucatan coast, using two models: a) a age structure model and b) a dynamic biomass model. Data used in both models were: capture (1976-2004), CPUE (1989-2004) and weight mean of the lobster tail (1987-2004). With the first model was obtained an initial biomass estimate of the 1,640 t lobster tail, with a standard deviation of the 66 t and the exploitation rate for the year 2004-2005 was  $F= 0.31$ ; a decrease in the biomass was observed in the last 4 years. Results obtained with dynamic biomass model were:  $r= 0.339$  and a RMS= 155.89 t of lobster tail and a current density approximate of the 2.5 organisms /ha. Resource exploitation rate has been increased significantly and a gradual decrease is observed in both models biomass estimation and CPUE measurement. As precautory approach measure is recommended to maintain current fishing effort and increase vigilance for carry out fishery management and co-management actions among users, administrators and investigators. On the other hand, is necessary to reorient the research for the resource evaluation.

Keywords: Stock assessment, *Panulirus argus*, Yucatán coast

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## Abstract – 068 Oral

**EXPLORING EFFECTS OF CHANGING HARVEST RATES IN THE BROWN SHRIMP  
SEQUENTIAL FISHERY OF THE WESTERN GULF OF MEXICO ACCOUNTING  
FOR INTERDEPENDENT ECOSYSTEMS**

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The management of exploited stocks has been based on monospecific population criteria. However, such management strategies don't consider interrelationships of target resources with other non-exploited groups. In the last years, many Ecopath models have been constructed; however interdependence at ecosystem level between adjacent areas, like tropical coastal lagoons and the adjacent continental shelf, are poorly known. Food-webs are complex in these systems, and it has been observed that they are affected directly by fishing (taking targets as sharks, tunas, sardines, anchovies, mackerel, penaeid shrimps). An Ecopath-based ecosystem model for the Alvarado lagoon and the adjacent continental shelf was constructed in order to understand how these systems interact, but particularly on the light of the shrimp sequential fishery. Different harvesting rates were applied to the brown shrimp (*Farfantepenaeus aztecus*) stock to evaluate the direct and indirect impacts on the structure and dynamics of coupled ecosystems. Ecosystem statistics were obtained (total system throughput, internal consumption, flows to respiration, flows to detritus, and flows to exportation). Overhead, ascendancy and capacity also were computed. The functional groups of both ecosystems showed a similar response to the changes in the harvest rate brown shrimp. This is the groups with lower trophic levels displayed a magnitude of greater change in their initial biomass. Nevertheless, the magnitude of change in the groups of the continental shelf was the double with respect to the groups of the lagoon. Particularly, in the case of the brown shrimp (in both ecosystems), significant changes in their initial biomass was not observed. Also, we also observed that the functional groups in the lower food web are higher resilient than the groups that occupy the top food web. We inferred that magnitude of change in functional groups could be an indirect measurement of the impact of fishery on the structure of the ecosystem.

Keywords: *Farfantepenaeus aztecus*, ECOPATH, functional groups, biomass

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## Abstract – 071 Poster

**RECOVERY STRATEGIES OF OYSTER FISHERY  
(*Crassotrea virginica*) IN TAMAULIPAS, MEXICO***R. Fernández Martínez\**, and *J.A. González Rangel*

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Mexico occupies the sixth place of the oyster production in the world. Traditionally, the oyster fishery has been exploited by artisanal fishermen. Unfortunately in Tamaulipas (state of Mexico) the oyster production has decreased dramatically around of 75% in the last 10 years, from 4,335 metric tons in 1993 to 1,031 metric tons in 2003. This, mainly because Tamaulipas government established sanitary restrictions on the fresh oyster sells. During the year 2003, national oyster production was around of 50,219 metric tons, which 94 % were just in the Gulf of Mexico, although in economical terms the Gulf of Mexico productions represents the 65% of the national production. This, because in the Mexican Pacific coast, the oyster production is mainly developed by aquaculture, which increase the market value. Tamaulipas state occupies the fourth place of the Mexican oyster production after states such as Veracruz, Tabasco y Campeche. However, Tamaulipas state is considered to occupy the first place in potential oyster culture, based on available aquaculture area which is 274,736 ha of coastal lagoons. To evaluate the real culture potential of oyster in Tamaulipas and to contribute to improve the oyster situation, two samples of oyster and water were recorded in four zones during the warm and cold seasons. Additionally, physico-chemical parameters such as pH, temperatura and salinity were recorded. Water samples were microbiologically analyzed using the fast method named SimPlate, to evaluate total coliformes and *Escheherichia coli* as well. Results indicated that just in water of one zone in the warm season, microbiological values were larger than Mexican norm. In general we concluded that water quality and oyster microbiological levels in Tamaulipas are acceptable. We concluded sanitary conditions of water and oyster populations in Tamaulipas are acceptable. as well as they have a great culture potential which must be promoted. Moreover, aquaculture represents a way to improve economical value and oyster production levels in Tamaulipas.

Keywords: Oyster aquaculture, coastal lagoon, water quality, sanitary condition

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## Abstract – 073 Poster

**APPROACH TO NATURAL HABITAT COLONIZATION RATE OF SPINY LOBSTER  
(*Panulirus argus*) IN YUCATAN COAST, MEXICO***C. Zetina-Moguel*<sup>1\*</sup>, *G. V. Ríos-Lara*<sup>2</sup>, and *S. S. Salas-Márquez*<sup>3</sup><sup>1</sup> Universidad Autónoma de Yucatán (Mexico), <sup>2</sup> Instituto Nacional de la Pesca (Mexico),<sup>3</sup> Centro de Investigación y Estudios Avanzados-IPN Unidad Mérida (Mexico)

Lobster fishery evolution in Yucatan coasts, Mexico, it has been characterized recently by capture technologies changes, incorporating very exact systems of geographical positioning, traps in the lobster fishing in deep waters and artificial shelters in shallow waters. These and other technological changes suggest that the traditional methods of evaluation and the management strategies based in the conventional models could, in short term, to be insufficient for the decisions in the perspective of a responsible fishing; as consequence efforts have been conducted to the exploration of new population models that could respond better to the fundamental questions in evaluation of populations and the fishery management. A tendency is the use of the metapopulations theory and in this perspective habitat colonization rate evaluation is excellent information. Antecedents of the habitat colonization rate evaluation, derive of experimental exercises mainly based on the use of artificial shelters. In this work the evaluation of habitat colonization rate of natural habitats is approached using lobster fishery information. During 2002 to 2005 were applied 110 lobster fishermen interviews during the beginning season fishing. Analysis was based in descriptive statistical, parametric and no parametric correlation analysis of and multiple step step regression analysis. Results indicate that natural habitat colonization time take between one week and four months depending on habitat location, capture behavior in the fishing places and prevailing meteorological conditions.

Keywords: Spiny lobster, habitat colonization, Yucatan shelf

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## Abstract – 080 Oral

**ANALYSIS OF THE PACIFIC RED SNAPPER (*Lutjanus peru*)  
SMALL-SCALE FISHERY IN A MULTISPECIFIC CONTEXT:  
AN ASSESSMENT AND MANAGEMENT PROPOSAL**

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Pacific red snapper (*Lutjanus peru*) is one of the most important fish resources landed by the artisanal fleets in Baja California Sur (BCS) and its fishery is considered to have potential for development. Some indirect evidences however call into question the potential for development. The purpose of this study is to know the productive capacity of Pacific red snapper considering that small-scale fisheries also catch another multiple species. As case of study it was selected the bays of La Paz and La Ventana since it is the most productive region of huachinango in BCS. Two approaches were used for analyzing the Pacific red snapper fishery: a population approach (monospecific) and a trophic approach (multispecific). For the first one, an age-structured simulation model was constructed for analyzing the Pacific red snapper dynamic population under different exploitation scenarios. For the second approach, a trophic mass-balance model (Ecopath) was constructed and impact of small-scale fisheries on ecosystem was evaluated with temporal simulations (Ecosim) under different scenarios based on the Pacific red snapper exploitation. Population model showed that Pacific red snapper fishery could only be developed with an effective regulation of both artisanal fleet and shrimp fleet. Predominance of bottom-up control in the food web was evidenced with a mixed trophic impacts analysis which implies that fisheries do not cause a significant impact in the ecosystem as a whole. Simulation scenarios developed with the trophic model show that results coming from both approaches are consistent and show that, besides the Pacific red snapper, most of target species are fully exploited by small-scale fleets. Therefore, for successfully regulate the Pacific red snapper fishery, management measures should be focused to more than just one species at a time. It is discussed the current stock concept as a population-based management unit and the necessity for defining an ecosystem-based management unit.

Keywords: Pacific red snapper, *Lutjanus peru*, trophic modeling, multispecies management

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## Abstract – 081 Poster

**THE UPPER GULF OF CALIFORNIA FISHERY  
AND THEIR ENVIRONMENTAL IMPLICATIONS***G. Rodríguez <sup>\*1</sup>, E.A. Aragón <sup>1</sup>, and M.A. Cisneros <sup>2</sup>*<sup>1</sup> CIBNOR, Guaymas (Mexico), <sup>2</sup> WWF- Golfo de California (Mexico)

The Gulf of California has been the most important fishery area in all Mexico. Fishery employees a high number of people and factories are increasing with a high profit in this part of the country. The area has a high diversity of species who are exploited because it high value. The Upper California Gulf Sea (AGC) represents a challenge for the Mexican society in conservation. These research assess the fishery of the AGC, describing distribution, season and harvest of the commercial species, as well the value of the product and the social organization of the fishermen. Three communities of Sonora and Baja California are studied. Data of this communities where used for their analysis. They catch between 15 and 29 species. Nevertheless, two are the most captured; Shrimp and Curvina. The value of this species is 100 million pesos. The 60% of the earnings are provided by 10 cooperativas. 29 cooperativas are allowed to capture shrimp and 32 for curvina. These captures required manage and conservation measures to assess to the biological and economical analysis. This effort also effects some endemically species as the Totoaba and vaquita, because the main effort of the fishery it's done in their environment, affecting the bottom of the sea with their trailing nets. Other important item is the water flow from the Colorado River who has not been adequate to the environment needs, changing nutrients requirements for several species as the curvina, totoaba and shrimp who breed and nursery in this side of the Gulf of California. of the fishery, because only in one community (Santa Clara) exist 541 minor vessels and 840 members. The activity in this small area of the Gulf can generate a low market yields for the marine products and Reserve management, requiring to diversify economical activities to dismiss the effort over the marine ecosystem.

Keywords: Communities, threatened species, small vessels, commercial species, environment management

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## Abstract – 089 Oral

**PRELIMINARY EVALUATION OF THE FISHING PURINEO METHOD  
IN THE LA JOYA-BUENAVISTA LAGOON, SOUTHERN MEXICO***S. Ramos-Cruz\*, and V.H. Martínez-Magaña*

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With the purpose of evaluating the use of balanced meal for chicken (purina) in the capture of shrimp (purineo method) within a coastal lagunar system, a simultaneous experiment of capture was made in two different fishing areas. In first of them food was used as “bait” to attract the shrimp and at the second area, captures without the use of the balanced food took place. Of complementary way, readings of the more important physical and chemical parameters (temperature, salinity, pH and dissolved oxygen) were registered and were taken sediments samples to explain if the food for chicken has an impact on the bottom. The results revealed the food as “bait” has a negative impact on the structure of the population by its agregador effect, since the captures tend to be made up in a greater percentage by small organisms (lengths and weights), in comparison with the natural method, increasing the rates of fishing mortalities. The readings of the physical and chemical parameters did not reveal differences that could indicate a possible effect of the chicken food on the quality of the water column, whereas the highest values of organic carbon were detected in the stations of La Joya and Buenavista, discarding this must to the effect of the purineo, but rather has a greater relation with problems of circulation of the water masses in these places. Nevertheless, with base in the effect that it has the fishing purineo method on the structure of the population is considered pertinent to eliminate it of the shrimp exploitation scheme.

Keywords: Purineo, white shrimp, fishing mortality, Joya-Buenavista

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## Abstract – 093 Oral

**VARIATIONS OF THE AMERICAN OYSTER *Crassostrea virginica*  
POPULATIONS FROM DIFFERENT COASTAL LAGOONS  
OF THE GULF OF MEXICO AND A MANAGEMENT PROPOSAL**

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Oyster fishery is one of the most important coastal fisheries of Mexico. Production from the Gulf of Mexico coast makes up 93.4% of national production; during 2000-2002 it reached over 49,000 mt, with value of 9 to 15 \$US Dollars. Production is based on natural beds, artisanal farms and enhanced beds of the American oyster *Crassostrea virginica*. Besides its economic value, it is an important social employment activity, as many coastal communities find their income and work opportunities in it. On the state of Tabasco there are 1 371 oyster fishers in 14 cooperative societies, and 3 000 shuckers. There is an extensive bed management activity with seeding of collected spat. Even though, there is no management of the exploitation, except for a minimum legal size of 80 mm that is not respected, as oysters are grown in bundles the mean size is around 50 mm. We studied the population dynamics from size structure data of oyster populations from five beds of three lagoons, that presented maximum high between 118 and 140 mm and mean size between 53.64 and 56.80 mm. Giving parameters for the von Bertalanffy growth equation with a very low  $L_{\infty}$  between 124 and 226 mm, with K between 0.48 and 1.26. In most cases a significant impact of seasonality was detected, mostly during winter, but at some localities it was during the summer. Total mortality fluctuated from 0.22 to 6.08, but estimated mortality from variations in number had an average of 1.90. We conclude that the populations are over exploited in size and this is affecting yields. It is recommended to increase mean size to 119 mm which means a minimum catch size of over 70 mm, this would increase yields 100% in biomass and there would be a significant number of organisms to buffer any increase on natural mortality.

Key words: American Oyster, *Crassostrea virginica*, production, fisheries management, von Bertalanffy

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## Abstract – 094 Poster

**REPRODUCTIVE PATTERNS OF AMERICAN OYSTER**  
***Crassostrea virginica* FROM DIFFERENT COASTAL LAGOONS**  
**OF TABASCO, GULF OF MEXICO AND A MANAGEMENT PROPOSAL**

*D. Aldana Aranda*<sup>1\*</sup>, *M. L. Sevilla*<sup>2</sup>, *E. Baqueiro Cárdenas*<sup>3</sup>, *A. Zetina Zarate*<sup>1</sup>, and *T. Brulé*<sup>1</sup>

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Oyster fishery is one of the most important coastal fisheries of Mexico. Production from the Gulf of Mexico makes up 93.4% of Mexican production; based on natural beds, artisan farms and enhanced beds of the American oyster *Crassostrea virginica*. Besides its economic value, it is an important social employment activity, as many coastal communities find their income and work opportunities in this fishery. 1371 oyster fishers and 3 000 suckers work in Tabasco. Even though, there is no management of the exploitation, except for a minimum legal size of 80mm that is not respected, as oysters are grown in bundles the mean size is around 50 mm, and a temporal ban from may 15th-June 30th and 15th Septiembre-30 October. Reproductive cycles of oyster populations from three lagoons of Tabasco are studied. Gonad samples were taken from six banks, subject to different environmental and pollution conditions from Mecoacan, Machona and Carmen lagoons. Variations were observed in gonad activity among localities, which reflects on the gametogenic cycle and spawning. In most cases a significant impact of reproductive patterns versus seasonality was detected, mostly during rains season. Spawn is present through the year and more intense and constant at Mecoacan, with a dominant pulse from April to August. At Machona and Carmen lagoons, it extends only from June to December or June-January, respectively. These differences in gametogenic cycle and spawning are a reflex of populations' recovery capacities under the different environmental conditions. Mecoacan is exposed to a higher organic urban discharge, presenting a shorter re-absorption and undifferentiated periods, faster gametogenesis and a well defined spawn stage; with a high intensity spawning period with three peaks (May, August and October). This differential reproductive behavior has positive implications in management program for this species in Mexico. Data obtained in this study permitted re defined the actual temporal ban for this species from June to October, in order to protected spawn stage and to permit a best recruitment for this species, giving the opportunity to take advantage of every possibility of settling through the year.

Key words: American oyster, *Crassostrea virginica*, reproductive cycle, fisheries management

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## Abstract – 095 Poster

**VARIATIONS OF REPRODUCTIVE PATTERN OF THE AMERICAN OYSTER  
*Crassostrea virginica* FROM PUEBLO VIEJO LAGOON, VERACRUZ, MEXICO**

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Oyster production on the Gulf of Mexico coast has suffered a drastic fall on most coastal lagoons of Mexico, whereas Pueblo Viejo Lagoon production on the state of Veracruz has been sustained, acting as a source of seed for restocking of other lagoons. This is due to the management of beds carried out by local fishers. This management is based on empirical knowledge for the collection of seed from planted shell beds. This work describes the variations of the gametogenic activity and the reproductive cycle during the year 2002, to aid in shell laying programs. Samples were taken from two beds, subject to different environmental and pollution conditions for histological analysis of the gonad tissue. There were variations in gonad activity among sexes and among localities, which reflect on the gametogenic cycle and spawning. Spawn was more intense and constant at Malagana, with a dominant pulse occurring from June to November. At Matacuaya it extends the year through. These differences in the gametogenic cycles and spawning periods are a result of sexes and populations recovery capacities under the different environmental conditions. The Malagana population is exposed to a higher organic load from the Panuco River and urban discharge, resulting in a shorter post spawning and rest periods, faster gametogenesis, and a well defined mature stage with a high intensity spawning period with three peaks. Meanwhile, the oyster population from Matacuaya presented longer and more intense post spawn and resting stages, gametogenesis extended longer in a higher percentage of the population, and they had a brief period of maturity.

Key words: Reproduction, american oyster, *Crassostrea virginica*, pollution

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## Abstract – 097 Oral

**BY-CATCH COMPOSITION IN THE ILHEUS SHRIMP FISHERY (BAHIA, BRAZIL)***G. R.A. Rocha\*, E.C.G. Couto, and M. Cetra*

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The effect of fishing on the marine ecosystem has been more studied in recent years. Trawling, in particular, is the focus of attention because of the gear's low selectivity and impacts on the sea floor. One of the impacts is the capture of non-target species (or by-catch) in the nets. In most shrimp trawl fisheries, the weight of by-catch caught is greater than the weight of the commercially important shrimps. Most of the by-catch is discarded at sea. Concern about the high by-catch is focused primarily on the non-target species, because they are the young of other commercial fisheries, and on species that are listed as endangered or as vulnerable. To identify, understand and manage the impact of trawling on by-catch species primarily, and on the fish diversity as a whole, the by-catch must be monitored. The first step is obtain a quantitative description of the by-catch and of factors influencing differences throughout a fishery, which is the objective of our study. Our study area is located on the continental shelf off Ilhéus. From March 2003 to February 2005, thirty-minute tows were made at three fixed stations, at depths of 16 m, with an otter trawl, of 9 m mouth opening, 20 mm stretch mesh in the body and sleeve. In the laboratory specimens were sorted, identified, counted, weighed and measured. The by-catch was characterized by a large proportion of non-fish species (mainly crustaceans), high diversity (more than 200 species), predominance of species at low abundance, and significant temporal variation in abundance (dry/wet season). Teleost fish contributed 40 % of the weight of the by-catch. A total of 30 families comprising 78 demersal fish species was collected. Sciaenidae was the most abundant family both in number of species (16) and individuals (63 %). A greater abundance of juveniles is observed throughout the year. The absence of elamobranchs is remarkable. The large proportion of fishes in the by-catch of tropical penaeid fisheries has implications for the potential ecological impact of trawling, because of differential survival among species.

Keywords: By-catch, tropical, trawling

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## Abstract – 106 Oral

**INCIDENTAL FISHING IN THE ARTISANAL SHRIMP FISHERY  
OF CHABIHAU LAGOON, YUCATAN, MEXICO***S. Leal\*, and M.A. Cabrera*

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One of the characteristics of the Yucatan coast, is the presence of lagoons with shallow waters where the artisanal fishing of shrimp takes place. In this fishery triangular nets called “tripies” are used as a net trawl or are placed in the bridges during the tide movements to catch shrimp. It has been observed that these nets are not selective and therefore the presence of incidental fauna is common in the catches. In this work we carry out an analysis and description of the incidental fishing in the shrimp fishery in Chabihau, Yucatan, in terms of species composition and variations in the abundance throughout fishing season, and we estimate the biometric relationships to the most abundant species. The relevance of this study is based on the fact that the knowledge about the impact of artisanal shrimp fisheries on the incidental fauna is almost null. A sampling program of the shrimp captures were conducted during one fishing season (December 2002-Enero 2003). We registered the number and duration of hauls, and weight of the catch (shrimp and incidental fauna). Samples of the incidental fauna were transported to the laboratory for species identification, and to measure length and weight of the organisms. A total of 95 hauls were registered with a total catch of 89,5 Kg of shrimp and 16.5 Kg of incidental fauna, estimating a proportion of 8:2 shrimp-incidental species. A total of 1747 fishes pertaining to 38 species and 20 families were registered, being the most abundant *Eucinostomus argenteus* (45.6%), *Anchoa mitchilli* (14.3%) and *Harengula jaguana* (8.4%). The results allow to conclude that the impact of the shrimp fishery on the incidental species is minimum, due to the low proportion of incidental species present in the catches, beside was observed that 70% of these organisms were returned alive to the water by the fishers.

Keywords: Incidental fishing, artisanal shrimp fishery, Chabihau

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## Abstract – 107 Poster

**A COMPARATIVE ANALYSIS OF ARTISANAL SHRIMP FISHERY  
FROM CHABIHAU, YUCATAN, THROUGH 2002-2003  
AND 2003-2004 FISHING SEASONS**

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Landings of artisanal shrimp fishery from Chabihau Lagoon, Yucatan were compared during two fishing seasons in terms of number of hauls, effective time of fishing and catches landed. Sampling of catches was carried out during November, December and January in each fishing season to record information about fishing effort and to obtain shrimp samples for identification species, sex and morphometric measures. Shrimps landings are composed of three species of *Farfantepenaeus*: *F. notialis*, *F. duorarum* and *F. brasiliensis* with *F. notialis* being more abundant (>40% of total catch). Juveniles and recruits were more abundant in the first fishing season, whereas juveniles and subadults were more abundant in the second one. We found significant differences in abundance of subadults shrimps between seasons (Mann-Whitney Test;  $P < 0.05$ ). We did not find significant differences in sex proportion to each species, but significant differences (Chi-square;  $P < 0.05$ ) were present between *F. notialis* and *F. brasiliensis* of the first season. The effective time of fishing (TEP) between fishing seasons shows significant differences (Mann-Whitney Test;  $P < 0.05$ ), whereas catch per unit of effort (CPUE), did not show significant differences between both seasons. The analysis of linear correlation applied to the TEP and CPUE showed a weak relation. This suggests that greater times of fishing not necessarily result in greater catches. Some ecological implications about effects of Isidore Hurricane on shrimp production in Chabihau Lagoon are discussed.

Keywords: Chabihau, Artisanal Shrimp Fishery, CPUE

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## Abstract – 110 Poster

**THE RED GROUPER FISHERY (*Epinephelus morio*)  
IN THE CAMPECHE BANK: MEASURE TRENDS  
FOR RECUPERATION AND ORDERING**

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The red grouper (*Epinephelus morio*) is the most important fishing resource in the Campeche Bank. The average production in last five years was 7,965 t representing incomes for U.S. \$ 23,894,215.00. The commercial catches in this fishery results in overexploitation of the population. The biomass has decreased from 248,548 t in 1958 (starts of fishery) to 46,487 t in 2003 what represents 19% of initial biomass. The National Institute of Fishing (INP) has proposed a management plan based in catch quotas, however, because opposition of fishermen to firm this plan, the INP has proposed an annual closed season based in reproduction aspects for red grouper. The data used in this reproduction study came from 29 research surveys Mexico-Cuba, and four from commercial fleet in the close season of fishing. The most important results are: a) proportion of Male/Female changes with the size of fishes, presenting the highest number of females in the class size 30 cm lt (1:31.5), b) At 75 cm lt the proportion of Male/Female was not significantly different of 1:1, c) The size where the sex change begins was between 30 and 35 cm lt, d) The spawn process was initiated in December and finished in may, The massive spawn was in February, March and April, e) 77% of mature fishes was in the bottom at 22° C of temperature, f) The mean individual fecundity was  $25.3 \cdot 10^4$  eggs, g) The relationship fecundity/size and fecundity /weight was  $F = 0.01002 S^{4.48375}$  and  $F = 4.50090 W^{1.48912}$  respectively, h) Relative fecundity varies from 102.6 and 573.5 eggs/g, i) Selectivity analysis presents significant differences depending of the size of hook used, and not in areas (west and east), j) The retention values of hook most used (6) was  $L_{50}$  53.7 cm,  $L_{25}$  47.8 cm and  $L_{75}$  59.6 cm lf, and implies the catch is formed for fishes of five years old (completely matures). The close season of fishing was proposed from February 15 to March 15 enclosing the maximum spawn of species.

**Keywords:** Red grouper, *Epinephelus morio*, closed season, Campeche Bank, reproduction

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## Abstract – 111 Poster

**THE OCTOPUS CAPTURE USING TRAPS IN THE YUCATAN PENINSULA:  
AN ALTERNATIVE FOR DIVERSIFY THE *Octopus vulgaris* FISHING***M. Perez Perez\**, and *R. Burgos Rosas*

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The octopus fishery in the Yucatan Peninsula is composed for two species: *Octopus maya* and *Octopus vulgaris*. Catch of octopus was varying reaching a historic maximum in 1996 with 25,280 tons, decreasing in 2002 with 16,693 tons. The locally traditional fishing method is the "gareteo" that consist of a derive rod with several lines having crabs as a bait, in depth between 1 to 30 meters. The high fishing pressure is for *Octopus maya* and an alternative fishing gear to avoid the trend, is diversify the catch system for octopus. The study area was the northeast of the Yucatan Peninsula (21°40' to 22°35' North lat. And 86°30 to 87 °50 West long.). This study describes the experiment of two different types of octopus traps on *Octopus vulgaris* catches, in four fishing travels at continental platform of Yucatan Peninsula from October 2005 to January 2006. The traps used were the Spanish and Japanese trap. Research was done on grounds from 30 to 50 meters deep, with two sets of 250 traps, each type of trap connected consecutively as a long line. The sets of traps were placed in parallel line for compare the technical efficiency of each trap type. The bait used was: *Eutthynnus alleteratus* (bonito), *Harengula jaguana* (sardine), *Haemulon plumieri* (chacchi), *Diplectrun radiale* (vulcay) and *Callinectes sapidus* (jaiba). A total 112 sets were done, with 76 for the Japanese trap and 36 for the Spanish trap. A total 1241 octopuses were caught, 614 by the Japanese trap and 627 by the Spanish trap. In shallow waters (near to 30 m deep) the Japanese trap get better catches, decreasing this catches with increasing deep. The Spanish trap was contrary behavior. The catches were better with increasing depth up 45 m. In Yucatan Peninsula, octopus fishers prefers the Japanese trap type for his easily use and for the efficiency in the catch of bait. The use of traps for octopuses catch, enables have access for the *Octopus vulgaris* populations in the depth, were the fishers can not caught with the traditional method (gareteo). In this study, with regard to catch ability, the results suggest Spanish trap type is more efficient that Japanese trap type. It's necessary to continue the study with the application of trap methods in other areas, of the continental platform in Yucatan Peninsula, at depth from 55 m, principally with the Spanish trap type.

Keywords: *Octopus*, traps, Yucatan Peninsula

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## Abstract – 004 Oral

**DYNAMIC ON A TROPICAL ESTUARINE SYSTEM:  
A BENTHIC COMMUNITY CASE FROM THE CELESTUN COASTAL LAGOON**

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The spatial and temporal structure of benthic macrofauna of a tropical coastal lagoon was explored. Data were obtained during 1994-1995 on a seasonal basis along the estuarine gradient. Multivariate analysis was used to assess the spatial structure of physico-chemical factors and benthic community. Preliminary results of physico-chemical factors delimited three rough zones along the estuarine gradient. Firstly, an inner zone with high freshwater influence; secondly, a mixing middle zone and; thirdly, an outer zone with high marine water influence. Preliminary results showed that polychaetes, mollusks, crustaceans and other major taxa exhibit high spatial and temporal variability in abundance and species composition, particularly in the middle zone, indicating alternation in species dominance. The inner and the outer zones showed more homogeneous abundance and composition. In the three zones the presence of mollusk and crustacean taxa remained steady through the sampling climatic seasons, but its dominance changed seasonally. Polychaetes disappeared completely during the northerly season, but they were the dominant group both in the rainy and the dry seasons. This high spatial and temporal variability in both the environmental factors and biological attributes of the benthic community could be interpreted as a response of the high dynamic instability of the whole system, response that do no support the traditional vision of stability attributed to the tropical ecosystems.

Keywords: Tropical, community, structure, benthos, Celestun

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## Abstract – 012 Oral

**JUVENILE FISH IN ESTUARIES: A HOTSPOT IN AN ECOSYSTEM APPROACH  
OF COASTAL RESOURCE SUSTAINABLE EXPLOITATION***G. Vidy\**

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Estuaries are recognised as favourable places, nurseries, for numerous species on which many coastal, mainly small scale, fisheries depend. Facing all the impacts of direct (pollution, excessive exploitation, loss degradation or fragmentation of habitat...) and indirect (global change ...) pressures, estuaries may fail in the completion of their nursery role. A lot of scientific articles on that theme are published almost every week on a diversity of particular facts and situations. An integration of that large amount of scientific results is needed to let them be effective. A nursery can be defined either in an "absolute" way, as the place where a lot of juvenile fish gather, or, in a "relative" way, as a place whose contribution to the recruitment is effective. Concerning the fisheries subject, the second point of view seems more suitable. To decide on that point, many issues as estuarine dependence, estuarine benefits for young fish, differential usefulness of different types and/or parts of estuaries, connectivity of habitat, suitable amounts, role and timing of continental water, actual role of predators, need to be clarified and brought together in the optic of an ecosystem approach. In that presentation, we will review and, as far as possible, synthesize the present state of the art in "Early Life Ecology" and propose future research directions.

Keywords: Juvenile fish, nursery, estuary, lagoon, ecosystem approach

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## Abstract – 013 Oral

**COUPLING SEVERAL FORMALISMS TO INTEGRATE SEVERAL KNOWLEDGES  
IN A MODEL OF A STRESSED ESTUARY***R. Duboz\**

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Complex systems modeling and simulation has made major advances in the last few years. In this particular field, concepts like multimodeling, heterogeneous model coupling or multiagent models have emerged and proved to be very relevant for the modeling and simulation of ecological systems. In this presentation, we will show how those new concepts can be adopted for the representation of complex ecosystems such as estuaries. We have developed an integrated model of tropical estuaries. We consider two African estuaries, the Sine Saloum (Senegal) and the Gambia river estuaries. The latter defines a “normal” situation, where salinity decreases in upstream direction, the former defines the reverse situation. The main objective is to understand the influence of the evolution of salinity on fish communities over several decades. To address this particular issue, we have elaborated an Individual Based Model (IBM) coupled with a model of salt intrusion. The IBM is formalized as a multiagent system in a discrete event system specification. The model of salinity is a differential equation forced by climate variability (rain and evaporation). We will show how climate can influence the spatial distribution of major species in an estuary.

Keywords: Integrated model, individual based model, estuarine communities dynamic

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## Abstract – 016 Oral

**MONITORING CLIMATE CHANGE IMPACTS IN PATOS LAGOON ESTUARY  
(32° 05' S, 52° 10' W), SOUTHERN BRAZIL, THROUGH THE BRAZILIAN  
LONG-TERM ECOLOGICAL RESEARCH PROGRAM**

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The Brazilian Long-Term Ecological Research (B-LTER) program is a cooperative effort among several research institutions across the country and Patos Lagoon estuary is one of the B-LTER sites with the largest environmental and biological datasets. It is located in the coastal plain of southern Brazil, in a warm-temperate biogeography transition zone due to the influence of the Subtropical Convergence in the southwestern Atlantic. Both, estuary and Atlantic shores play a crucial role in the marine shelf areas and limnic or terrestrial environments of the coastal plain. In a long-term perspective, one of the main natural climate features affecting the large drainage basin of Patos Lagoon (ca. 200,000km<sup>2</sup>) is the elevated freshwater inflow into the system triggered by El Niño events, which can affect hydrology, water quality, and fish assemblages in its estuarine area (971 km<sup>2</sup>). During El Niño events freshwater from the middle-upper lagoon expands towards the estuarine zone enabling several freshwater fishes to spread throughout the estuary, resulting in higher fish diversity in this region, but high freshwater discharge decreases the overall abundance of “estuarine-related” species that occur year-round and use the estuary as a nursing-ground. White-mouth croakers, mullets and pink shrimp, which together sustain the increasingly impoverished and over-fished artisanal estuarine fishery in this region, are among those “estuarine-related” species that could be negatively affected by sustained, high freshwater discharge triggered by El Niño events. A comparison (1979-1984 and 1996-2002) of fish experimental data (community structure) and relative abundance (CPUE) reflects the observed drop on the official fishery landing. We hypothesized that artisanal fishery impacts on this estuarine fish assemblage will be more important at the population than at the community level, since natural disturbances triggered by local and regional climatic factors seem to play a major role in driving the inter-decadal variation.

Keywords: El Niño, fish community structure, fishery, Patos Lagoon

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## Abstract – 017 Poster

**NUTRIENTS BALANCE ANALYSIS THROUGH LOICZ  
AND THE TROPHIC STATUS OF THE ENSENADA HARBOUR, B.C. MEXICO***R. González de Zayas<sup>1\*</sup>, and G. de la Lanza Espino<sup>2</sup>*<sup>1</sup> Centro de Investigaciones de Ecosistemas Costeros de Cayo Coco (Cuba),<sup>2</sup> Instituto de Biología, UNAM (Mexico)

The Ensenada harbour in Baja California Mexico, is one of the most important in the Pacific coast of Mexico. In last two decades Ensenada harbour has experienced several anthropogenic pressures around them. In this work inorganic nutrients were quantified as well as the balance of dissolved inorganic nitrogen (DIN) and phosphorus (DIP) were estimated. Additionally, NID and DIP trophic state were evaluated. To fulfill described objectives, 17 sampling stations were established in the Ensenada Port and one sampling station in The Todos Santos Bay. Sampling stations were visited each three months. On each sampling station, nutrients such as ammonium, nitrates + nitrites, phosphates and chlorophyll "a" were estimated. The DIN and DIP fluxes, as well as the net ecosystem metabolism (NEM) were calculated following LOICZ (Land Ocean Interactions in the Coastal Zone) methodology. In March 2003, The Ensenada Port imported DIN ( $-5.32 \text{ mmol m}^{-2} \text{ día}^{-1}$ ) and DIP ( $-0.44 \text{ mmol m}^{-2} \text{ día}^{-1}$ ). Conversely, in June, September and November DIN and DIP were exported, and the higher exportation rates observed in November ( $+12.85 \text{ mmol m}^{-2} \text{ día}^{-1}$  de NID y  $+0.37 \text{ mmol m}^{-2} \text{ día}^{-1}$  de PID). For the annual balance DIN and DIP were both exported. Net denitrification was estimated as  $0.75 \text{ mol m}^{-2} \text{ año}^{-1}$ . Heterotrophy dominated metabolic processes in this ecosystem ( $\text{NEM} = -10.60 \text{ mol m}^{-2} \text{ año}^{-1}$ ), this condition was supplied by organic carbon from marine adjacent environment. The chlorophyll "a" showed a heterogenic behavior in both environments Ensenada Port and Todos Santos Bay. The highest chlorophyll concentrations were observed in March ( $16.3 \text{ mg m}^{-3}$  for the Port and  $11.5 \text{ mg m}^{-3}$  in Todos Santos Bay).

Keywords: Dissolved inorganic nitrogen (DIN), dissolved inorganic phosphorus (DIP), heterotrophy, Primary productivity, denitrification.

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## Abstract – 018 Poster

**METAZOARIAN PARASITES OF THE “FIDDLER CRAB” *Uca spp*  
IN THE LAGOON SYSTEM OF PROGRESO, YUCATAN, MEXICO***J.A. Cerón-Gómez\*, and S. Guillen-Hernández*

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The genus *Uca* (fiddler crabs) is one of the most abundant and characteristic genus presents in estuaries and coastal lagoons in the tropical areas. They are an important link in the food chains of this zone, where they are an important part in the diet of a great variety of vertebrates living in such ecosystems. Although, they seem to be good candidates to host different parasites species, there are not studies on crustaceans as host of parasites in Mexico. As a first step in the study of the parasite-fauna of this genus, we decide to study the parasites of two different species of *Uca* in the Lagoon System of Progreso, Yucatán. Between September 2004 and August 2005 a total of 855 crabs were measured, sexed and examined: 314 belonging to the species *Uca thayeri* and 541 to *Uca speciosa speciosa*. Seven different parasite species were identified: Two digenean (*Probolocoripher sp.* and one Maritremitinae), two acantocephalans (*Hexaglandula corynosoma* and *Arythmorhynchus frassonii*), two nematode larvae and one isopod (*Leydia sp.*). In *U. thayeri* the seven parasite species were found and in *U. speciosa speciosa* only four of them were recorded (*Probolocoripher sp.*, Maritremitinae and two nematode larvae). Results showed a positive relationship between infection levels and host length in some parasites species (*Probolocoripher sp.*, *Hexaglandula corynosoma* and *Leydia sp.*) and seasonal changes in infection levels in others (*Hexaglandula corynosoma* and *Leydia sp.*).

Keywords: Fiddler crab, metazoarian parasites, Progreso, Yucatán.

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## Abstract – 029 Oral

**ENVIRONMENTAL INFLUENCE ON MATURITY STAGE SPATIAL DISTRIBUTION  
OF WHITEMOUTH CROAKER (*Micropogonias furnieri*)  
ALONG AN ESTUARINE GRADIENT**

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The maturity stage distribution of the whitemouth croaker (*Micropogonias furnieri*) and its relationship to environmental factors was evaluated from 166 stations sampled between 1994, 95, 96, 97, 98, 99 and 2003 during spring within the Río de la Plata estuary (36° S, 56° W). A canonical correspondence analysis (CCA) was used to define maturity stage spatial distribution of whitemouth croaker and to estimate their association with environmental factors (depth, temperature and salinity of surface and bottom waters, horizontal gradient of bottom salinity and bottom temperature, and vertical stratification). Results indicated that bottom salinity has a major influence on the spatial distribution pattern of *M. furnieri* maturity stage from spent and resting stage, associated to high salinities, to immature and gravid (with hydrated oocytes) and running stage, associated to low salinity, across developing and partially spent stage. Although the immature stage, and gravid and running stage are associated to similar bottom salinities, these stages were segregated, been the spent stages associated to high bottom salinity horizontal gradient. That distinct preferences for different bottom salinities and bottom salinity horizontal gradient by the various maturity stage of this species results in a differential distribution pattern along the main axis of the estuary. The area with low salinities and high horizontal bottom salinity gradient, associated habitat for gravid (with hydrated oocytes) and running stage, is located at the river head. The horizontal retention mechanism within spawning habitat favors the growth and survival of fish larvae, and the transportation to nursery habitat

Keywords: *Micropogonias furnieri*, maturity stage, environmental factors, Río de la Plata, estuary

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## Abstract – 031 Oral

**STRIPED WEAKFISH POPULATION STRUCTURE IN THE URUGUAYAN COASTAL ZONE, ENVIRONMENTAL INFLUENCE ON ITS INTER-ANNUAL VARIABILITY***A. J. Jaureguizar\**, and *R.A. Guerrero*

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The springtime temporal variations on striped weakfish (*Cynoscion guatucupa*) population structure and its relationship to environmental factors was evaluated from 86 stations sampled in 1994, 98, 99 and 2003 in the Uruguayan coastal zone (35°-33.4°S). We examined the inter-annual variability of age-class structure over fourth years under different oceanographic conditions: (1) 1998 (El Niño year) was characterized by elevated water temperature; (2) 1999 (La Niña year) was characterized by decreased water temperature; and (3) 1994 and 2003 were 'typical years' with intermediate values in that parameter. To determine whether or not major shifts in population structure occurred between years we used ANOSIM and SIMPER analysis to determine which age-class typified and discriminated between years. A canonical correspondence analysis (CCA) was used to define age-class structure temporal pattern of *C. guatucupa* and to estimate its associations with environmental factors (depth, temperature, salinity, vertical stratification, and zonal and meridional component of the wind). The *C. guatucupa* population structure showed significant difference between 1998-1999 and 1994-2003. During 1998 and 1999 years the population structure was dominated by adults (between 4 and >7 age-class), while that in 1994 and 2003 years the population structure was dominated by juveniles (between 0 and 3 age-class). CCA results indicated that zonal wind and salinity has a major influence on the temporal pattern of *C. guatucupa* population structure. Juvenile population structure was associated low salinities and occurred when the wind flow force an inflow of freshwater into the marine coastal area from the Rio de la Plata estuary, while that adult structure, associated to high salinities, occurred when the area was dominated by an wind forced inflow of shelf water. The obtained results support the hypothesis that the environmental synoptic condition has major influence on the fish distribution and its population structure than the large scale one

Keywords: *Cynoscion guatucupa*, population structure, Uruguayan coastal zone, environmental influence, inter-annual variability

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## Abstract – 032 Oral

**HABITAT USE FOR GROWTH AND RECRUITMENT  
OF PACIFIC YELLOWLEG SHRIMP *Farfantepenaeus Californiensis*  
(DECAPODA, PENAEIDAE) ON THE CONTINENTAL SHELF  
AND ADJACENT AGIABAMPO LAGOON, MEXICO**

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This study analyzed growth and recruitment of Pacific yellowleg shrimp *Farfantepenaeus californiensis* (Holmes, 1900) populations inhabiting semi-arid coastal lagoons and continental shelf in a semi-arid subtropical region in the Gulf of California, Mexico. Biological samplings of the yellowleg shrimp population was conducted in the coastal lagoon and offshore on a monthly basis from December 2001 to November 2003. The length of females ranged from 90 to 150 mm, greater lengths were more common offshore during April and July. In the lagoon, shorter specimens prevailed all year. There were no significant differences between lagoon and offshore in mean length to within 1% of probability. The dynamics of penaeid shrimp in semi-arid climate lagoons differs from the pattern found in more semi-tropical parts of the Mexican Pacific, where lagoons do not have permanent communication with the Gulf of California. Evidence suggests that this species can complete its life cycle in the lagoon system or the continental shelf.

Keywords: *Farfantepenaeus californiensis*, Agiabampo, habitat use

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## Abstract – 034 Oral

**FISH ECOLOGY AND TERRESTRIAL CARBON USE IN THE COASTAL ZONE:  
IMPLICATIONS FOR DEMERSAL FISH PRODUCTION***A. Darnaude*<sup>1\*</sup>, *M. Harmelin-Vivien*<sup>2</sup>, and *C. Salen-Picard*<sup>2</sup><sup>1</sup> CNRS (France), <sup>2</sup> Centre d'Océanologie de Marseille (France)

Successful fisheries management depends on our ability to identify causes of population fluctuations. Relationships between climate and fisheries have been explained for many pelagic species. However, the effects of temporal variations in weather conditions on demersal resources are less well understood. Here we present the results of a study investigating the role of fish ecology in population responses to changes in continental inputs to coastal areas. To assess the conditions for terrestrial particulate organic matter (POM) uptake by benthic fish, depth distribution, diet and stable isotope data from the juveniles and adults of five commercial flatfish species were compared off the Rhone River (NW Mediterranean). Isotopic signatures differed with fish species and benthic life stage, suggesting intra- and interspecific differences in trophic levels and food sources. Food web analysis indicated terrestrial POM uptake in all life stages of *Solea solea* and *Arnoglossus laterna*, in *Buglossidium luteum* adults and in *Solea lascaris* juveniles, whereas all life stages of *Citharus linguatula*, *S. lascaris* adults and *B. luteum* juveniles exploited marine POM almost exclusively. Fish diet and depth distribution accounted fully for the differences in terrestrial POM uptake observed. Greater terrestrial signatures were observed in fish eating larger quantities of deposit-feeding polychaetes (main prey exploiting terrestrial POM) and occurring mainly at 30-50 m depth (where river POM sedimentation and its uptake by the benthos were the highest). Due to differences in fish depth distribution and diet, Rhone River floods were predicted to have little effect on *C. linguatula* but to increase the other four species' stocks for several years, with a maximum impact on *S. solea*. Because the ability of coastal benthic fish to exploit terrestrial inputs depends strongly on their ecology, this parameter must be carefully assessed before making hypotheses about the consequences of variations in river discharge on fisheries' production.

Keywords: Benthic food webs, population dynamics, river run-off, stable isotopes

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## Abstract – 035 Oral

**LINKAGE AMONG CLIMATIC VARIATION AND ARTISANAL FISHERIES  
BEHAVIOR OF COMMON SNOOK (*Centropomus undecimalis*)  
IN TROPICAL ATLANTIC COAST**

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Common snook (*Centropomus undecimalis*) is a very important resource for both artisanal and sport fisheries in Tabasco, Mexico. However, Capture per Unit Effort (CPUE) has diminished more than 50% in the last half decade; possible causes are over-fishing and change in the local climatic and hydrological conditions. The objective of this research is to show a possible relation among CPUE and fishermen behavior (effort) with pluvial precipitation (PP) and sea surface temperature (SST). We collected data of capture of common snook (kg per vessel) in a reception center of San Pedro Port, Centla, Tabasco, from September 1999 to June 2005. Pluvial precipitation data were obtained from the Comisión Nacional del Agua and SST data from satellite images provided by The International Research Institute for Climate and Society. Monthly average data were standardized (Std. Score = (raw score - mean)/Std. deviation) and smoothed with moving average, multiple and simple correlation were tested. Results show that in the first half of the analyzed period (May 2000 to March 2002) the peaks of Effort and CPUE precede the highest values of PP and SST (June to August each year). While in 2002 the highest values of effort (fishermen behavior) were observed from October to December (152 vessels/month), this is probably related to a change in annual climatic conditions. Along 2002 were registered anomalous peaks of PP during June (250mm), September (425mm), and November (300mm). This change in rain pattern is coincident with 2002 El Niño event. After it the effort and CPUE repeated the behavior previously described, although CPUE was low (average 13.7 kg/vessel). We concluded that effort (fishermen behavior) is influenced principally by previous experiences and prevailing climatic conditions (PP). The CPUE reflects success of the recruitment process of common snook into fishing area in response to the change in climatic conditions.

Keywords: Climatic variability, tropical fisheries, CPUE, Tabasco, coastal environment.

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## Abstract – 037 Oral

**EFFECTS OF THE 1997-1998 ENSO EVENT ON THE DEMERSAL  
FISH COMMUNITIES FROM THE CONTINENTAL SHELF  
FROM JALISCO AND COLIMA, MEXICO**

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The results of an analysis about the effects of the 1997-1998 ENSO event on the the demersal fish communities from the continental shelf from Jalisco and Colima, Mexico, are showed. 230 fish species were identified. There were caught more than 144,000 fishes with an approximate weight of 6,500 kg. The most important fish species were *Porichthys margaritatus*, *Syacium ovale*, *Cynoscion nanus*, *Diodon hystrix* and *Urotrygon asterias*. The catch by unit of area (CPUA) of the abundance (number of individuals by hectare) was from 495 organisms by hectare in the stratum two of the El Coco site, up to 1752 organisms in the stratum two of Navidad site. However the differences observed in the abundance among sites, strata or years were not significant, except for the stratum one of the El Coco ( $F=2.87$ ,  $p < 0.05$ ). The biomass stayed below the 75 kg/ha during the whole study, finding significant differences mainly among the strata of depth from both places (Navidad:  $F=6.64$ ,  $p < 0.05$ ; El Coco:  $F=35.97$ ,  $p < 0.05$ ), but don't between years. The diversity only showed differences among strata ( $F=10.7$ ,  $p < 0.05$ ), as well as the specific richness ( $F=73.5$ ,  $p < 0.05$ ). The taxonomic distinctness indexes showed that a bigger diversity exists in the stratum one, and also that the species that inhabit there are less taxonomically related among them that those that are in the stratum two. By way of the ordination and classification analysis it was verified that the group of species shows a clear separation for strata of depth; although some species also appear in both strata, it is remarkable the difference of their contribution to the similarity of one or another stratum. In general a rearrangement of the fish fauna was observed in accordance with the environmental conditions. Finally, the environmental changes caused by the 1997-1998 ENSO event had effects that could be considered of moderate to severe, as ecological, like changes in the composition, as economic.

Keywords: Fish community ecology, demersal fishes, ENSO event

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## Abstract – 040 Oral

**SPATIAL AND TEMPORAL DISTRIBUTION OF ESTUARINE-DEPENDANT  
FISHES IN THE SAVANNAH RIVER ESTUARY, USA***C. A. Jennings\**, and *R. S. Weyers*

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Attempts to assess how the fish assemblage in the Savannah River Estuary (SRE) might be affected by a proposed harbor expansion project for the Port of Savannah (Savannah, GA, USA) were hindered by the lack of information about the spatial and temporal distribution of fishes in the estuary. Accordingly, we conducted a 2-year investigation to determine the temporal and spatial distribution of estuarine-dependant fishes in the SRE. We used ichthyoplankton nets, a drop sampler, and various seines to sample the fishes monthly at eight, 2-km long reaches of the SRE. During the fish sampling, we also measured water quality (i.e., temperature, salinity, dissolved oxygen, conductivity, and pH) in depth-integrated profiles during the spring and neap tidal periods and in surface (<1m) measurements. We used two-way ANOVA to evaluate species distribution and abundance among seasons (spring, summer, fall, winter) and habitats (polyhaline >15ppt; mesohaline 5-15ppt; oligohaline 1-5ppt; and tidal freshwater <1ppt). Fish sampling yielded 91 fish species and 68,826 individuals. Fish abundance, distribution, and assemblages varied either among habitats or seasonally ( $P < 0.01$ ). Fish density and species richness were low in fall, increased in late winter, and peaked in spring. Spatial patterns in fish distribution were less recognizable. Most members of the fish community were estuarine generalists capable of tolerating a wide range of salinities (5.0-15.0 ‰). Marine species whose distribution was limited to areas with higher salinities (> 10 ‰) comprised a smaller subset of the assemblage; these species occasionally invaded the estuary as the salt wedge moved inland during periods of low river discharge. Obligate freshwater species and those intolerant of salinities above 5.0 ‰ comprised the smallest component of the assemblage. Members of this latter group may be at the greatest risk of range contraction or population declines in the advent of increased salinities in the estuary.

Keywords: Ichthyoplankton, estuarine-dependant fishes, Savannah river estuary, salinity-defined habitats, harbor expansion

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## Abstract – 042 Oral

**RELATIONSHIP BETWEEN TYPE OF BOTTOMS AND SPATIAL  
DISTRIBUTION OF THE RED GROUPER (*Epinephelus morio*),  
IN THE CAMPECHE BANK, MEXICO**

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The red grouper *Epinephelus morio* has been historically one of the most important fisheries of the Campeche Bank where two fleets of Mexico and one from Cuba participate. Currently the stock size is one third respects to the early 70s and the state of the fishery was declared as overfished. Several management measures have been taken in order to improve the state of the stock such as minimum legal size and in recent years a closed season however, the stock remains depleted. Federal government have expressed the necessity to develop specific research aimed to explore the potential use of marine protected areas as a management measure for stock recovery and maintenance of stock health. The first phase in this research, and considering fish behavior, this contribution investigates the relationship between type of bottoms with the spatial stock distribution and structure. For this we used 11 types of bottoms which are related with three different biological stages of the life history; juveniles, young adults and late adults. Quantitative analysis suggests a significant relationship between the spatial distribution of the red grouper and the bottoms. These results are the base for further modeling and exploration of the use of a MPA as management tool for fisheries.

Keywords: Red grouper, bottoms, spatial distribution, Gulf of Mexico

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## Abstract – 045 Poster

**FISH POPULATION SURVEYS IN ESTUARIES: A COMPARISON BETWEEN  
ACOUSTIC AT MOORED STATIONS AND PURSE SEINE SURVEYS**

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In most estuarine ecosystems, the fish biomass is difficult to estimate, since most of the standard sampling methods are difficult to implement and may be limited to certain biotopes. Moreover, Protected Areas are no longer limited to marine ecosystems and several protected areas have been created in estuaries, lagoons or mangrove environments. In these areas, turbid waters do not allow direct diving observations and fish sampling, often performed using destructive – because efficient and non selective - gears such as trawling or seine nets, is always an ethic problem. As a consequence there is an increased need for liable, non-destructive methods to study fish assemblages in these environments. In order to describe the fish biomass distribution and evolution in the Gambia estuary, five research surveys have been conducted at different hydrological seasons. The fish assemblages were sampled by vertical echosounding at moored stations and at the same time and same location with a purse seine. The purpose of this work, still in process, is to compare the two methods, to try to inter-calibrate them and to seek for their complementarity. Though significant, the global direct correlation between estimations of biomass performed with the two sampling methods were too low to be considered satisfactory. Moreover the level of correlation between the two methods varies extensively following the survey, the season or the zone of the estuary taken into account. The role of the main environmental variables: depth, salinity, transparency and current strength on the quality of the correlation of the estimation made by the two methods was emphasized.

Keywords: Fish communities, estuary, West Africa, acoustics, purse seine

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## Abstract – 061 Poster

**A COMPARATIVE ANALYSIS OF FISH ASSEMBLAGES SPATIO-TEMPORAL  
STRUCTURE IN FOUR WEST AFRICAN ESTUARINE ECOSYSTEMS***M. Simier*<sup>1\*</sup>, *J.M. Ecoutin*<sup>2</sup>, and *J.J. Albaret*<sup>2</sup><sup>1</sup>Institut de Recherche pour le Développement (IRD), <sup>2</sup>IRD-Dakar (Senegal)

Fish assemblages, as indicators of environmental changes, are known to be good tools for determining the state of health of aquatic ecosystems. In estuarine environments, at the interface between riverine and oceanic domains, their composition is highly influenced by the balance of fresh and marine waters inputs. We compare the fish assemblages in four datasets from a comprehensive database gathering information collected by IRD since the 80s on fish assemblages and their environment in West African estuarine ecosystems. These data, collected using the same protocol and gear (purse seine net), are representative of various types of environments: the Ebrié Lagoon (Ivory Coast), the Fataala Estuary (Guinea), the Gambia Estuary (The Gambia) and the inverse hypersaline Sine-Saloum Delta (Senegal). For each ecosystem, two datasets were used, one for the dry season and the other for the wet season. A total number of 119 species belonging to eight bio-ecological categories were identified. A correspondence analysis showed a double marine-freshwater affinity gradient. The freshwater affinity component of assemblages was only observed in some areas of the Ebrié Lagoon and in the upper zone of the Gambia Estuary. According to the ecosystem, the main species from these categories were different: mainly Bagridae and Schilbeidae in Ebrié, and Synodontidae in Gambia. The strictly estuarine component was particularly well represented in the Ebrié Lagoon in terms of number of species. The marine affinity component was largely predominant in the Fataala and especially in the Sine-Saloum estuaries. The assemblages of the hypersaline upper zone of the Sine-Saloum, particularly during the dry season, were characterized by few species belonging to both Marine-Estuarine and Estuarine with marine affinity categories (Mugilidae), and strictly Estuarine species (Cichlidae). For a better knowledge of the dynamics of these ecosystems, a comparison was made between the spatial organization of fish assemblage in the dry and the wet seasons.

Keywords: Estuary, West Africa, fish assemblages, ecological categories, comparative approach

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## Abstract – 066 Poster

**THE RELATION BETWEEN MANGROVE AND THE JUVENILE FISH DIET  
IN TWO WEST-AFRICAN ESTUARIES***N. Gning*<sup>1\*</sup>, and *G. Vidy*<sup>2</sup><sup>1</sup> Cheikh Anta Diop University, Dakar/RAP-IRD (Senegal),<sup>2</sup> Institut de Recherche pour le Développement (France)

Among the benefits juvenile fish are supposed to obtain when entering estuarine mangrove ecosystems, abundant food resources are frequently related. The exact relation between those resources and the mangrove is far to be clear and evidence from literature is not establish. The diet of some species whose juveniles are common in the mangrove area of the Sine Saloum and Gambia river estuaries (West-Africa) was approached through a qualitative study. First results showed a clear link between the diet of young fishes and the fauna located on or near the mangrove pop-root. A new approach, using stable isotopes in juvenile fish, is in progress to improve those results.

Keywords: Juvenile fish, nursery, mangrove, feeding ecology,

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## Abstract – 075 Oral

**CONSTRUCTION OF A FISHERIES MODEL INCORPORATING  
CLIMATE VARIABILITY FOR THE STOCKS OF *Haliotis* spp. (Abalone)  
IN BAJA CALIFORNIA, MEXICO**

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The abalone (Gastropoda: *Haliotis*) is a highly priced and globally distributed marine resource. In the area of Baja California, Mexico it is of great importance for the survival of many human settlements along the Pacific coast. In spite of the high effort to regulate the fishery at present the stocks are heavily decimated. To evaluate the importance of climatic variability and to predict future development of the stocks of two economically important species (*H. corrugata* and *H. fulgens*) a surplus-production model was applied to available fisheries and biomass data. Three different approaches were followed: 1) applied the model as proposed originally, 2) replaced the original linear observation model with a non-linear model and 3) was a combined model that incorporated fisheries and climate variability as extrinsic factors via the model parameters that reflect density-dependent, density-independent and fishery processes. An anomaly series of the Pacific Decadal Oscillation (PDO) Index with the cold and warm regimes of the Pacific representing water temperature was applied to the combined model. Results indicate that climatic variability has a strong influence on the abundance of *H. corrugata* with a low performance during “warm” regimes. The stock of the other species, *H. fulgens*, is not affected in its biological productivity but it is influenced indirectly by climate effects via its fishery. The combined models predict that during the favourable “cold” regime in which the PDO entered around 2000 the resource will recuperate if exploited at a low level. The model designed here can only predict the development of *Haliotis* in Baja California, as the change of environmental factors induced by a latitudinal or vertical gradient is similar to that induced by temporal variability. CPUE is not suitable as indicator of stock abundance.

Keywords: Climate variability, surplus production model, *Haliotis*, Pacific decadal oscillation

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## Abstract – 076 Poster

**NITRIFYING PROCESSES IN THE WATER-SEDIMENT INTERFACE  
OF SONTECOMAPAN LAGOON, VERACRUZ, MEXICO***V. Morán-Villa\*, M. del J. Ferrara-Guerrero, and J. Aldeco-Ramírez*

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Microbial communities have a relevant role in the complex organic compounds oxidation and essential nutrients regeneration for feeding the ecosystems primary production, which is regulated principally by the availability of nitrogen of phytoplanktic assimilation. In the shallow coastal environments, the highest percentage of recycled nitrogen is emitted from the sediments towards the water column, contributing mainly to the requirements of nitrogen under the form of ammonium for the phytoplankton growth. Among physical, chemical and biological factors, the temperature, ammonium concentration, pH, dissolved CO<sub>2</sub> concentration, salinity, inhibiting compounds, macrofaunal activity and presence of macrophytes, among other things are important in the regulation of the nitrifying process in the marine coastal sediments. The Sontecomapan Lagoon, located SW from Veracruz State (Gulf of Mexico), is actually one of the priority zones in terms of exploitation and conservation; due to this fact, this study pretends to contribute to the knowledge of the nitrifying processes in the water-sediment interface of this lagoon. The samples of bottom water and first centimetre of sediment were obtained from 6 stations within the lagoon. The nitrification rates were measured using the sodium chlorate inhibition technique. The NH<sub>4</sub><sup>+</sup>, NO<sub>2</sub><sup>-</sup> y NO<sub>3</sub><sup>-</sup> analysis were made each 4 hours by colorimetric techniques, according to Aminot-Chaussepied (1983). The nitrification rates observed varied from 0.10 to 4.17 μmol day<sup>-1</sup> l<sup>-1</sup> in the bottom water, and from 4.76 to 156.9 μmol m<sup>-2</sup> h<sup>-1</sup> in the sediment. Concerning the ammonium oxidising bacteria (9.33 x 10<sup>7</sup>), nitrite oxidising bacteria (5 x 10<sup>4</sup>) and denitrifying bacteria (28 x 10<sup>7</sup>), the highest values were encountered in the sediments in “Nortes” season under rivers influence zones, and also in the *Ruppia maritima* zone.

Keywords: Coastal lagoon, nitrification rate, bacteria, bottom water, upper layer sediments

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## Abstract – 091 Oral

**COMMUNITY PATTERNS OF TREMATODES  
OF *Cerithidea pliculosa* IN CELESTUN, YUCATAN, MEXICO**

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We now know that mollusks can play an important role in vertebrate community structures, or the subsequent host. In temperate latitudes, the seasonal changes in the host population (density, size, etc.) can influence the level of infection and structure of the trematode community in the invertebrate hosts. However, there is a lack of knowledge regarding this subject in tropical systems. Therefore, this study aims to describe the community structure of trematode larvae in the snail *Cerithidea pliculosa* and to determine patterns at component community level over time. Snails were collected monthly in two water springs (*Yá'xaa* and *Baldiocera*) in Celestun, Yucatan, from 2001 to 2005. A total of five trematode species were found. In both water springs, the prevalence of trematodes was similar for the rainy and dry seasons, but decreased in the season of the north winds.

Keywords: Trematode, component community, snails

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## Abstract – 098 Poster

**PARASITES OF THE FIDDLER CRAB *Uca thayeri* IN CELESTUN, MEXICO***N. Argáez-García*<sup>1\*</sup>, *M. L. Aguirre-Macedo*<sup>1</sup>, and *S. Guillén-Hernández*<sup>2</sup><sup>1</sup>Centro de Investigación y Estudios Avanzados-IPN Unidad Mérida (Mexico),<sup>2</sup>Universidad Autónoma de Yucatán (Mexico)

Fiddler crabs are an important link in the food web of marshes and estuaries, where contribute to the parasitic transmission. However, in the Laguna de Celestún, Mexico, the knowledge of the metazoan parasites which use these hosts are scarce. In the present we identify the parasites species which are infecting the fiddler crab (*Uca thayeri*) in this area. The effect of the salinity on the infection parameters of parasites of the fiddler crab *U. thayeri* will be analyzed. We carry out sixteen samplings from June 2004 to August 2005 in four different locations along the estuary where we collected 30 crabs in each sampling. The parasites were collected and identified. Five metazoan parasites were identified parasiting these crab species: the digenean metacercaria *Probolocorypher sp.*, the acanthocephalan *Hexaglandula corynosoma*, one larval nematode and the isopod *Leidyia sp.* Except the isopod, all the parasites were in larval stage, emphasizing the ecological importance of these hosts in the transmission of parasites in this ecosystem. The ecological parameters were obtained as laid Bush *et al.* 1997.

Keywords: Parasites, crabs, communities, Celestún, Mexico

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## Abstract – 003 Oral

**RELATIONSHIP BETWEEN BENTHIC COMMUNITY CHARACTERISTICS  
AND HABITAT QUALITY IN CELESTUN COASTAL LAGOON***D. Pech\*, N.A. Hernandez-Guevara, and P.L. Ardisson*

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The relationship between species diversity, abundance of benthic community and sediment characteristics was examined along the estuarine habitat of the Celestun coastal lagoon. Data were collected seasonally during 1994-1995. Distance between the 12 sampling stations was set up 1-1.5 km apart along the estuarine gradient. Temperature, salinity, pH and dissolved oxygen were recorded as physical factors associated to the water column. Organic matter, porosity, interstitial salinity, pH, and sand, silt and clay composition were recorded as physical factors associated to the substratum. Preliminary results from the analysis of physical-chemical factors and biological characteristics of the benthic community show that Celestun lagoon is an environment highly heterogeneous in both the spatial and temporal axes of variability. Multiple regression analysis shows that the benthic species diversity is mainly explained by temperature, salinity and pH factors, meanwhile abundance are mainly explained by the sediment composition and interstitial salinity. Canonical analysis shows that sediment texture and interstitial salinity were the main factors that structure the benthic community. These preliminary findings show that habitat quality plays an important role on the establishment of the benthic species and the patterns definition in this coastal lagoon. A conceptual model of the macrobenthic community as a function of habitat quality is presented. Since this historical data were generated in 1994-1995, this model may serve as a reference biological criteria to establish current monitoring programs at this coastal lagoon.

Keywords: Diversity, habitat quality, benthos, Celestun

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## Abstract – 006 Oral

**COMPARATIVE FISH SCHOOLS MORPHOLOGY, SWIMMING SPEED  
AND BEHAVIOUR IN TWO SHALLOW WATER LAGOON CHANNELS,  
OBSERVED AT SHORT RANGE BY MULTIBEAM SONAR**

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In situ observation in shallow water environment of complete amphidromus fish schools is seldom. Nevertheless such observations are needed for ecological and management studies and purposes. The fish schools of two Mediterranean shallow waters lagoons have been recorded continuously during a complete diel cycle (autumn, 1999). In this study we used multibeam sonar in horizontal beaming (25 m), set in fixed position, covering the whole cross part of the 1.5 m depth channel. The sonar provides successive images where the fish schools produce characteristic mobile 'echo traces'. The method of sonar data analysis is thus presented, by the use of Infobancs software, which permits to extract the information on fish school delivered by the sonar at a constant time step during their passage inside the sonar field. The information collected for each observed fish schools of both lagoons were: observation time, size, shape, position inside the channel, instantaneous swimming speed, index of sinuosity and displacement direction. The amphidromus fish schools were small compared with marine one (as clupeids); three quarter of them had a surface inferior to 9 m<sup>2</sup>. There were no significant differences of length, width, average surface and shape between the schools of the two lagoons. Nevertheless the variability of these values was higher in Prevost than in Ingril. There is an effect of the time of the day and the lagoon origin on the school positions inside the channel; the schools were closer to the bank in Ingril than in Prevost and during the day than during the night. The measured swimming speed values are presented (80 % of them are < 1.5 m.s<sup>-1</sup>), they were independent from the sinuosity index except for the school above 2.5 m.s<sup>-1</sup> which shown a more straight movement. According our results we discuss about the multi pass hypothesis.

Keywords: Fish school, shallow water, lagoon, sonar, amphidromus

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## Abstract – 008 Poster

**TITLE ENVIRONMENT AND FISH COMMUNITY VARIATIONS  
AT A TEMPORAL AND SPATIAL SCALES OF THE ALVARADO LAGOON SYSTEM**

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Hydrologic and nektonic community variations were measured between July 2000 and June 2001 at the lagoon system of Alvarado, Veracruz. The data were collected during the three seasons of the year in which the area can be divided. Dissolved oxygen, salinity, water temperature, nutrients, and chlorophyll a were measured as well as fishes in different stations located at the rivers, urban and marine influenced areas. A total of 3344 organisms were collected including 63 species. Of the total organisms collected, 766 belonged to 59 species for the windy season, 1270 to 57 species for the dry season and 1308 organisms of 53 species for the rainy season. Nutrients concentrations were higher at the rivers' mouth during the rainy and windy seasons. This result is related to the high agricultural activities around the area, a re-suspension of sediments during the windy season, and the subsequent transformation of the organic matter into liable nutrients. According to their physical and chemical characteristics, three areas were identified within the lagoon system corresponding to their topography: Camaronera Lagoon, Buen País Lagoon, and urban zone of the Alvarado Lagoon. Relating the environmental characteristics to the spatial distribution of fishes, it was found that during the windy and dry seasons marine-related species dominated in the Camaronera – Buen País lagoons. In here, species like *Strongylura marina*, *Bagre marinus*, *Hyporhamphus roberti*, *Hemirhamphus brasiliensis*, *Hemicaranx amblyrhynchus*, *Oligoplites saurus*, *Elops saurus* and *Sphyraena guachancho*. On the other hand, the fresh water region, influenced by the Papaloapan, Acula and Blanco Rivers, is dominated by species like *Rhamdia guatemalensis*, *Cichlasoma urophthalmus*, *Dormitator maculatus*, *Agonostomus monticola*, *Belonesox belizanus*, *Oreochromis aureus*, *Guavina guavina* and *Gobiomorus dormitor*. Some of the species occurring along the lagoon system, such as *Mugil curema*, *Mugil cephalus*, *Dormitator maculatus*, *Centropomus undecimalis*, *Centropomus parallelus* and *Cichlasoma urophthalmus*, are commercially important.

Keywords: Veracruz, Mexico, fish ecology, coastal lagoon, RAMSAR Site

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## Abstract – 011 Oral

**TROPHIC LEVEL AT A MICROSCALE:  
THE SOUTHEAST OF VERACRUZ ARTISANAL FISHERIES ANALYSIS***L. Abarca-Arenas\*, R. Ronzón-Rodríguez, and E. Valero-Pacheco*

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At a macroscale, the world fisheries present what appears to be a decline in the trophic level of the target species. At a mesoscale, the results are not conclusive with some areas declining while others not. Few works have been done at a microscale, which is the objective of the present research, the analysis of a six years data for five, contiguous artisanal fisheries. The fisheries target species are freshwater fish to oceanic, depending on the location of the fisher's congregation. Using the same methodology as previous works, we calculated the trophic level (TL) for each fishery during 1999 to 2004. As a result, freshwater fisheries presented a low TL; mixed fisheries (freshwater and sea species) presented a mid TL, and oceanic fisheries presented the highest of all values. The temporal trend of the TL for all fisheries presented no reduction with a small increase in the oceanic fisheries. The mean TL value for the five fisheries along time showed a steady behavior during the period under study. These results resemble those found for studies at a mesoscale fishery (e.g. Mexico as a country or the Gulf of Mexico). It is argued here that the high diversity of species with a change of target species during the period studied is responsible for the no decrease of the fisheries trophic level as has been shown for large scale fisheries around the world.

Keywords: Trophic level, artisanal fisheries, Mexico, ECOPATH

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## Abstract – 014 Oral

**THE HELMINTH INFRACOMMUNITES OF THE FIDDLER CRAB  
(*Uca thayeri*) AS BIOINDICATORS OF CHEMICAL POLLUTION  
OF COASTAL LAGOONS OF YUCATAN, MEXICO**

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The statistical associations between chemical pollutants and the helminth infracommunities of parasites of the fiddler crab *Uca thayeri* were investigated. Data on pollutants were obtained from sediments by gas chromatography. Data on the helminth parasites were obtained for 313 fiddler crabs from 12 sampling points in three coastal lagoons (Celestun, Chelem, Dzilam) of Yucatan. Pollutants in sediments were pesticides, polychlorinated biphenyls [PCBs] and polycyclic aromatic hydrocarbons [PAHs]). Heavy metal content was not determined. Seven helminth species were recovered in the fiddler crabs. Using redundancy analysis (RDA), we found significant negative associations between pesticides, PCBs and 2-3 ring PAHs with respect to the mean number of helminths per crab ( $F = 8.920$ ;  $P = 0.0002$ ; 4999 permutations). These associations suggest deleterious effects of the pollutants on the mortality of (1) free-living larval forms, (2) metacercariae in the crab, (3) infected crab or (4) intermediate host. The results suggest that quantitative changes in these infracommunities may be good indicators of environmental impact by chemical pollution in the coastal lagoons of Yucatan.

Keywords: Parasites, coastal lagoons, Yucatán

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## Abstract – 015 Oral

**THE HELMINTH INFRACOMMUNITIES OF THE CHECKERED PUFFER  
(*Spherooides testudines*) AND THE JENNY MOJARRA  
(*Eucinostomus gula*) AS BIOINDICATORS OF CHEMICAL  
POLLUTION OF COAST OF YUCATAN, MEXICO**

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The statistical associations between chemical pollutants present along the coast of Yucatan and the helminth infracommunity parameters of the checkered puffer *Spherooides testudineus* and the jenny mojarra *Eucinostomus gula* were investigated. Data on pollutants were obtained from sediments by gas chromatography. Data on the helminth infracommunities were obtained for 227 puffers from 60 sampling points in four coastal lagoons, and for 77 mojarras from 40 sampling points along the coast of Yucatan. Pollutants in sediments were pesticides, polychlorinated biphenyls [PCBs] and polycyclic aromatic hydrocarbons [PAHs]. Heavy metal content was not determined. Seven and six helminth species were recovered in puffers and mojarras respectively. Using redundancy analysis (RDA) and after controlling for fish length and sampling station, there were significant negative associations between pesticides and 2-3 PAHs with respect to the individual infracommunity values of the Brillouin diversity index in puffers ( $F=17.15$ ;  $P=0.0002$ ; 4999 permutations). For jenny mojarras, the RDA analysis showed significant negative associations between pesticides and PCBs with respect to the total and mean number of individual helminths in these infracommunities ( $F=11.21$ ;  $P=0.03$ ; 4999 permutations). These associations suggest deleterious effects of the pollutants on the mortality of (1) free-living larval forms, (2) metacercariae in the fish, (3) infected fish or (4) intermediate host. The results suggest that quantitative changes in these infracommunities may be good indicators of environmental impact by chemical pollution along the coast of Yucatan.

Keywords: Parasites, coastal lagoons, fish helminth communities

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## Abstract – 025 Oral

**USING INDICATORS TO ASSESS THE IMPACT OF HYPERHALINITY  
AND FISHING ON FISH CATCHES APPLICATION TO THE GAMBIA  
AND THE SINE SALOUM ESTUARIES**

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A comparative study, using environmental and biological indicators, was conducted in West Africa where two estuaries : Gambia and Sine Saloum, respectively located in the Gambia and Senegal, are particularly suited for investigating the impact of climate change and fishing effort on the fish assemblage. The Gambia estuary is a "normal" one, characterized by a seasonal freshwater flow, a decreasing salinity gradient from the mouth towards the head and a moderate exploitation by small-scale fisheries. At the contrary, the Sine Saloum doesn't receive any freshwater input from the river, is an inverse estuary with an increasing salinity from downstream to upstream (more than 100 psu) and is submitted to intensive fishing activities. The two estuaries are very close and, independently of natural and anthropogenic perturbations, could be characterized by the same fish assemblage. The comparison, based on surveys of commercial fisheries focused on fishing activities and catches in the two estuaries. Different indicators were used related to environment (physicochemical parameters, biotic capacity), exploitation (effort, CPUE, yield), species composition (index of diversity, ABC curves), sizes composition (average, slope), trophic levels (average, ratio top predators/phytoplanktonophagous), biological data (size at first maturity, fecundity, growth). From these results, we classified indicators and tried to identify those which are robust and can be used for comparative studies across years and ecosystems.

Keywords: Fish populations, biological indicators, estuary, fishing effort, drought

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## Abstract – 030 Poster

**COULD OTOLITH Sr:Ca RATIO BE USED AS A TOOL  
FOR DISCRIMINATING FISH POPULATIONS? EXAMPLE OF APPLICATION  
FOR *Sarotherodon melanotheron* POPULATIONS (PISCES, CICHLIDAE)  
IN THE HYPERSALINE ESTUARY OF SALOUM (SENEGAL)**

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Otolith microchemistry is a powerful tool in fish ecology and could be used in support to fishery management. In particular, the otolith strontium:calcium (Sr:Ca) ratio can be used as a marker to follow fish movements through waters with different salinity levels (*i.e.* Sr levels). In West Africa, the Saloum estuary (Senegal) has been submitted to strong perturbations due to a drought phenomena that occurred during the last 30 years, leading to an inverse gradient with higher salinities upstream (> 130). The habitat occupation strategy of the tilapia *Sarotherodon melanotheron* has been studied along the salinity gradient of the Saloum (salinity between 32 and 100). The individual migratory behaviour has been analysed from otolith Sr:Ca concentration ratios from fish sampled in five locations during the 2003 wet season and the 2004 dry season. In the upper part of the estuary (salinities > 50), the Sr:Ca ratio showed high variations, from 2.51 to  $33.30 \times 10^{-3}$ . These maximum observed values have never been reported in the literature. The individual mean of Sr:Ca ratios increased according to the salinity gradient in the estuary, with significantly higher values in the upper part (Sr:Ca mean =  $16 \times 10^{-3}$ ) than in the lower part (salinity < 50, Sr:Ca mean =  $12 \times 10^{-3}$ ). No significant difference in the Sr:Ca mean was observed between locations with comparable salinities. These ratios allowed therefore to discriminate the populations of this species and to hypothesize that they did not undertake large scale movements within the estuary. For fish species living in ecosystems with moving boundaries, such as estuaries, otolith microchemistry is potentially useful for the identification of the spatial distribution of populations and then for the management of fisheries.

Keywords: Estuary, drought, West Africa, otolith microchemistry

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## Abstract – 036 Oral

**TITLE SPATIAL PATTERNS OF MANGROVE SHORELINE FISH  
COMMUNITIES OF GUADELOUPE (FRENCH WEST INDIES)  
IN RELATION WITH ENVIRONMENTAL VARIABLES**

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The goal of the present study is to identify and explain the main patterns of spatial variation in shoreline mangrove fish communities of Guadeloupe Island in terms of the influence of major environmental variables. Thirty-two stations were studied along the Grand Cul-de-Sac Marin lagoon (Guadeloupe). Fishes were sampled with hoop-nets from February to April 2005. At each site, 18 environmental descriptors were estimated. A total of 89 species of fishes belonging to 37 families were identified. Hierarchical clusterings, canonical correspondence analyses and redundancy analyses were performed on the data so obtained. Fish community structures were explained by six quantitative descriptors (i.e. salinity, water transparency, nitrates, hydro dynamism factors, dissolved oxygen and pH). These descriptors were distributed along a gradient oriented from the coast seawards. This gradient opposed the mangrove stations under reef influence to the stations influenced by the proximity of river mouths. Canonical analyses also revealed the presence of an east-west gradient of confinement in the lagoon, characterized by the enrichment of the bottom communities by coral formations in the western part of the lagoon. This enrichment explained the presence of reef species in the mangrove fish community. Considering trophic categories of the mangrove fish assemblages, first and second order carnivores dominated in biomass in the stations located near river mouths whereas planctivores were dominant near reef areas. These last results suggest that food availability could play an important role in the structuration of the mangrove fish communities in addition to the abiotic factors.

Keywords: Fish community structure, spatial distribution, canonical correspondence analysis, redundancy Analysis, mangrove habitat

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## Abstract – 049 Oral

**FUNCTIONAL DIVERSITY OF TAXONOMICALLY DIVERSE  
COMMUNITIES IN RELATION TO ENVIRONMENTAL VARIABLES***S. Villéger<sup>1\*</sup>, J. Ramos Miranda<sup>2</sup>, D. Flores Hernández<sup>2</sup>, D. Mouillot<sup>1</sup>, and A. Sosa López<sup>2</sup>*<sup>1</sup> Université Montpellier II (France), <sup>2</sup> Universidad Autónoma de Campeche (Mexico)

One of the aims of ecology is certainly to understand relations between environment and species diversity at both global and local scales. As such we need ecosystems with strong environmental gradients where diversity is likely to be non-randomly distributed. Coastal lagoons are of these particular ecosystems as physico-chemical parameters vary greatly between marine-influenced and freshwater-influenced habitats. Furthermore coastal lagoons are of the greatest importance for human activities but are also both very sensitive to stress and more and more impacted by anthropogenic perturbations. Among all the communities living within, fish and shrimps are a main component not only in terms of living resources but also for the functioning of the system. Whilst most of previous studies on communities focused on species richness or abundance distribution within communities, a functional approach seems more appropriate since it allows generalization independently of taxonomy even across phyla. We thus analyzed the relations between ten physico-chemical parameters and several index of functional diversity calculated on nekton communities (fish, shrimps and cephalopods). The data were collected monthly in 37 stations around Terminos Lagoon (Campeche, Mexico) in 2003. The functional trait studied here is the trophic level which is an integrative parameter quantifying the diet of the species. Our results demonstrated that various components of functional diversity based on trophic level are not randomly distributed along environmental gradients but that some trophic guilds have preferendum. This study highlights how diversity is constrained by environmental constraints in such highly variable ecosystems.

Keywords: Nekton, trophic level, functional diversity, Terminos Lagoon

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## Abstract – 055 Poster

**DO THE PROXIMITY OF CORAL REEFS OR MANGROVES INFLUENCE  
THE JUVENILE FISH ASSEMBLAGES IN CARIBBEAN  
*Thalassia testudinum* SEAGRASS BEDS?**

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The seagrass beds are well recognized for their fundamental role as nurseries, shelter and feeding grounds in tropical areas. The aim of the present study was to examine whether the proximity of adjacent ecosystems like mangroves and coral reefs play a structuring role for the seagrass assemblages of juvenile fishes. For that purpose, the fish fauna of the *Thalassia testudinum* seagrass beds of the Grand Cul-de-Sac Marin Bay in Guadeloupe (F.W.I) was studied at two sites located near coral reefs and near coastal mangroves. The samples were collected using a seine net and a hoop net, both day and night. Examination of minimal and maximal length for each species revealed that the mean size of the fish was similar in both sites:  $7.9 \pm 0.16$  cm near mangroves and  $7.5 \pm 0.20$  cm near the reefs. Individuals less than 8 cm represented 70% of the fish abundance near the reef and 59% near mangroves. Both types of seagrass beds function as an important nursery habitat for juveniles since an equivalent number of fishes with a size inferior to 6 cm was found in both sites. A closer examination of the faunistic list reveals that, near the reef seagrass beds represent a good recruitment area for coral-reef fishes in addition to the typical seagrass species (51 species out of 71 possess juveniles). Near the coast, although the number of juveniles was lower (37 species out of 50), the recruitment was constituted by species from different origins (mangrove, seagrass and reefs).

Keywords: Seagrass beds, juvenile fishes, diel variations, reefs, mangroves

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## Abstract – 057 Oral

**ELASMOBRANCHS IN SHRIMP TRAWAL FISHING  
IN NORTH OF VERACRUZ, MEXICO**

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Between June and July 2005, two shrimp sea fishing cruises were reviewed with the goal of measuring the shrimp closed season effect and the impact of the trawl fishing in the elasmobranchs population. Two shrimp fishing steel boats were used. Each with 4 trawl nets. The first boat size was 20.3 meters (m) length with a 365 hp engine motor, and 16 m floatline in the nets. The second boat 21.3 m, 402 hp and 17 m in floatline. The study area was from Zempoala to Tamiahua. The depth oscillated between 12.7 and 85.5 meter. 73 fishing sets were performed, with an effort of 263 hours of trawl, working in an area of 6,038 hectares. 1,028 elasmobranchs were caught with 806 Kg of total weight. 7 rays and 3 sharks species were found: *Raja tejana* (491 organisms, 188kg.), *Gymnura micrura* (369 organisms, 385kg.), *Rhinobathos lentiginosus* (81, 62.7kg.), *Torpedo nobiliana* (25, 21.6kg), *Dasyatis americana* (9, 24.8kg.), *Raja spp.* (4, 4kg.), *Raja garmany* (4, 5kg.); *Squatina dumeril* (42, 107kg.), *Squalus spp* (2, 2kg.) y *Mustelus canis* (1, 7kg.). In the first travel, 484 organisms were identified and sexually counted. In the second travel, 544 organisms were identified, sexually counted, measured and weighted. Elasmobranchs represent only 6% of the total amount of capture in both travels. The capture per unit effort was 6.14 elasmobranchs per trawl hour, with elasmobranchs density of 0.17 organisms per hectare.

Keywords: Sharks, rays, shrimp.

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## Abstract – 058 Oral

**ELASMOBRANCH FISHERY IN CENTRAL AREA  
VERACRUZ STATE, MEXICO**

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From October 2004 to August 2005 the catches of shark fishing fleet in Anton Lizardo and Zapote Beach, from Veracruz, Mexico. was reviewed. Species were identified and measured. The fishing gear and techniques were also reported. The fishery is coastal. The fleet was formed of 27 fiberglass boats with a length of 7.6 meters. The boats were equipped with outboard engine motors from 60 to 125 h.p. The small-scale fishing gear consisted in bottom and surface long line, with 500 – 1600 curved No. 4 (eagle claw) hooks. Live bait (snappers, grunts) and fish flesh (rays, bonito, tunas, morays, sardines) were used. The fishery is multispecific; 4,933 organisms were counted; 17 species of shark were represented for 1448 organisms caught; 5 different ray species for 690 organisms and 60 species of teleostean for 2,795 organisms. The most frequent species were atlantic sharpnose shark (*Rhizoprionodon terraenovae*), 18%; southern stingray (*Dasyatis americana*) and crevalle jack (*Caranx hippos*), horse-eye jack (*C. latus*) 11% each. The global efficiency averages showed that 29 % organisms caught were sharks; 14% rays, and 57% teleosteans. These global efficiency averages changes in every location: Anton Lizardo 34, 11 y 55% and Zapote Beach 11, 24 y 65%, respectively. Differences were based in fishing techniques, bait, depth, hooks, zone, season, and environmental conditions.

Key words: multispecific, sharks, rays, teleostean, fishery coastal.

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## Abstract – 059 Poster

**SUSTAINABLE DEVELOPMENT IN WILD PROTECTED AREAS.  
EFFECTS OF THE AQUACULTURE OF PINK SHRIMP  
IN THE LAGUNA DE ROCHA NATIONAL PARK, URUGUAY**

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The environmental impact assay is a methodical and integrative analysis to identify, predict, interpret and communicate the effects of human actions to improve the rationality in the decision making process. From December 2003, and summer 2004, a pink shrimp aquaculture experience was carried out by the local fishermen cooperative at the South area of Laguna de Rocha (a National Park in Uruguay). The experience consisted in four fences, 2 with 20 and 2 with 30 individuals m<sup>-2</sup>). The feeding consisted of fish debris and shrimp ration, and the harvest started at the end of April. The objective was to analyse the impact of the pilot experience on abiotic water and sediment parameters, and on the structure of the benthos, through a modification of the BACI design. Samples (by triplicate) were taken inside the two fences with higher densities (impacted area), in an unaffected area (control) and at 15 and 50 m of distance from the fences (potentially affected area). Sampling was performed before the larvae inoculation, during and after the culture. The benthos community was collected with corers and the specific richness and total and relative abundance were estimated. Statistical analysis was done by Spearman correlation and two ways ANOVA. The results indicated that: 1) no impact was detected on the abiotic water and sediment parameters, with exception of ammonium, which increased, probably from shrimp excretion; 2) benthos was negatively affected, diminishing the community parameters due to the consumption by shrimp; 3) the impact was located only inside the fences. The recovery of the system after the fences removal was not evaluated, because shrimps were not completely removed. On an ecosystem perspective, this pilot experience does not represent a negative impact. The carrying capacity of this activity for the whole lagoon is under evaluation.

Keywords: Environmental impact, shrimp aquaculture, coastal lagoon

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## Abstract – 060 Oral

**SIMPLE INDICATORS AND PROCEDURES FOR THE MANAGEMENT  
OF BENTHIC RESOURCES WITHIN THE CHILEAN SYSTEM  
OF TERRITORIAL USER RIGHTS FOR FISHERIES (TURF)**

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In Chile a new tool for the co-management of benthic resources has been implemented, which grants exclusive fishing rights to fishermen organizations, subjected to a management plan which needs to be approved and is supervised by the fisheries authority. The management plan has to be proposed, and once implemented also monitored, by the fishermen organization, which nevertheless according to law, has to be assisted by a professional in marine sciences. In order to develop an effective co-management, with the fishermen getting and understanding relevant information about the status of their resources and environmental health, being capable to use this to decide how to proceed with the fishery within their management area, simple indicators and procedures are needed. The aim of this study was to analyze the information commonly produced in the monitoring of the management areas and to develop a protocol for the analysis and decision to be taken. A graphic analysis of time series of the abundance, condition and size structure is done, identifying patterns in their trajectories to be used as indicators of different situations. The different indicators are combined and integrated into a decision making matrix to be used by fishermen. The emphasis is on indicators which make sense to fishermen, and besides the information of the status of the resource and the system, also deliver useful information for a better commercialization of their products. Using this protocol the development of the Management Area System in Chile is analyzed and discussed.

Keywords: Chile, co-management, indicators

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## Abstract – 064 Oral

**HABITAT SPECIFIC GROWTH RATES AND CONDITION INDICES  
FOR THE SYMPATRIC SOLES POPULATIONS OF *Solea solea*  
(LINNAEUS, 1758) AND *S. senegalensis* KAUP 1858,  
IN THE TAGUS ESTUARY, PORTUGAL, BASED ON OTOLITH  
DAILY INCREMENTS AND RNA:DNA RATIO**

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Habitat specific growth rates, condition indices and hatching dates were estimated for *Solea solea* and *S. senegalensis*, in two nursery areas within the Tagus estuary. While in the uppermost nursery area of the Tagus estuary juveniles of the two species of sole live in sympatry, in the lower nursery only *S. senegalensis* is present. Daily increments of left lapillar otoliths were used to estimate age, determine growth rates and hatch dates for each population. Condition indices were assessed through RNA:DNA ratio in muscle samples. Growth rates were higher for *S. senegalensis* than for *S. solea*. Growth rates of *S. senegalensis* from the uppermost nursery were lower than those for the same species from the lower nursery. The RNA:DNA condition index followed the trend given by the growth rate estimates. RNA:DNA index was higher in *S. senegalensis* than in *S. solea*, while *S. senegalensis* from the uppermost nursery area presented lower condition values than the same species from the lower nursery. Larger variations in salinity and highest pollution loads may be important factors lowering the habitat quality of the uppermost nursery in comparison to the lower nursery which has smaller salinity variations and is less impacted by pollution and human pressure. The different hatching periods of each population imply different life strategies histories which may also have strongly influenced growth rates. The use of growth rate estimations based on otolith readings versus RNA:DNA indices for habitat quality assessment purposes is discussed

Keywords: Growth, otoliths, RNA:DNA, flatfish, habitat quality

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## Abstract – 065 Oral

**ECOLOGICAL INDICATORS FOR ASSESSING CONSEQUENCES OF MARINE  
PROTECTED AREAS AT THE SCALE OF FISH COMMUNITIES:  
EXAMPLES FROM CONTRASTED ECOSYSTEMS**

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Marine Protected Areas (MPA) are considered as major tools for integrated coastal management and for fisheries management. Representative MPA networks in particular in coastal areas are going to be designed in the next years as part of international agendas for conservation of biodiversity and management of coastal uses. Monitoring MPAs and assessing their performance with regard to the objectives of conservation and restoration of ecosystems is therefore indispensable. We propose statistical approaches that enable to evaluate and test ecological effects of MPA upon the overall fish community, while accounting for habitat. The structure of the assemblages is considered through a range of univariate and multivariate indicators constructed from biological responses such as abundance, size and diversity indices, and calculated for several standpoints that reflect the life-history and functional traits of the species in the assemblages. These methods were used and tested in contrasted examples from Mediterranean and coral reefs ecosystems. Significant results were obtained at several temporal and spatial scales. They provide guidelines for constructing ecological indicators that are valid in a variety of contexts.

Keywords: Marine protected area, ecological indicator, coastal ecosystems, diagnostic

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## Abstract – 069 Poster

**FUNCTIONAL AND TAXONOMIC DIVERSITY OF FISH ASSEMBLAGES  
USED AS ECOLOGICAL INDICATORS OF COASTAL MARINE ECOSYSTEMS***D. Rocklin*<sup>1\*</sup>, *M. Louis*<sup>2</sup>, *C. Bouchon*<sup>2</sup>, *Y. Bouchon-Navarro*<sup>2</sup>, *D. Mouillot*<sup>1</sup>, and *T. Do Chi*<sup>1</sup><sup>1</sup>Université Montpellier II (France), <sup>2</sup>Université Antilles Guyane (Guadeloupe, FWI)

Fish assemblages associated with sea grass nurseries in the Grand Cul-de-Sac Marin, Guadeloupe were characterised in terms of species richness, Shannon diversity, taxonomic diversity ( $\Delta$ ,  $\Delta+$ ), taxonomic distinctness ( $\Delta^*$ ) and functional diversity (FD). Fish sampling was carried out every two weeks in four stations of the lagoon : one seaward influenced by nearby coral reefs, two coastal, and one intermediate between seaward and coastal sites. Sampling took place from February to May 2004. The spatio-temporal variability of taxonomic indices were analysed and compared to traditional diversity indices. FD was evaluated using ten morphological measurements reflecting feeding, swimming and behavioural traits of species. Functional groups of species (FG) were then defined by running a clustering analysis on the ten morphological variables (Euclidean distance and Ward method). A total of 82 species were identified belonging to 32 families. The temporal trend in the seaward site showed at several occasions a decrease of diversity indices (such as Shannon and  $\Delta$ ) with an increase of  $\Delta^*$ , reflecting movements of schools taxonomically very different than the installed community. The two coastal sites were characterized by lower richness and taxonomic diversity whereas the intermediate site was characterised by a high taxonomic diversity. Clustering analysis lead to 21 FG, composed of species with common trophic level and/or habitat requirements. Fish assemblages in the intermediate site presented all the 21 FG and a high redundancy with 16 FG composed of more than one species. Only 17 FG were represented in the seaward site, of which 11 were single species groups. In contrast, almost all the FG were present in the coastal stations, but these groups were often represented by only one species. Consequently, these sites would be more sensitive to external perturbation, since the loss of one species could lead to the loss of a function.

Keywords: taxonomic distinctness, functional diversity, sea grass beds, Caribbean

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## Abstract – 084 Oral

**FUNCTIONAL AND STRUCTURAL INDICATORS FOR THE ASSESSMENT  
OF ECOLOGICAL STATE IN TROPICAL COASTAL WETLANDS:  
PRELIMINARY RESULTS**

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Coastal ecosystems, especially wetlands, have come under significant and increasing pressure from human activities. In Mexico as in many other countries, decision makers in the local and regional scales (i.e. watershed) count only on limited information either on degradation state and its causes, or on the success of protection and rehabilitation efforts. Sound management of these wetlands and their watersheds is therefore very uncertain. An ongoing research project in Tamaulipas south most coastal wetlands, is evaluating possible indicators with an ecosystem approach. Several indicators of both ecosystem functioning and structure are been measured simultaneously within a one year (four seasons) time frame. The main objective is to assess the ecological correspondence of both kinds of indicators while developing an assessment tool of ecological integrity of these coastal habitats. Mangrove estuaries as well as shallow coastal lagoons presenting contrasting levels of degradation/rehabilitation are studied along with reference sites. Preliminary data analysis of *in situ* decomposition rates as well as N and P mineralization patterns resulted in large differences among sites early in the decay process. Initial samplings (fall and winter) of the nekton community (total catch, number of fish taxa, size and mass per taxa) also resulted in large differences among sites. These functional and structural measurements of studied estuaries and lagoons apparently have good correspondence, separating sites with different ecological state. It appears, however, that decomposition measurements (functional indicators) may be a more accurate and consistent indicator. An epibenthic organism (*Balanus sp.*) is also been studied in a functional approach and initial data will also be presented, along with observations on two structural characteristics of *Crocodylus moreletii* population in some of the studied sites.

Keywords: Coastal wetlands, indicators, functional, structural

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## Abstract – 085 Poster

**ARE REEF FISH ASSEMBLAGES GOOD INDICATORS OF MPA EFFECTIVENESS?  
THE CASE OF CABO PULMO REEF, WEST MEXICO**

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Fish assemblages have traditionally been considered as reliable indicators of coral reef health conditions. However, this idea has not been adequately tested in western coast of the tropical Americas, and the generality of the concept may be hindered by the particular ecological conditions and evolutionary history of the area. In this study we compared community structure of fishes in 1987 and 2004 at Cabo Pulmo reef, and look for possible changes caused by the remarkable coral mortality caused by the 1997 ENSO. This work proposes the use of fish community descriptors for monitoring the status of a MPA. Cabo Pulmo was selected because is the only coral reef in the Gulf of California and was declared National Park in 1995. The species richness, abundance, diversity (Shannon), evenness (Pielou) and taxonomic distinctness of the reef fish community, as well as stratum and depth affinity was assessed throughout 36 cylindrical stationary census. Surveys were conducted in October 2003 (warm season) and February 2004 (cold season), at two depth strata (5m and 5.5m). None of the descriptors was significantly different between seasons ( $p > 0.5$ ), but richness, abundance and taxonomic differentiation were higher in the deeper zone. Most species preference for physical factors associated to deeper zones maybe the reason of the pattern observed. Comparison of these results with data gathered in 1987, shows a significant decrease of abundance, richness and diversity, but a remarkably stability of the fish species composition. This does not necessarily mean a failure as MPA, since other environmental perturbations such as hurricanes and ENSO have recently affected this coral reef.

Keywords: Reef fish, indicators, community structure, Cabo Pulmo

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## Abstract – 112 Poster

**ANALYSIS OF REGIME SHIFTS IN FISHERIES USING  
AN ECOSYSTEM HEALTH INDICATOR***L. Kernegger<sup>1</sup>, J Carstensen<sup>2</sup>, and J.M. Zaldivar<sup>1\*</sup>*<sup>1</sup> Institute for Environment and Sustainability (Italy),<sup>2</sup> National Environmental Research Institute (Denmark)

We have applied a thermodynamic indicator (specific exergy) to assess the health of marine ecosystems using the FAO fisheries landing database. The results showed a continuous decline, since the 70's, for the World marine ecosystem health. Specific exergy gives a weight to each species, depending on the genetic information content. The biomass for each species is multiplied by this factor and then the sum of all values divided by the total biomass. Therefore, this value is independent of the total catches and reflects the quality in terms of information content of what we are extracting from the whole oceans. On the contrary, the same analysis applied to aquaculture data from FAO shows no decreasing trend. Change point detection of gradient at unknown time using likelihood ratio test, with the null hypothesis of linear relationship, has then been applied to identify regime shifts and correlate them with well-known historical events in all defined FAO areas.

Keywords: Thermodynamics indicators, marine ecosystem health,

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## Abstract – 113 Poster

**TROPHIC LEVEL SPECTRA: UTILIZATION AS AN INDICATOR  
OF NEKTON COMMUNITY STRUCTURE***J. Ramos Miranda*<sup>1\*</sup>, *D. Flores Hernández*<sup>1</sup>, *A. Sosa López*<sup>1</sup>, and *L. Ayala Pérez*<sup>2</sup><sup>1</sup>Universidad Autónoma de Campeche (Mexico),<sup>2</sup>Universidad Autónoma Metropolitana, -Xochimilco (Mexico)

The trophic level (TL) has been used as an indicator of ecosystem structure change and it is remarkable sensitive on long term data series. However TL indicator may also be used to trophic variability into the ecosystem in short term data series. The natural variability of the ecosystems and their impacts (environmental and anthropogenic) promotes diverse habitat creation where several fish species interacts and serves like linkage between adjacent habitats. This implies changes in TL composition linked to fish species composition which is habitat dependent. In this study TL composition was analyzed for fish community in the west Terminos Lagoon area as well as adjacent coastal zone from February 2003 to January 2004 through 37 sampling stations. The data base was analyzed temporally by climatic seasons (Dry, Rainy and Stormy seasons), then and spatial stratification was established based on hydrological conditions and performing a cluster analysis by climatic season. The study area show an important freshwater influence and spatial strata reflected this effect. For the dry season cluster analysis allowed to define five zones and for the rainy and stormy season seven and eight zones were established. The trophic analysis of the fish community was analyzed by climatic season and by spatial strata. The fish biomass along trophic levels showed significant differences ( $P < 0.05$ ). In the dry season and zone 2 (marine zone) carnivorous fish species were dominant, TL 4.5 (*Scorpaena pluimeri*), in the zone 3 (marine-estuarine zone), included mainly herbivorous and detritivorous, TL 2.25 (*Archosargus rhomboidalis*), carnivorous TL 3.75-4 (*Bairdiella chrysoura* and *B. rhonchus*), and in the higher TL 4.5, *Chaetodipterus faber* and *Synodus foetens*. The zone 4 (estuarine zone), showed a strong presence of herbivorous and detritivorous fishes (TL 2.25) such as *A. rhomboidalis*, omnivorous (TL 3.25-3.5) such as *Sphoeroides testudineus* and *Eucinostomus gula* and carnivorous (TL 4.5) mainly represented by *C. faber*. During the rainy season, zones 2, 3 and 5 showed particular trophic conditions. The zones 2 and 5 showed a similar trend in biomass along TL. Although zone 2 and 5 showed similar trend species such as catfishes (*Cathorops melanopus* and *Bagre marinus*) dominated the TL 3.5 in the zone 2; and for the zone 5 the same TL was dominated by *Centropomus parallelus*. In the zone 3 and strong biomass contribution was observed for the lower TL (2.5) mainly dominated for the Sparid *A. rhomboidalis*, in this zone omnivorous species (TL 3.25-3.5) were represented by *S. testudineus* as well as the catfishes (*C. melanopus*, *Ariopsis felis* and *B. marinus*). In the stormy season similar patterns in TL terms were observed between zones where *C. melanopus* was the most important species in biomass contribution terms. We conclude that environmental influence (particularly the climatic variability), is the main factor structuring the trophic condition of the fish communities as well as its variability.

Keywords: Trophic level, indicators, environmental variability, Campeche-Tabasco

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## Abstract - 001Oral

**FISH FOR THE FUTURE: AN ASSESSMENT OF FISHERY  
CONSERVATION POLICES IN THE PHILIPPINES***M.R. Campos\**

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Lamon Bay is one of the most important fishing grounds in the Philippines. In spite of this, most fishermen in the area live in poverty, and their plight is getting worse, not better. Fish catch is declining by 13.5 % a year, more than double the decline experienced elsewhere in the country. Current fisheries policies for the area have failed to improve the situation but no research has been done to find out why. Are the policies poorly designed? Or have they not been adequately enforced? This report attempts to fill this information gap about the reasons for policy failure. Drawing on data from secondary sources and an original survey, it uses a bioeconomic model to simulate the effects of changes in the enforcement levels of three current policies: ban on electric shiners, fish cage regulation, and regulation of both electric shiners and fish cages. Investments of the government on different levels of enforcement were assessed using benefit cost analysis. The report assesses the effects of enforcing current fisheries policies more stringently. It finds that a substantial investment (PHP 614,000 per year) would be required to ensure compliance with regulations and that the benefits of achieving high levels of compliance would exceed costs by only a tiny margin. The situation would be transformed into one in which large and perhaps increasing numbers of people would continue to fish, expending larger amounts of effort to comply with various gear restrictions but, in all likelihood, harvesting no fewer fish.

Keywords: Fishery conservation impact bioeconomic model

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## Abstract – 019 Oral

**APPLICATION OF A DYNAMIC MASS-BALANCE MODEL  
FOR EXPLORING ECOSYSTEM IMPACT OF HARVESTING SMALL  
PELAGIC SPECIES OF THE WEST FLORIDA SHELF**

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Baitfish are stock complexes comprised of small pelagic species like Spanish sardine, scaled sardine, Atlantic thread herring, and menhaden. They represent important fisheries in Florida. Evaluating future baitfish management strategies in Florida hinges on the significance of baitfish in relation to their critical role as the prey of other species, their significance to commercial and recreational fisheries and, the tenet that their vitality is an indicator of the health and productivity of the marine environment. We have constructed a trophic dynamic model for the west Florida shelf (WFS) with the following objectives: to describe the present ecological and spatial structure of species assemblages of the WFS, to characterize the role of baitfish within the WFS marine ecosystem, and to explore the consequences of certain harvest management decisions on baitfish and other biotic components of the ecosystem. We use this trophic dynamic model to predict changes in biomass of pelagic components and large groupers with the increase in fishing mortality for baitfish at various prey vulnerability settings; run dynamic simulations where mackerel and grouper stocks are fished at variable fishing mortality rates; and explore the effects of both long and short-term oceanographic changes (*i.e.* regime shifts in the ecosystem).

Keywords: Baitfish, ECOPATH/ECOSIM, west Florida shelf

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## Abstract – 020 Oral

**LINKAGE BETWEEN NUTRIENT LOADING AND FISH ABUNDANCE  
IN TAMPA BAY, FLORIDA***C. Guenther\**, and *B. Mahmoudi*

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Tampa Bay is an important nursery area for many species of commercial, recreational, and biologically important fish species. During the past 50 years major changes in nutrient loadings have occurred due to urban development followed by pollution control measures. Circular changes in primary production have occurred in association with these fluctuations in nutrient loading. Benthic plant dominance was replaced by phytoplankton dominance only to be replaced by benthic plants. There is anecdotal evidence that changes in productivity associated with these changes have been reflected in the fish community. The objectives of this study are to determine whether spatial and temporal patterns in abundance of several species sampled in the Florida fisheries independent monitoring program (FIM) can be explained by historical changes in coastal nutrient loading. The overall goal is to implement the model as a management policy analysis tool. We linked a hydrodynamic model for Tampa Bay nutrient loading and productivity to ecopath/ecosim ecosystem models for trophic interactions in the Tampa Bay fish community. We used 55 years of annual time series data of rainfall, runoff, nutrient loading, and wind to create a Tampa Bay nutrient reconstruction model. Predicted times series of nutrient loading and predicted space-time series of nutrient concentrations were used as forcing functions in ECOSIM (population and biomass dynamics) and Ecospace (biomass dynamics) models to predict ecological responses. The nutrient forcing data exerts bottom-up control and predicts 50 years of biomass estimates for 28 species of fish. The model fits well for obligate estuarine species but does not perform as well for facultative estuarine species.

Keywords: ECOPATH, ECOSIM, ecosystem, Tampa Bay, Florida

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## Abstract – 021 Oral

**A CATCH FORECAST MODEL FOR THE PERUVIAN SCALLOP  
(*Argopecten purpuratus*) BASED ON ESTIMATORS  
OF SPAWNING STOCK AND SETTLEMENT RATE**

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The fishery of the Peruvian Bay scallop (*Argopecten purpuratus*) in Independencia bay (Southern Peru) is being subjected to great interannual variability in catch and effort, mainly - but not exclusively - due to the ENSO (El Niño- Southern oscillation) - caused changes in the population dynamics of the stock, which greatly proliferated during the warming phase of the El Niño events 1983 and 1998. As a consequence „gold rush conditons“ arose for the resource users, who profited from a multi million dollar export business. After the El Niño booms, the system normalized and the catches dropped to normal levels. This boom and bust situation of the fishery has made a rational management of the resource difficult, and the annual catches are considered largely unpredictable, just like the stochastic environment. This paper attempts to provide a catch forecast model to enable scallop divers and business men to better prepare for and adapt to the ever changing conditions of the scallop stock. The model assumes that annual catches are mainly the result of the recruitment success of the incoming new cohort, which is supposed to be a function of adult spawning stock size and the number of settlers to the sea bottom. The latter is considered a function of the instantaneous larval mortality rate and the temperature - dependent development time to the settlement stage, the former proportional to the catches taken over the spawning period (Nov.-April). Using monthly catch and temperature data for the period 1983-1998, we constructed a multiple regression model to predict the catch for the year after the recruitment period (July-July) as a function of a) the catch during the spawning period (as a proxy for spawning stock biomass) and b) the settlement factor that was derived from the mean water temperature over the spawning period, an assumed instantaneous larval mortality rate, and the relationship between temperature and larval period to settlement. A high regression coefficient ( $r^2 = .9459$ ) of the resulting equation proved that both factors are able to explain a large part of the inherent variability of the data. The model shows that the annual catch greatly depends on the spawning stock size when temperatures are low, while this factor decreases in importance with increasing temperatures, at which the settlement factor is much more influential instead. These findings are relevant for the stock management: at low temperatures, the maintenance of a large enough spawning stock over the spawning period (Nov.-April) is decisive for the yield of the postrecruitment fishing period thereafter, while at increasing spawning temperatures, spawning stock size is of decreasing importance for determining the yield.

Keywords: Peru, El Niño, scallops, catch prediction

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## Abstract – 022 Oral

**COMPARISON OF TWO METHODS TO DETERMINE  
THE MATURITY PERIOD IN PENAeid SHRIMPS (DECAPODA, PENEIDAE)***E.A. Aragón-Noriega<sup>1\*</sup>, and W. Valenzuela-Quiñonez<sup>2</sup>*<sup>1</sup> CIBNOR- Unidad Sonora (Mexico), <sup>2</sup> CIIDIR Unidad Sinaloa (Mexico)

Most of the studies about the reproductive period of shrimp species are based on the percentage of mature females (PMF). The objective of this work was to determine the reproductive period of the penaeid shrimp applying an egg production index (EPI), combining fecundity, size structure and density of mature females. As well as make comparison with PMF method. The maximum maturity months obtained with PMF did not match with those of maximum egg production period. This because PMF did not takes into account the abundance but the proportion of mature female. It is concluded that in order to define the maturity period of penaeid shrimp, at least we need three indices here proposed and comprised in the EPI.

Keywords: Maturity period, egg production index, penaeid shrimp

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## Abstract – 024 Poster

**HOW CAN MPAs DESIGNED FOR CONSERVATION BE USED AS FISHERIES  
MANAGEMENT TOOLS? THE CASE OF WEST AFRICA***P. Tous\**

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In West Africa, in the area covered by the Sub-Regional Fisheries Commission, the fisheries sector faces the most serious crisis of its history, with a decline in biomass, loss of biodiversity and growing conflicts between resource users whose livelihoods are declining. Paradoxically, conservation has made significant progress in recent years and decades, and this region possesses a network of over 20 MPAs, covering a large number of coastal and estuarine habitats, and necessary for the protection of numerous threatened species. However, for the most part, these MPAs were created without any baseline assessment of commercial fisheries resources. Furthermore, the regulations in effect within these MPAs do not always address fishing activities (there exist very few zones strictly closed to fishing) and their application is not fully assured. It is therefore very difficult to evaluate the contribution of these MPAs to the conservation of resources and the sustainability of the fisheries sector. In recent years, there has been a multiplication of initiatives to increase the number and area coverage of MPAs, and it is urgent to proceed to an inventory and rigorous monitoring of impacts in order to guide choices in the creation of new MPAs. In parallel, existing MPAs and those being established offer interesting examples of participatory approaches between resources users and institutions for sustainable management of coastal areas. In order to benefit from these experiences in relation to fisheries management, it is also urgent to make decision-makers aware of the need to define common objectives and to integrate policies for environment and fisheries management.

Keywords: Overfishing, MPA, Impact, fisheries management, policies

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## Abstract – 048 Oral

**TROPHIC MODELING OF EASTERN BOUNDARY CURRENT SYSTEMS:  
A REVIEW AND PROSPECTUS FOR SOLVING THE “PERUVIAN PUZZLE”***M. Taylor\**, and *M. Wollf*

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Eastern Boundary Current systems ('EBCs') are among the most productive fishing areas in the world. High primary and secondary productivity supports a large biomass of small planktivorous pelagic fish ('small pelagics'), which are important drivers of production to the entire system whereby they can influence both higher and lower trophic levels. Environmental variability causes changes in plankton (food) quality and quantity, which can affect population sizes, distribution and dominance among small pelagics. This variability combined with impacts from the fishery complicate the development of management strategies. Consequently, much recent work has been in the development of multispecies trophic models to better understand interdependencies and system dynamics. Despite similarities in extent, structure and primary productivity between EBC systems, the Peruvian system greatly differs from the others in the magnitude of fish catches, due mainly to the incredible production of the anchovy *Engraulis ringens*. This paper reviews literature concerning EBC dynamics and the state-of-the-art in the trophic modeling of EBCs with the objective to critically analyze the potential of this approach for system understanding and management and to adapt existing steady-state models of the Peruvian system for use in (future) dynamic simulations. A guideline for the construction of tropho-dynamic models is presented taking into account the important trophic and environmental interactions. In consideration of the importance of small pelagics for the system dynamics, emphasis is placed on developing appropriate model compartmentalization and spatial delineation that facilitates dynamic simulations. Methods of model validation to historical changes are presented to support hypotheses concerning EBC dynamics and as a critical step to the development of predictive models. Finally, the identification of direct model links to easily obtainable abiotic parameters is emphasized to add practicality to the model as a predictive tool.

Keywords: Trophic structure, modeling, eastern boundary currents, upwelling, small pelagic fish, Peru

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## Abstract – 070 Poster

**A LENGTH-STAGES BASED MATRIX MODEL  
FOR STRIPPED WEAKFISH (*Cynoscion guatucupa*)**

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Stripped weakfish is a scienidae species inhabitants estuarine, coastal and marine waters of Argentina, Uruguay and Brazil. It represents an important part of the catch of coastal fisheries in these countries, and supports traditional fishermen communities along their wide geographical distribution. This species belongs to a group of about 20 species that corresponding to a multi-specific demersal fishery denominated in Argentina “coastal fish assemblage”. The catch of the species presents strong fluctuations along time and is considered as the second species in commercial importance after *Micropogonias furnieri* (whitemouth croaker) with an average annual catch of about 15,000 ton. Like other species belonging to multi-specific fisheries the assessment of stripped weakfish present complex characteristics. The coastal fisheries are characterized by poor historical information or lack long term fishery data series. In general coastal fisheries are multi-specific fisheries and single commercial CPUE data would not represent an abundance index. Catch structure is dependent of the variability in spatial distribution of the stock according to the special characteristics of the coastal ecosystem. To assess a coastal fishery stock we remark the importance of data obtained from research activities and their integration within the stock assessment model. We develop a length-stages based non-linear matrix model to evaluate the status of the stripped weakfish stock. The model considers: reproductive parameters, catch at specific length-stages, growth parameters and abundance index of some stages. Non-linearity become due to changes in fishing extraction pattern along time. A linear model is considered (fixed extraction pattern) for projections. The model approaches the population structure dynamics with few data and taking into account this dynamics allows adopting precautionary biological reference points to limit the fishery.

Keywords: Stage structured models, matrix models, fishery stock assessment, *Cynoscion guatucupa*

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## Abstract – 074 Poster

**TOWARDS AN INTEGRATION OF THE CAMPECHE BANK ECOSYSTEM DYNAMICS  
FOR ECOSYSTEM-BASED FISHERIES MANAGEMENT***M. J. Zetina-Rejón\*, F. Arreguín-Sánchez, and V.H. Cruz-Escalona*

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The Campeche Bank, situated in the South part of the Gulf of Mexico, is an extensive continental shelf with oil industry and fishing interacting. In this area some fishing-measures were adopted in order to protect the fish resources. Some measures are coastal waters as protected areas and prohibition of trawl fishing within an area of five miles from the coast. In spite of those measures, some important resources had shown a biomass declination (*v.g.* red grouper) or even had collapsed (*v.g.* pink shrimp). Although, some previous studies carry out in this region had recognized two typical ecosystems, the Campeche Sound and the Continental Shelf of Yucatan, there are some evidences based on the life history of several species (shrimps, spanish and king mackerels, octopus, red grouper among others) that suggest that both systems functions in synchrony or even could be consider like one ecosystem. In this sense, we construct an ECOPATH trophic model of this region based on two independent model of each system. In this work we describe ecosystem trophic structure and functioning of this region. Additionally we suggest, using dynamic ecosystem (temporal and spatial) simulation, how both ecosystems interacts in terms of flows of biomass and how some fishing strategies could impact the biomass stocks. This study will be the base for future work to suggest marine protected areas as fisheries management tool.

Keywords: Campeche Bank, ecosystem dynamics, ECOPATH, ecosystem approach

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## Abstract – 082 Oral

**EVALUATING THE IMPACT OF ARTISANAL AND RECREATIVE FISHING UPON  
THE DYNAMICS OF A SEA BREAM POPULATION (*Diplodus sargus*)  
AROUND THE BANYULS RESERVE (MEDITERRANEAN)**

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J.S. Kolusniewski, and P. Lenfant*

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In this study, we used a generic simulation tool, ISIS-Fish, to evaluate the impact of spatial and seasonal management measures upon the white sea bream (*Diplodus sargus*) population dynamics of the French Catalan fishery (north-western Mediterranean). ISIS-Fish is a spatially and seasonally explicit model, including a population dynamics model, an exploitation model, and a management model that also depicts the response of fisher's to management measures. The population and exploitation models were parameterised from existing knowledge, and parameters were stored in a database included in the software. We evaluated the impact of each fishing activity upon sea bream dynamics. A range of management options were tested, including Total Allowable Catch (TAC) and several MPA designs encompassing the Banyuls-Cerbère natural reserve. Fisher's behaviour in reaction to these measures was also considered. Uncertainty about model parameters and assumptions was accounted for by running sensitivity analyses based on a simulation design.

Keywords: Simulation, management measures, sensitivity analysis,  
*Diplodus sargus*, fisheries dynamics

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## Abstract – 083 Oral

**ECOSYSTEM-BASED QUALITATIVE ANALYSIS TO EXAMINE  
THE RESPONSE OF THE NORTHERN GULF OF CALIFORNIA BIOLOGICAL  
COMMUNITY TO SPECIFIC MANAGEMENT PRACTICES ORIENTED  
TO DIMINISH THE FISHING PRESSURE ON CERTAIN RESOURCES**

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Worldwide, the Northern Gulf of California (NGC) is considered a marine area with high levels of biodiversity. In Mexico, it represents 15 % of the overall fishing economy and it is also an important area for the development of tourism. However, marine ecosystems within this area are undergoing rapid environmental degradation due to a combination of natural and social reasons (lack of an appropriate management plan for the artisanal and commercial fisheries and the decrease in the supply of fresh water by the Colorado River). Management actions have been implemented in order to revert the negative impact upon the fisheries. Nevertheless, results seem ineffective. For this reason, there is a need to develop systematic, interdisciplinary and useful tools that can assist in the improvement of a more efficient fisheries management plan. We used a qualitative modeling technique (loop analysis) to evaluate the effect of the fishery on the biological community from the NGC. This approach allowed to analyze the system's response to various management scenarios. Ten fisheries indicators were selected and integrated into the Stress-State-Response model proposed by Organization for Economic Cooperation and Development to measure sustainable development. State and stress indicators were classified as functional groups using taxonomic and fisheries criteria, and in fishing gears according to their selectivity and intensity. Alternative models were generated to encompass the spatial and temporal variation of the system (seascapes). Two management scenarios were used as positive inputs to the system, to represent more strict regulations over two fishing gears (*beach seine* and *shrimp trawl-net*). The response of the system to these specific objectives allowed us to identify the obvious and not so obvious implications of these management practices within an ecosystem context, where resources are highly interconnected.

Keywords: Marine Protected Areas, Loop analysis, environmental indicators and seascape

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## Abstract – 092 Oral

**TROPHIC STRUCTURE, FLOWS OF ENERGY AND MATURITY  
OF THE ECOSYSTEM OF THE TABASCO  
CONTINENTAL SHELF, MEXICO**

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The South of the Gulf of Mexico is an important economic area due to fishing and oil industry. The oceanographic conditions and complex biological interactions of the ecosystem must be integrated in an ecosystem approach for the sustainable use and assessment of natural resources. The main purpose of this study was to construct a trophic model, using the ECOPATH approach, of the Tabasco's Continental Shelf. The model incorporates the available information at species level and was used to describe trophic interaction, to quantify energy flows through the food web and to describe the ecosystem maturity. The model includes 33 functional groups. Results show to be consistent with the biology of the functional groups included in the model. The characterization of trophic structure was made with the statistics of functional groups and of ecosystem, and also through network analysis. Some of the attributes including in Ecopath to know the state maturity of the Ecosystem were analyzed, as they are the biomass of the system, the reason production/respiration, omnivory index, cycling index among others. Barracudas and sharks were the top predators of the system. The source of energy was equally originated from primary producers (50.1 %) and from detritus (49.5%), this shows that both groups are important for the trophic structure of the ecosystem. Most flows occur in the lower levels of the food web. According to ascendancy, the ecosystem is developing in 52.2 % of its top level in the ecosystem.

Keywords: ECOPATH, ecosystem, food web, fisheries

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## Abstract – 099 Oral

**THE ACOUSTIC MULTIFREQUENCY APPROACH AS A HELP  
TO THE DESCRIPTION OF THE ECOSYSTEMS' COMPONENTS***A. Lebourges-Dhaussy<sup>1\*</sup>, and J. Guillard<sup>2</sup>*<sup>1</sup> Institut de Recherche pour le Développement (France),<sup>2</sup> Institut National de Recherche Agronomique (France)

The acoustic methods are well known for fish stock assessment; they have been classically applied on rather large ships not able to go shallower than around 20m deep, and with equipment at one standard frequency, very often 38 kHz, considered appropriate for fish detections. Nowadays, the equipments become smaller and this allows on one side to work on smaller ships in order to reach shallower waters (coastal zones, lakes, estuaries); on another side to use several frequencies even during shallow waters surveys and to get by the way a more exhaustive view of the medium and of its components. Additionally the 38 kHz for example appears in some situations as a very good detector of organisms that are not fish and the use of various frequencies may evidence that another frequency is more appropriate for fish detection in a given area. A recent European program (SIMFAMI: "Species Identification Method From Multifrequency Information") has shown the potential of information contained in the frequency domain, particularly in terms of organism's classification. Individual target strength measurements at one frequency can give indications on the size distribution of the present population. But multifrequency processing of the data may allow fish/plankton separation among the acoustical detections and also help to various zooplankton types classification. This presentation has a methodological approach and deals with the possible contribution of the multifrequency acoustic technique in shallow water ecosystems studies.

Keywords: Acoustic, multifrequency, classification

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## Abstract – 005 Oral

***IN SITU* OBSERVATIONS FOR MANAGEMENT PURPOSES  
OF PELAGIC FISH RESOURCES IN THREE SHALLOW WATER LAGOONS**

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The increase of population density and thus induced activities on coastal lagoon watersheds raise the problem of their management. In 1999, three independent lagoons were considered for a comparative study. Regular *in situ* measurements in several compartment levels (water, phytoplankton, biological potentiality and sediment), were carried out in each lagoon in order to evaluate their eutrofication level. Analyses of commercial fish landing were made monthly in each lagoon for the main targeted species. Aside scientific fish samplings have been led to estimate the lagoon fish taxonomic diversity and the catch per unit of effort of the main fish species. Additionally fixed acoustic observations in horizontal beaming across each lagoon channels were made with multibeam sonar and split echo sounder. Identification fishing by cast nets and channel current measurement were led simultaneously during acoustic observation. Climatic data were recorded over the same year (temperature, wind, rain, lagoons and Sea temperature and salinity). We could notice that there was a limited impact of the eutrofication level on the fish diversity. The autumnal fish migration is determined by a quick break down of the lagoon water temperature and salinity. The fish movement is independent from the current direction and intensity. It is possible to obtain and then combine numerous data on the lagoon fish resources and their habitat (restricted area), which provides accurate information and so allows to estimate ecological indicators for a better management of such a complex coastal system.

Keywords: lagoon, pelagic fish, eutrofication, acoustics, management

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## Abstract – 026 Oral

**SUSTAINABLE AND PARTICIPATIVE PLAN OF THE SHRIMP FISHERIES  
OF THE SALOUM ESTUARY (SENEGAL)***H. Diadhiou<sup>1\*</sup>, and A. Kane<sup>2</sup>*<sup>1</sup>Institut Sénégalais de Recherche Agronomique (Senegal), <sup>2</sup> IUCN

The shrimp fisheries is one of the main activities made by the fishermen in artisanal fisheries in the Saloum Delta (one third of the listed fishers in 2005). Three types of fisheries, the trailing net, the set net and the drifting net, are used by different types of actors in the fisheries areas (bank, channel, from the channel to the bank). The catches around 300 tones a year are for the main part linked to the trailing net used along the bank. This gear catches small size shrimps. The governors of the Fatick and Kaolack regions (natural region of the Sine Saloum) take twice a year some decrees to regulate fishing. These decrees allow and forbid on proposals of the fisheries regional service chiefs. This service organize surveys to determine the number of shrimps by kilogram of product (mean to appreciate the size of shrimp). Fishery is open when the results of the surveys are inferiors or equals to what the regulation plans. It is closed in the other case. Practically, the Fisheries Service faces enormous difficulties to make apply the regulation. A lot of fishers still explode shrimp even out the legal periods. This situation led the IUCN, the USAID and the ISRA/CRODT to work on the elaboration of an action plan for the sustainable and participative management of the artisanal shrimp fisheries in the Saloum estuary. A meeting between the various actors of the shrimp fishery (Fisheries Administration, NGOs, research, territorial leadership, local collectivities, fishers, fishmongers, etc.) allowed the validation of this document whose implementation is programmed in the coming years.

Keywords: Artisanal fisheries, participative management, regulation, shrimp, meeting

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## Abstract – 044 Oral

**COGNITIVE MAPPING AS A NEW METHODOLOGICAL TOOL  
FOR THE STUDY OF A CORAL-REEF ECOSYSTEM SUBMITTED  
TO A MAJOR INCREASE OF HUMAN IMPACTS**

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The settlement of a mining complex in the north-western lagoon of New Caledonia will lead to a two to three fold increase in the population size, within the next 10 years. Hence, the demand for using the lagoon will increase, mainly for the living resources, in addition to other impacts on the habitats. The lack of scientific studies on the functioning of the local ecosystem instigated the use of a social based methodology to harvest the local people's knowledge. Cognitive mapping is mainly used for social conflict solving in firm. The understatement of this methodology is that each one has its own representation of a partially observed world due to its own experience, believes and experiments. A Cognitive Map (CM) is a sketch representation of those believes, in a shape of a web of concepts, linked together by causal relationships. In the study area about 40 individual CM were collected on the functioning of the socio-ecological system. During interviews, each stakeholder was asked to draw his own CM by defining natural and human factors from the watershed to the lagoon that impact fish resources. To compare the different CM, a common framework is created by setting up an ontology, based on those different stakeholders' concepts. The distances between maps are then calculated, and stakeholders clustered. The identification of the most significant concepts among a group's set of maps is a good basis to define easily appropriable indicators.

Keywords: Cognitive map, local knowledge, integrated management, ontology, clustering

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## Abstract – 046 Oral

**ESTABLISHING SOCIAL-ECOLOGICAL-ECONOMIC INTERLINKAGES  
FOR ECOSYSTEM APPROACH TO RESOURCE MANAGEMENT:  
A CASE STUDY OF FISHERIES IN BHITARKANIKA MANGROVES, ORISSA, INDIA**

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Management of a renewable resource like fishery, to be ecologically and socially sustainable, requires integration of ecological, economic, and socio-economic linkages among various components in its habitat ecosystem. The dynamic interactions among ecological, economic, and socio-economic factors along with existence of multi-stakeholders make the resource management problem in coastal fisheries multifaceted. This study analyses the complex ecological-economic linkages, role of property rights in harvest and management of fishery, and its impact upon the local population in terms of income and livelihood and alternative employment opportunities in a coastal fisheries in India. The study area Bhitarkanika is a mangroves ecosystem, a National Park, and a Ramsar site as well. In such a coastal fishery which happens to be a unique ecosystem like mangroves and also a National Park, the establishment of social-ecological-economic interlinkages and understanding them, can be a crucial part of resource management. The management plans for protected areas have to take into account the resource consumption needs of the local community along with the conservation requirements (say, for its ecological and recreational uses). This study identifies the key components of the ecosystem and uses system diagrams to understand the functioning of the social-ecological-economic system. The system diagrams trace out the key components, stock and flow variables, and cause and feedback links in the social-ecological-economic system and provide a holistic understanding of the problem. The key ecological and economic components are identified through statistical analysis of data from primary household and stakeholder surveys. This paper identifies anthropogenic factors affecting the ecosystem functions which in turn can adversely affect sustainability of the fishery-mangrove ecosystem. This approach would help enriching newer integrative thinking towards solving the complex dynamic resource management problem. Use of this approach in designing and assessing viable management options with policy implications is discussed.

Keywords: Integrated resource management, ecosystem approach, social-ecological-economic system, sustainability

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## Abstract – 047 Oral

**BIOLOGICAL SURVEY OF FISH ASSEMBLAGES IN A PROTECTED AREA LOCATED  
IN A MANGROVE ESTUARINE ZONE: THE BAMBOUNG BOLONG  
(SINE SALOUM, SÉNÉGAL)**

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The development of MPAs requires the setting of suitable survey protocols to study and possibly quantify their physical and biological evolution in comparison with an established initial stage. A one-year survey was performed in a restricted area of the Sine-Saloum inverse estuary, the Bamboung Bolong, before its classification as a MPA. Bamboung was then surveyed during 2 years after fishing was closed. The same scientific design, including environmental and biological (purse seine fish sampling) data collection at key periods of the hydrological cycle was used during both phases. A short presentation of the main environmental and ichthyological features is made. The area showed no vertical or horizontal water stratification, moderate salinity variations (from 28 to 52 psu), relatively low turbidity, well oxygenated water. Biodiversity was relatively high in the area, which is a spawning and/or nursery ground for numerous species. Results allowed to position the Bamboung Bolong in the context of West African estuaries and to follow its evolution as an MPA. The first, short-term effects of the protection were described and changes in the composition and structure of fish assemblage as well as in life history traits of main species were studied. No clear effect on global abundance, biomass or average number of species and no radical changes in the composition of the community in terms of ecological categories were observed. Conversely, the capture of 14 new species after fishing closure, modifications in size structure, particularly a greater number of large size individuals and species, an apparently more intense reproductive activity, and a sensible rise of the trophic level were noted and may be considered as early indicators of the decrease of fishing pressure. A greater homogeneity in the spatial distribution of fish community was also noted. The methods used and the significance of these results are discussed.

Keywords: Estuary, Marine Protected Area, West Africa, fish assemblage

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**Abstract – 050 Oral****AN ANTHROPIC TWIST TO ECOSYSTEM APPROACH TO FISHERIES***E. González \*, H. Trujillo, and E. Yáñez*

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Traditional fisheries management approaches have failed to ensure sustainable development of fisheries and conservation of aquatic ecosystems and resources for various reasons, including: failure to properly consider ecological dynamics and processes, human impacts driven by market incentives, lack of alternatives and inter-sectoral relationships, complex and ill defined political and legal systems and environmental variability, among others. Sustainable development of fisheries implies the need to simultaneously reach objectives of economic growth, environmental sustainability and social equity. In social and economic terms this may be translated as the need to maximize the level of well being that humans may attain from use and existence values of fisheries resources and aquatic environments. The above is subject not only to economic efficiency conditions but, very importantly to resource-ecosystem-environment dynamics and renewal-resilience capacities; as well as, to equity conditions related to generational, ethnic, gender and social-cultural factors. Ecosystems Approach to Fisheries (EAF) is increasingly been advocated as the correct approach to reach sustainable development of fisheries. Nonetheless, tendency to overemphasise on ecological and biological aspects at the expense of socioeconomic, cultural, management and governance aspects driving anthropogenic processes and determining actual rates of resources and ecosystems uses, may still preclude the identification of correct paths to sustainable development of fisheries. Thus, a further extension of present ecosystem approach to fisheries is required to properly incorporate social aspects driving human actions on fisheries such as technological, economic, legal, institutional and cultural ones. In addition, attention must be given to the identification of practical methods to benchmark existing knowledge and information in fisheries, as the base to define proper action paths to sustainable development of fisheries. A holistic, ecosystem, anthropogenic, integrated, dynamic and quantitative approach for sustainable development of fisheries is applied to specify a theoretical, though operational, model of the fisheries sector and its contribution to sustainable human well-being. This model is used to identify and benchmark existing knowledge and information in the common hake fishery in Chile. A participatory and structured analysis of the current existing knowledge and information of the Chilean hake fishery system and, its gaps with respect to the theoretical model, is applied to define a research programme as the basis for the design of a proper sets of actions upon which the structure a set of management actions seeking to reach sustainable development of this fishery.

Keywords: Sustainable development, structured analysis, benchmark, hake fishery, research programme, holistic approach

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## Abstract – 051 Poster

**LOOKING FOR SUSTAINABLE DEVELOPMENT THROUGH ECOTOURISM,  
THE CELESTUN WETLAND CASE***E. Charles<sup>1\*</sup>, and A.M. Amaya<sup>2</sup>*<sup>1</sup>Japan International Cooperation Agency (Japan),<sup>2</sup>Universidad Autonoma Metropolitana-Xochimilco (Mexico)

Celestun is located in the Northwest part of Yucatan Peninsula, 2.5 hours from the airport of Merida. It is located within one of the most important federally protected wetlands in Mexico. The main economic activities are fishing, particularly Octopus, salt production, and a small tourism industry. Previous studies show that fishing industry is over exploited. This industry and the salt production are also being endangered by environmental pollution from the production of fishmeal and municipal sewage. Local and federal government does not have enough resources to protect the marine environment of the wetlands around Celestun. Also the community is largely unaware of how to protect their environment and resources. Due to this, Celestun inhabitants have tried to improve their conditions with ecotourism, taking advantage of their natural richness. Yet, this is a new activity for them and they are not prepared to manage it. Ecotourism is a reality that will continue as economical entrance for many families. The next step is to make the ecotourism as a part of an Integrated Management under the politic of sustainable development. In this study our initial objective was to make an analysis of the present tourism situation in Celestun and to look for an integrated management through empowering people in ecotouristic issues. It was found that the main elements people need are management, marketing, environmental education, basic scientific knowledge, legal regulation, etc. Our next primary proposals are: 1. Diversification of economic activities to reduce negative impact of over exploitation of fishing activities, and tourism could be an option; 2. Introduction of green cost (tourists' responsibility for environment conservation) in the products and services offered; 3. Implementation of environment monitoring by ecotouristic groups.

Keywords: Ecotourism, Celestun, sustainable development, wetland, green cost

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## Abstract – 052 Poster

**A PRELIMINARY ASSESSMENT OF WILDLIFE RESOURCES USED BY MAYAN PEOPLE OF TWO COASTAL COMMUNITIES OF CAMPECHE, MEXICO***F. Méndez Cabrera\**, and *S. Montiel*

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The species of wildlife used by today's Mayan people and the manner in which these natural resources are used were evaluated in two communities of the northwestern coast of the Yucatan Peninsula in the state of Campeche: the village of Tankuche (a rural settlement located 36 km from the coast line) and the coastal community of Isla Arena. Through participant observation and interviews (N = 220; May-August 2003 and February 2005) with the local people, we registered the species and uses of wildlife, that are locally recognized in each community. A total of 105 species (60% animals and 40% plants) were recognized by the local people as ones locally used for food, building materials, medicines and decorations. In Tankuche the people interviewed recognized a higher number of plant species as natural resources (34 species) than in Isla Arena (17 species). However, people of the later community recognized more animal species (54 species) than in the former community (35 species). The *guano* palm (*Sabal yapa*) and the white tailed deer (*Odocoileus virginianus*) were the main resources in Tankuche, while six marine species such as spotted seatrout (*Cynoscion nebulosus*), gray snapper (*Lutjanus griseus*), Common octopus and Mexican four-eyed octopus (*Octopus vulgaris* and *O. maya*), Atlantic sharpnose shark (*Rhizoprionodon terranova*) and white grunt (*Haemulon plumieri*) were registered as the main resources in Isla Arena. Social recognition of natural resources appears to be correlated with local productive activities. However, even when local people use a wide array of wild species in general, only some of these are important in the daily life of each locality studied.

Keywords: Wildlife, resources naturals, knowledge traditional, communities Mayan

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## Abstract – 054 Poster

**WILDLIFE UTILIZATION IN A MAYAN VILLAGE OF CAMPECHE, MEXICO:  
AN APPROACH TO LOCAL EXTRACTIVE PRACTICES, SPECIES HUNTED  
AND THE SOCIO-ECOLOGICAL IMPLICATIONS**

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In tropical environments, the over-exploitation of terrestrial ecosystems for “bushmeat” (wild game) not only constitutes a global threat to biodiversity but also might seriously affect local people who depend on wild animals as a primary food resource. With the aim of evaluating this problem at the local level, we evaluate the current extractive practices of inhabitants of the Ejido Petenes, a small Mayan village located within a biosphere reserve in the central coastal lands of Campeche, Mexico. During seven months (June-December 2005), we carried out participant observation in the study community, surveying 167 local family representatives. Field work (41 days) resulted in the recording of a total of 20 animal species used by the local people, such as white tail deer, wild turkey, peccary, rabbit, coati and agouti. We found that local people use wild animals for the family diet as well as for commercial, ornamental and medicinal purposes. Traditional hunting was found to be the main way that local people obtain meat from wild species. This activity, done by the men of the community, has three modalities: *batida* (a group beats the bushes, scaring game towards waiting hunters), *lampareo* (using a hand light at night) and *acecho* (“stalking”; practiced by 1-2 individuals). From a human ecology perspective, we analyze and discuss the implications of the traditional hunting for the development of suitable conservation strategies in a biosphere reserve.

Keywords: Wildlife, management local, coastal wetlands, Petenes, Campeche, Mexico

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## Abstract – 062 Oral

**SUSTAINABLE DEVELOPMENT OF A COMMUNITY-BASED  
SPINY LOBSTER FISHERY IN BAJA CALIFORNIA, MEXICO:  
A CASE OF SUCCESSFUL MANAGEMENT**

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The lobster resource has sustained a high priced fishery over more than 100 years along the west coast of the Baja California peninsula. In this paper is examined how the traditional management of the lobster fishery in Baja California has been evolving into a co-management type and which are its perspectives under the current legal framework. This is community-based fishery as fishing rights were allocated exclusively to fishermen's cooperatives. A scheme of limited entry regime, developed from this system, includes a clear delineation of a fishing zone and a maximum number of boats and traps authorized for each cooperative. During the last 15 years a co-management system has been developed, involving governmental institutions and productive organizations. On the basis of a cooperative mechanism, information requirements for management are being satisfied. We analyze the influence of such management system on the trends and current state of the red spiny lobster (*Panulirus interruptus*) fishery in the central coast, between Punta Abreojos and Vizcaino Bay, which accounts for approximately 80% of the total catch. Recent stock assessment by using some biological reference points derived from population dynamics models demonstrates that this lobster fishery presents an outstanding stability and exploitation is near to the maximum sustainable yield. As the catches followed an upward tendency and reached the highest levels (> 1600 t) in the series during the 2001-2003 years, I suggest that enhancement of recruitment into the fishery responds to improvement of the management system, combined with favorable environmental conditions. This is a case of well-managed fishery through an adaptive approach, where the limited entry and co-management strategies are the key controls. Scientific advice based upon systematic research, conducted by Instituto Nacional de Pesca, plays a determinant role for setting regulations.

Keywords: Lobster community-based fishery, management

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## Abstract – 077 Oral

**THE EVOLUTION OF THE BROWN SHRIMP *Farfantepenaeus aztecus*  
FISHERY AND ITS MANAGEMENT IN THE NORTHEAST MEXICO**

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The fishing of the brown shrimp in the northeast Mexico is the most important fishery in the Mexican coast of Gulf of Mexico. Their captures in the last years have already around the 11,000 tn. This fishery is sequential because the population is captured in the coastal lagoons, mainly in Laguna Madre and open sea. This characteristic results that the management and determination of administration objectives are difficult to raise and to carry out. The closed seasons was established in 1993, the earliest objectives were looking for the equitable distribution of the capture between the productive sectors and the maximization of the landings, however in recent years, due to the drastic changes in the commercialization of the shrimp, and mainly the diminishing of prices, searching a balance between captures of both sectors with the objective of increase of the yield by recruit changed the whole vision. This new scheme of management has been obtained thanks to a participation strategy, a constant consult with the stake holders and the obtained results. In the present work, the historical information of fishery is analyzed, the measures and criteria for its management and the present situation and future perspective of fishery as well.

Keywords: Brown shrimp, fishery, management, Mexico

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## Abstract – 086 Poster

**MOVEMENT AND GROWTH OF JUVENILE LOBSTERS (*Panulirus argus*)  
IN THE CORAL REEF BANCO CHINCHORRO***A.E. Ramírez-Estévez\*, C. Aguilar-Cardozo, G. Escobedo, and F. Figueroa-Paz*

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As part of the Fisheries Management Plan of lobster in the Yucatan Peninsula a tag-recapture program of juvenile *P. argus* was implemented in Chinchorro Bank as it was defined as one of the priorities of the plan. The program was carried out from June to October 2005 in the Chinchorro Biosphere Reserve, located at the South-East coast of Quintana Roo, Mexico. The goals involve: a) to identify space and temporal movement pattern from the breeding areas towards the deeper areas where reproductive adults usually are located, b) to estimate average size at which lobsters are recruited to the fishery and c) to estimate if there are differences in growth rate between males and females under natural conditions. To capture juveniles, 24 small artificial habitats built with PVC pipes (casitas) were used. 8 casitas were placed around the Cays located in the North portion and 16 at the center of Banco Chinchorro. Of 267 juveniles captured, only 48 % (128) were marked as they presented a size  $\geq 40$  mm of cephalothorax (Lc). Of which, 72 were males and 56 females. The global range of sizes was between 17 and 82 mm (Lc). In spite of the low number of marked organisms, 19 recaptures were obtained (15%) two of them by way of commercial fishing and the rest in subsequent revisions by researchers. Regarding the increase in size, average values for juvenile in the 40 to 60 mm range of Lc, were 6.6 mm/monthly in females and 5.3 mm/monthly in males. Due to the low re-capture of lobsters, it was necessary to relocate some casitas being observed three zones with a greater presence of juvenile around the Cayo centro. The results obtained until now do not allow to define a route or movements pattern. However, it is expected that a reconsideration of the sampling program will allow to verify and explain possible causes of the observed patterns and to help in the decision making concerning the future management of these zones.

Keywords: Spiny lobsters, *Panulirus argus*, Mexican Caribbean

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## Abstract – 087 Poster

**A PROPOSAL FOR AN ALTERNATIVE FISHERIES MANAGEMENT  
OPTION BASED ON THE PRODUCTION RATES OF *Strombus gigas***

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The queen conch *Strombus gigas* is one of the main fisheries in the Caribbean. Fishing in Mexico is regulated by capture quotas, limited access and closed seasons. On account of its inherent features it is a resource with a high vulnerability to fishing, nevertheless *S. gigas* can also be regarded as a resource with a high recovery capacity after a closed season lasting 5 years as occurred in the Cozumel Bank, Quintana Roo. This work aims to contribute to the knowledge about the productive potential of *S. gigas* on the Mexican Caribbean coast, by means of a growth analysis, taking into account both individual as well as population growth rates. With these data, a fishing management scheme is proposed. This study includes data obtained for queen conch from Cozumel and Chinchorro Banks in Quintana Roo. A frequency analysis was used to estimate the individual growth parameters with the Bertalanffy Model based on the total length data for *S. gigas* from Chinchorro Bank, by using the FISAT program. In addition biomass data from the Cozumel Bank, collected both prior to and after a 5-years closed season, during which a lack of mortality due to fishing is assumed. The logistic population growth estimation of the equation parameters is explored by means of the Bayes analysis

Keywords: *Strombus gigas*, growth rates, management

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## Abstract – 088 Poster

**ALTERNATIVES FOR THE MANAGEMENT OF THE QUEEN CONCH  
*Strombus gigas* THROUGH THE CULTURE OF JUVENILES***D. Martínez-Vázquez\*, C. Padilla-Zouza, and P. Cadena-Romero*

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The queen conch *Strombus gigas* is one of the main fisheries resources in the Mexican Caribbean. The fishery of this mollusk has been deteriorating for several decades due to the strong market demand. Natural populations of this mollusk have decreased considerably, and as a consequence an increased fishing effort is required to meet the authorized quotas, resulting in a less profitable activity. Diverse regulatory measures have been implemented (closed seasons, quotas, minimum size at capture, closed off areas) that have not been effective in the recovery of this resource. Given this situation, management alternatives that intend to reduce the impact on natural populations are urgently required. The present work analyzes the viability of exploiting the juvenile population using semi-culturing. The design of a system for the handling and feeding of juveniles in marine enclosures, using a Pilot Production Unit (PPU) is presented, based on experiments on behavior, growth and mortality of organisms in confinement. Growth rates of 4 mm/month and weight gains of 35 g/month were achieved. Attempts will be made to increase these rates using enriched diets. These results have motivated an analysis of the viability of a management strategy based on the extraction of juveniles for semi-culture, focusing the fishing effort on organisms that have a high natural mortality, with the intention of protecting the reproductive stock. On the other hand, this practice would permit the implementation of repopulation programs, by the reintegration of a percentage of the production into the environment, to reduce the impact of the extraction by liberating organisms with a greater probability of recruiting into the reproductive population. In this manner, the intention is to offer an opportunity to obtain income through the mariculture of this species to the productive sector and to reduce the impact on natural populations.

Keywords: *Strombus gigas*, aquaculture, growth, mortality

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## Abstract – 100 Poster

**COMPARATIVE DESCRIPTION OF FISHERY OF *Mugil curema*  
IN THE COASTAL LAGOONS OF CUYUTLÁN,  
SIGHTS ON AND AGUA DULCE, JALISCO**

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Coastal lagoons are important ecosystems from the biological and commercial point of view, given the high diversity of species, habitats, sources of food and protection against predators. Cuyutlan lagoon has 7,200 has of surface, ranging between 37 km of length and 3 km width with average depth of 130 m; separated from the Pacific Ocean by a sandy barrier. Agua Dulce Lagoon on the other side, with similar surface and depth (700 Ha, 140 m respectively) has the highest production of the coastal lagoons in this state; the communication between the lagoon and the ocean is by an artificial channel and depth can reach 2100m towards South East. Both lagoons are the largest coastal lagoons in their state and produce more than a dozen of commercial species. Fishery of the grey mullet (*Mugil curema*) represents an important line in the catch, after the shrimp and crabfish. Monthly surveys were undertaken in each area sampling 3,206 individuals of grey mullets in Cuyutlán and 879 in Agua Dulce. They were measured in length and weight in order to compare size distribution in each site. Results show significant differences ( $P > 0.05$ ) and confidence intervals were determined (95%). Although both lagoons are inhabited by the same species and they are located in neighboring geographic areas, clear differences exist between both populations. Differences are assumed to be due to differential fishing patterns of exploitation in each one. Differences in mesh size employed in each area could be influencing results (Agua Dulce, 8,89 and Cuyutlan 6.35 cm) with evident management patterns more conservative in Agua Dulce.

Keywords: grey mullet, *M. curema*, Cuyutlán, Colima, Agua Dulce, Jalisco, coastal lagoon

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## Abstract – 101 Oral

**SOCIO-ECONOMIC CHARACTERIZATION OF COASTAL COMMUNITIES  
TO ESTABLISH REGIONS AND PROMOTE DEVELOPMENT  
FROM FISHING COMMUNITIES' PERSPECTIVE**

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This paper presents preliminary results of a project that aims to establish micro-regions in the coastal zone of the Gulf of Mexico and Caribbean, in order to consider local development into the management plans and programs in the regional. The approach considers socio-economic perspective of coastal communities. It is expected that the identification of geographic units can: a) promote multiplicative interregional effect through economic policies using market mechanisms, taking advantage of linkages that generate higher surplus, b) to promote through social policies wealth of all social groups, at least to the minimal level. This way it is expected to cluster similar regions in terms of size of the population and economic activities, such a way that the new regions proposed allow a multiplicative effect at the regional level reaching the highest values. At the same, it is expected that it can allow promoting social policies that generates benefits for all people involved in efficient manner. The characterization is done throughout identification of two indicators: 1) urbanization index by locality, as a way to show territorial distribution of population base on the number of people in the area, 2) estimation of the index of location or specialization, to determine the level of specialization of population by sector working in each locality and compare this with those at the municipal, state and coastal level. Base on these indicators and an index of comparison at the municipal level micro-regions will be identified in terms of size of the population and socio-economic activity.

Keywords: Fishing activity, regional development, micro- regions, planning, indicators

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## Abstract – 102 Poster

**SOCIAL PERCEPTION OF THE ECOSYSTEM SERVICES  
IN A COSTAL COMMUNITY: CONTRIBUTIONS  
FOR FISHERIES INTEGRATED MANAGEMENT**

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Many of the factors that lead to the world environmental crisis have their origins in social perceptions. In order to understand perceptions of the women about ecosystem services of the coastal and marine ecosystem, it is fundamental to carry out a successful strategy of fisheries integrated management. Since the women are responsible of education of the children, who will be the drivers of the ecosystem in the future. The present work was developed in a costal community in the region of Chamela, Mexico. The main environmental problems are the pollution of wetlands and the pressure on the coastline by tourism. The methods were the interview and the participant observation. The results indicate that the women recognize nine ecosystem services provided by coastal and marine ecosystems, divided them into provisioning (food, medicines and wooden resources), regulating (climate regulation, and bioregulation), and cultural (scenic beauty). Nevertheless, reduction, in recent times, in the provision of the services has been recognized by women. The main causes are the increasing fishery activities and the pollution. The consequences have been the loss of sources of uses and the lack of foods and medicines. Fisheries management strategies require considering perceptions the social actors and, inform through programs of environmental education and participatory workshops. The ecosystem services are an excellent tool to reflect with the women and her families about human dependence on ecosystems and the need for sustainable management strategies.

Keywords: social perceptions, ecosystem services, woman, children, environmental education

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## Abstract – 103 Oral

**EVALUATION OF SHRIMP *Pandalus platyceros* IN DEEP WATERS  
OF THE WEST COAST OF BAJA CALIFORNIA, MEXICO***E. Sánchez-Juárez\**

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Shrimp populations of *Pandalus platyceros* is distributed in the Pacific Ocean from Hokkaido, Japón to the Aleutianas Islands in the west coast and from Alaska to San Diego, CA, USA in the North East coast. Towards South, the species has been reported in front of Cabo Colonet in Mexican waters. The species has been targeted by the shrimp fleet since 1993 after permits were granted to a Mexican enterprise. In this study, estimation of abundance of shrimp population in Mexican waters was undertaken by surveys collecting information in the area through the use of traps employed by three boats. Bait was base on canned sardine and cat food with excellent results. Shrimp beds were identified in submarine canyons and submarine channels between 30 and 32°N at depths ranging from 160 and 225 m. Leslie-De Lury depletion models were used to estimate shrimp abundance through mobile average of observed Catch per Unit Effort (CPUE), and accumulated catch modified by Bratten. Population size of adults in the sampled area was estimated on  $110 \pm 10.2$  MTs. Study area was divided in 13 conventional zones. The most sounding results are the determination of the life cycle of this species in Mexican waters in temporal basis and the identification of zones with higher abundance. Finally, management measures for this species are suggested.

Keywords: Crustacean, Pandalidae, *Pandalus platyceros*, Depletion Models: Leslie-De Lury, Bratten, Baja California, Mexico

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## Abstract – 104 Poster

**GONADIC MATURATION STAGES OF *Octopus maya* (VOSS & SOLÍS, 1966)  
IN THE YUCATAN PENINSULA, MEXICO**

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The octopus fishery is the second most important for Campeche regarding the social and economical contribution to the region. *Octopus maya* sustains this fishery. The present study aimed to analyze maturation stages of male and female gonads of *O. maya* in order to assess the adequacy of ban periods. The relationship between gonadic maturation and size was evaluated. Maximum Reproductive Peak was also estimated. 1,200 organisms were collected from 2000 to 2004. Gonads were removed and analyzed in fresh. Testicles, ovaries oviducts and oviducal glands were measured. Fecundity was estimated by counting the eggs on mature gonads. Spermatophore number was also estimated in adults. Organisms smaller than 40 mm of mantle length (25-35 g) were not used for this analysis due to sex identification difficulties. Females ranging from 50 to 160 mm mantle length (ML) were observed for maturation. Maturation appears to start in females at 110 ML. In fresh, four maturation stages were identified: I- early maturation stage, II-mature stage, III-spawning stage, and IV-post-hatching stage. Females can produce between 1912 to 2153 eggs. In males, sexual development appears to start in organisms as small as 90 ML since they contained spermatophores in Neddham's sac. Males can shed between 10 to 82 spermatophores. Three stages were observed: I-immature stage, II-adults stage, III-adult in regression stage. It is likely that the reproduction potential is associated to size in both sexes. Two reproduction peaks were observed, one at the end of spring and the other during fall, being the latter the most important.

Keywords: Reproduction, reproductive peak, maturation stages

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## Abstract – 105 Poster

**THE SHELLFISH FISHERY IN THE NORTH ZONE OF CAMPECHE, MEXICO  
FISHERY SEASON 2005***J. Santos-Valencia\*, J.M. Seca-Escalante, C.M. Medina-Martínez, and M. Huchín-Maturel*

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La producción de caracol en el Estado de Campeche durante 2003, constituyó el 71% de la captura total de caracol reportada para Golfo de México y Mar Caribe. En este trabajo, analiza la captura histórica, se determina la composición de especies en la captura, la estructura de tallas de las dos especies principales que la constituyen y se estima la captura por unidad de esfuerzo ejercida en la pesquería. Se comparan los resultados con estudios anteriores para determinar si han habido cambios en las poblaciones de caracol en los últimos años. Los muestreos se realizaron de forma mensual en la zona norte de Campeche, a bordo de embarcaciones comerciales que se seleccionaron de forma aleatoria y sin reemplazo. La producción de caracol en Campeche se ha incrementado en los últimos seis años. La captura se constituye por cuatro especies: caracol tomburro o negro *Turbinilla angulata*, caracol sacabocado o lix *Busicon carica*, caracol rojo o chacpel *Pleuroploca gigantea* y caracol lanceta *Stombus costatus*. En *Turbinella angulata* las mayores frecuencias de tallas se ubicaron entre 180 y 190 mm, con promedio de 190 mm de longitud total (LT); en *Busicon carica* las mayores frecuencias de tallas se ubicaron entre 180 y 200 mm, con talla promedio de 181 mm de LT. Los rendimientos obtenidos por buzo en el puerto de Campeche fluctuaron entre 10 y 20 kilos de caracol por día. En Seybaplaya los rendimientos fueron ligeramente menores entre 7 y 15 kilos y en Champotón, entre 10.5 y 21 kilos por día. Al comparar estos resultados con los de Baqueiro (1990 y 1996), se concluye que la captura ha mejorado en los últimos años, el esfuerzo se ha dirigido a un menor número de especies, sin embargo en la distribución de tallas presentes en la captura y a los rendimientos obtenidos por buzo, no se observaron diferencias importantes.

Keywords: Fishery, shellfish, CPUE

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## Abstract - 108 Oral

**FROM ABUNDANCE TO SCARCITY OF FISHING RESOURCE: SOCIOCULTURAL AND ECONOMIC SCHEME OF ARTISANAL FISHERMEN OF YUCATAN***J. Fraga \**

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In the collective memory of the fishermen of Yucatan, it prevails the following phrase «before, we were few fishermen, there was lots of fishing but there was no market», now we are more fishermen and the 'cake' is divided among more people, it doesn't mean that there are no resources any more, there are fishing resources, but it is divided among more people». It might be a perception of scarcity, a need to emigrate, to be a young professional but not fisherman, fishing hardly pays for itself, useless projects, are common phrases that constitute speeches and practices among the artisanal fishermen of Yucatán. This paper will focus by means of the ethnographic method and interviews to depth of the relation between abundance and scarcity of the fishing resource, considering the analysis of two variables: the members' socioeconomic behavior of maritime households and the external intervention by means of subsidies that break the social organization and local management of fishermen's communities for the sustainability of their resources. To emphasize this fact, we will focus our analysis on three fishermen's communities in Yucatan with organizational diverse forms and local histories that demonstrate the most challenging controversy for the multidisciplinary science: how to achieve the community based coastal resources management. From the socio-anthropology of fishing, Acheson's contributions and Mc Cay (1987), MacCay (1978), McGoodwin (1990), Alegret (1995), Breton and Savard (1995), Fernández (2005), Pomeroy and Rivera Guieb (2005) continue being fundamental to analyze the relation between fishing-market-community-state and science.

Keywords: Socio anthropology, fisheries, maritime households, local management

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## Abstract - 109 Oral

**PUBLIC POLICIES FOR THE COASTAL-MARINE ZONE  
OF MEXICO: PROPOSAL***E. Rivera-Arriaga<sup>1\*</sup>, I. Azuz-Adeath<sup>2</sup>, and P. Muñoz-Sevilla<sup>3</sup>*<sup>1</sup>Universidad Autónoma de Campeche (Mexico), <sup>2</sup>CETYS-Universidad (Mexico),<sup>3</sup>Instituto Politécnico Nacional (Mexico)

Public policies for the coastal-marine zones are composed by a group of objectives, principles, criteria, and general guidelines for the protection of the environment within a given society. Tailoring a specific policy for the coastal-marine zone in Mexico is an urgent need that should be met considering the multisectoral nature of these zones; the economic revenues obtained from the number of activities performed within it; and the impacts carried out on every aspect of the local communities. The policies for the coastal-marine zones demand that each sector of the society make an environmental, social and economic balance over the historical process of regional development that has been done in the coastal fringe; and that defines and address the requirements and ultimate management needs of both the population and the governmental authorities. The Mexican shoreline is 11,122 Km length; 7,828 Km in the Pacific Ocean and Cortes Sea; and 3,294 Km in the Gulf of Mexico and Caribbean Sea. The national migration rate towards the coastal zone is rising; and seventeen of the thirty two Mexican states have an ocean front, which corresponds to 56% of the total continental territory. Considering this, the Mexican coastal-marine policy must address among other: the main coastal-marine issues, assess the capacity building requirements, tackle the financial requests, and rely on the sustainable development of that fringe that each municipal and state government should define as their coastal zone. The present proposal for the coastal-marine policy is based on two main streams: (1) those challenges that from the environmental point of view are derived from the national, state and municipal development plans; and (2) those obtained from the local, state and regional expressions of the National Environmental Policy. This proposal for the coastal-marine policy urge that each economic sector in every coastal community; review their present and future challenges and grant them hierarchies; establish attainable deadlines for undertaking them; define the essential resources for management; and grant the responsibilities that should embrace each sector, and those that must be jointly attained. In the absence of a policy for the Mexican oceans and coastal zones, the management of the fisheries is pending on a thin thread. For a long time Mexico's fisheries have suffered the impact of this policy gap, some examples are the tuna fisheries embargo in the Pacific, the red snappers fisheries issues in the Atlantic, and currently the approval of the 13<sup>th</sup> amendment of the Magnuson Act for the moratorium of the Gulf of Mexico U.S. shrimp fisheries that would have dramatic consequences for this resource within our exclusive economic zone. This ocean and coastal policy will be an important contribution for the sustainable administration of our fisheries.

Keywords: Coastal zone, management, public policies

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