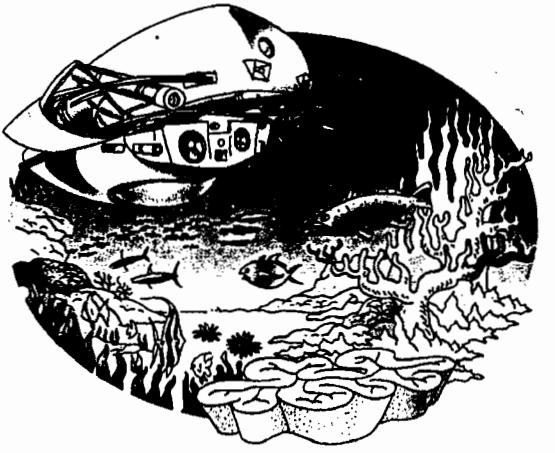

MARINE BENTHIC HABITATS CONFERENCE

NOUMÉA - NEW CALEDONIA - NOVEMBER 10 - 16, 1997

PROGRAMME
and
ABSTRACTS

Conference Organisation

Jean-Marie Auzende : IFREMER
Greg Cailliet : Moss Landing Marine Laboratories, Monterey, USA
René Grandperrin : ORSTOM
Gary Greene : Moss Landing Marine Laboratories, Monterey, USA

Local Organising Committee

Jean-Marie Auzende : IFREMER
Gérard Baudchon : Coopération Régionale du Haut Commissariat
Richard Farman : Province Sud
Michel Gargon : Chambre de Commerce et d'Industrie (CCI)
René Grandperrin : ORSTOM
Jacqueline Thomas : ORSTOM
Christian Habault : MESR
François Jarrige : Directeur du Centre ORSTOM de Nouméa
Yves Lafoy : SME, Représentant de la Nouvelle-Calédonie auprés de la SOPAC
Doriane Sanchez : Directeur du GEST (Groupement pour l'exportation des services et techniques de Nouvelle-Calédonie)
Pierre Siapo : Province Iles
Dominique Cluzel : UFP
Jean-Paul Gaudechoux : CPS
Karell Henriot : Province Nord

SCHEDULE OF THE MARINE BENTHIC HABITATS CONFERENCE

Monday 10 November

Registration at ORSTOM: from 8h30 to 10h00

Opening Session: 10h00

Short welcome given by:

M. Dominique Bur: French Government Delegate for New Caledonia and Wallis and Futuna
M. François Jarrige: Director of Nouméa ORSTOM Center
M. Robert Dun: General Director of PC
M. Alf Simpson: Director of SOPAC
M. Geoffroy Holland: Chair person of IOC
M. Jean-Marie Auzende: Chair person of the Local Organising Committee
M. Gary Greene: Co-Chair person of the Organising Committee

Session I. HABITAT CHARACTERISATION TECHNIQUES

Chair person: K. ABLE

14h00-14h20- Leach, J.H.J.
Semi-submersible imaging systems.

14h20-14h40- McRea Jr.J.E., Greene H.G., O'Connell V.M. and Wakefield W.W.
Mapping marine habitats with high resolution sidescan sonar.

14h40-15h00- Williams I.M. and Leach J.H.J.
The relationship between depth, substrate and ecology: a drop video study from the southeastern Australian coast.

15h00-15h20- Exon N.F. and Hill P.J.
Swath-mapping of the seabed beneath benthic fishery areas off Tasmania

15h20-15h40- Fernandez J-M., Bellet S., Badie C., Fichez R., Chifflet S., and Bernard C.
Dating sedimentary records in tropical lagoon deposits: the use of microwaves in accelerating extraction procedures for 210Po

15h40-16h10 - COFFEE BREAK and POSTER SESSION

Chair person: J.H.J. LEACH

16h10-16-30- Pitcher C.R., Smith G.P., Wassenberg T.J., Cappo M., Doherty P.J. and Hooper J.N.A.
Use of an ROV to research the life history of dominant structural shelf seabed epi-fauna, important for fisheries habitat and biodiversity.

16h30- 16h50- Able K.W., Grassle J.F., Von Alt C. and Glenn S.C.
Enhanced studies of recruitment on the continental shelf: development of fiber-optic linked sensors for monitoring abiotic factors.

16h50-17h10- Moore S.W.
Low-cost data-logging instrument arrays: a valuable technique for characterising coral reef environments.

17h10-17h30- Gordon S.R., Kloser R. and Pitcher C.R.
A digital acoustic system for benthic habitat mapping.

17h30-17h50- Kvitek R.K., Iampietro P. and Bretz C.K.
Multi-media marine GIS: fusion of conventional marine habitat mapping with video data capture to produce quantitative virtual site visits for benthic environmental monitoring.

17h50-18h10- McGoldrick M.C. and Leach J.H.J.
Draper's reef: a semi-submersible study of a near shore reef.

POSTER SESSION

19h00- EVENING COCKTAIL

Tuesday 11 November

Session II. SHALLOW LAGOONS, BAYS AND REEFS

Chair person: A.B. McDIARMID

8h00-8h20- Schlacher T.A., Newell P., Clavier J., Schalcher-Hoenlinger M. and Chevillon C.
Soft-sediment benthic community structure in a coral reef lagoon - the prominence of spatial heterogeneity and " spot endemism ".

8h20-8h40- Long B.G., Skewes T.D.,Taranto T.J., Dennis D.M. and Pitcher C.R.
Rapid assessment techniques for shallow reef resource surveys and habitat mapping.

8h40-9h00- Auster P.J. and Malatesta R.J.
Studies of fish assemblages on deep temperate reefs and banks: linking geophysical methods and direct observations.

9h00-9h20- Harris P., Fichez R., Golterman H.L. and Badie C.
Eutrophication process in the Papeete Lagoon (Tahiti, French Polynesia): using sediment geochronology to reconstruct phosphorus cycling evolution during the past century.

9h20-9h40- Mary N., Smith B.J. and Ward J.B.
Influence of habitat on the structure of benthic macroinvertebrate communities in New Caledonian freshwaters.

9h40-10h00- Labrosse P. and Chauvet C.
The AQUATOLL Project: experimental project of extensive aquaculture of juvenile marine finfishes under tropical insular conditions.

10h00-10h30 COFFEE BREAK and POSTERS

Chair person: M. KULBICKI

10h30-10h50- Parrish J. D. and Friedlander A.M.
Effects of habitat characteristics on Hawaiian reef fish assemblages.

10h50-11h00- Collen J.D.
Tropical Pacific foraminifera.

11h00-11h20- Eagar S.H.
Benthic ostracoda from Tarawa Atoll, Republic of Kiribati.

11h20-11h40- Letourneur Y., Labrosse P. and Kulbicki M. Comparison of commercial fish assemblages of New Caledonian fringing reefs subjected to different levels of ground erosion.

11h40-12h00- Kulbicki M. and Mou Tham G.
Structure of the reef fish assemblages in three bays of New Caledonia subjected to different anthropogenic disturbances.

12h00-12h20- Cabioch G., Turpin L., Recy J. and Correge T. Growth of the fringing and barrier reefs in New Caledonia.

12h20-12h40- Tatarata M. and Serra C.
Polynesian coral reefs monitoring network: methodology and evaluation of data after 8 years.

12h40- 13h30- LUNCH

Session III. DEEP SHELVES, SLOPES, TRENCHES, CANYONS AND SEA MOUNTS

Chair person: G.M. CAILLIET

13h30-13h50- Greene H.G., O Connell V.M., Wakefield W.W. and McRea J.
The Mount Edgecumbe offshore lava field- A diverse mega-habitat for commercial, demersal fish in SE Alaska, USA.

13h50-14h10- Bornhold B.D., Collins W.T., Harper J.R., Currie R.G. and Olynyk H.
A multiparameter approache to nearshore seabed mapping- case studies from British Columbia, Canada.

14h10-14h30- Yoklavich M.M.
Sensing essential benthic fish habitats in deep water.

14h30-14h50- Bax N., Kloser R., Williams A., Gowlett-Holmes K. and Wadley V.
Acoustic habitat definition on the continental shelf of southeast Australia and its relationship to the invertebrate and fish fauna.

14h50-15h10- Kelley C.D., Mundy B.C. and Grau E.G.
Use of the *PISCES V* submersible to locate nursery grounds of commercially important deepwater snappers, family Lutjanidae, in Hawaii.

15h10-15h30- Parrish F.E. Demartini E., Ellis D. and Moffitt R.
Importance of habitat in the production of the Hawaiian deep-water snapper (*Pristipomoides filamentosus*).

15h30-16h00- COFFEE BREAK and POSTERS

Chair person: R.A. PICKRILL

16h00-16h20- Johnson K.A.
Habitat-specificity and oceanographic influences of rockfish recruitment in Monterey Bay, California.

16h20-16h40- Cailliet G.M., Wakefield W.W., Andrews A. and Moreno G.
A comparison of the fish fauna from beam trawl samples, camera sled videos and submersible observations in benthic deep-sea habitats off central California.

16h40-17h00- Starr R.M.
Direct and indirect estimates of fish density on a rocky bank.

17h00-17h20 - Malahoff A. and Chave E.H.
Distribution of fish and benthos on Cross Seamount, Hawaii.

17h20-17h40- Stone G., Kraus S., Martin S., Joy L., Hutt A. and Yoshinaga A.
Reducing marine mammal fisheries bycatch: experiments in New Zealand with acoustic pingers.

17h40-18h00- Greaves J. and Garrigue C.
Preliminary population estimation of humpback whales in New Caledonia.

18h20-19h30- WORKING GROUP: SHALLOW TECHNIQUES: (G. CAILLIET, V O'CONNEL, K. ABLE, M. YOKLAVITCH, M. KULBICKI): evaluation of existing shallow techniques; how can they be used in the South-West Pacific area; what kind of questions could be answered with these techniques; which Program should be initiated in the region?

- MEETING GOOS (W. ERB): relation between Habitats and GOOS; What could be monitored and for what purpose?; Who are the potential users?; Preparation of the next GOOS meeting in SUVA (February 98).

- MEETING FFEM (J-M. AUZENDE- R. FICHEZ- J. LEGUERE): Discussion and writing of the planned proposal (with Fiji, PNG and Vanuatu) which will be submitted for funding by the French Fund for Environment.

Wednesday 12 Novembre

Session IV. INTERPRETATION, ANALYSIS AND MODELS

Chair person: J-M. AUZENDE

8h30-8h50- Greene H. G., Starr R., and Yoklavich M.
A classification scheme for marine benthic habitats.

8h50-9h10- Pickrill R.A.
The application of geoscience to marine habitat research in Canada.

9h10-9h30- Grandperrin R., Auzende J-M., Richer de Forges B., Bouniot E., Durand Saint Omer L., Habault C., Henin C., Laboute P., LaFoy Y., Rivaton J., Thomas J., Van de Beuque S., and Virly S.
Marine resources of New Caledonia: the ZoNeCo programme.

9h30-9h50- Bouniot E.
Organisation of the data banks of the local management and practical applications department (SGVL): description of the general structure.

9h50-10h10- Bouniot E.
Bathymetry processing: description of the model created by local management and practical applications department (SGVL) of the ZoNeCo Programme.

10h10-10h40- COFFEE BREACK and POSTERS

Chair person: H.G. GREENE

10h40-11h00- Van de Beuque S., Lafoy Y., Auzende J-M., Grandperrin R. and Bouniot E.
Benefits of swath mapping of the southern part of the EZ of New Caledonia.

11h00-11h20- Lafoy Y., Auzende J-M., Van de Beuque S., Grandperrin R. and Bouniot E.
Determining habitat structure and lithology: the ZoNeCo programme multidisciplinary surveys.

11h20-11h40- Bonneville A., Beuzart P., Clouard V., Claucke R., Le Suavé R., Loubrieu B., Saget P. and Thomas Y.
ZEPOLYF 1 cruise: complete geophysical survey of a new seamount chain in French Polynesia.

11h40-12h00- Clark M. R.
Orange roughy fisheries on seamounts in New Zealand

12h00-12h20- Koslow J.A.
Conservation of seamount fisheries and benthic habitat: the Australian experience

12h20-12h40- Kulbicki M. and Andrefouet S.
Use of SPOT images to estimate fish stocks and to model trophic structure in Tuamotu atolls: preliminary results from three atolls.

12h20-14h00- LUNCH

Session V. IMPACTS AND MANAGEMENT

Chair person: R. GRANDPERRIN

14h00-14h20- Pichon M.
Interactions between the ocean, coral reefs and the coastal zone.

14h20-14h40- Pitcher C.R., Burridge C.Y., Wassenberg T.J. and Poiner I.R.
The effects of trawl fisheries on shelf seabed habitats.

14h40-15h00- Engel J. and Kvitek R.
Impact of commercial trawling on a benthic community within Monterey Bay National Marine Sanctuary.

15h00-15h20- Grimes C.B., Koenig C.C., Fitzhugh G.R. and Scalon K.M.
Marine harvest refugia in the U.S. South Atlantic and Gulf of Mexico: problem's approaches and initial results.

15h20-15h50- COFFEE BREAK and POSTERS

Chair person: I.R. POINER

15h50-16h10- Davis G.W.
Management of Guam's coastal resources.

16h10-16h30- Gawel M.J.
Protection of the marine benthic environment of Guam.

16h30-16h50- Poiner I.R., Skewes T.D., Long B.G., Taranto T., and Pitcher C.R.
Conservation planning to support informed decision making and sustainable development.

16h50-17h10- Koenig C. C. and Grimes C.B.
Approaches to the restoration of a deep-water population of the habitat-structuring coral *Oculina varicosa* in the Oculina Research Reserve off Fort Pierce, Florida, U.S.A.

17h10-17h30- Lemonnier H, Herlin M. and Coatanea D.
Shrimp aquaculture in New Caledonia: an example of an artificial marine habitat

17h30-17h50- Joannot P., Deveau J., Dubois J., Gerbault A. and Lucas M.
The Nouméa Aquarium: a tool for research

18h00-19h00- WORKING GROUP: DEEPER TECHNIQUES (R. PICKRILL, G. CAILLIET, G. GREENE, J-M. AUZENDE): evaluation of existing deep techniques; how can they be used in the South-West Pacific area; what kind of questions could be answered with these techniques; which Program should be initiated in the region?

MEETING EZ (A. SIMPSON): discussion and writing of proposal for EZ survey in the region; UNCLOS, evaluation of living and non living resources.

Thursday 13 Novembre

Session V. IMPACTS AND MANAGEMENT (continued)

Chair person: N.E. EXON

8h30-8h50- O'Connell V.T., Carlile D.C., Wakefield W.W. and Greene H.G.
Habitat-based assessment of a long-lived species in the Gulf of Alaska: implications for commercial fisheries management.

8h50-9h10- Rees J G, Williams T M, Weeks J, Sharp V, and Setiapermana D.
Evaluating the effects of contaminated waters and sediments on benthic faunas: development of monitoring protocols and pollution management strategies.

9h10-9h30- MacDiarmid A.B. and Butler M.
Effects of fishing: experience in New Zealand with marine reserves and spiny lobsters.

9h30-9h50- Pitcher C.R., Skewes T.D., Smith G.P., Gordon S.R., Long B.G. and Taranto T.
Methods for rapid characterisation, quantification and mapping of shelf seabed habitats.

9h50-10h10- Stanbury KB. and Starr R.M.
Applications of GIS for habitat assessment and marine resources managment.

10h10-10h30- Davidson J.
Does High resolution video technology mean a clearer vision for management?

10h30-11h00- COFFEE BREAK

11h00-12h00- WORKING GROUP: IMPACT AND MANAGEMENT (I. PITCHER, M. YOKLAVITCH, V. O'CONNEL, R. STARR, Y. LAFOY)
OTHER MEETINGS: GOOS, FFEM, EZ, etc... continuation of the WG meetings of tuesday 11 November

12H00-13h00- LUNCH

FROM 13h00 EXCURSIONS

1) Parc de la Rivière Bleue (Bus= 50 persons max.)
2) Nouméa Aquarium (walking distance)
3) Station Aquacole de la Baie de Saint-Vincent - Saint Vincent IFREMER's Prawn Farm (Bus= 50 persons max.)

19h00- Dinner at the ORSTOM Tennis Club House (Offered by the Local Organising Committee)

Friday 14 Novembre

Session VI. HARMFUL ALGAE IN THE SOUTH PACIFIC

Chair person: H. ENEVOLDSEN

From 8h30
1- Introduction
2-Introductory talks

Enevoldsen H. and Diogene J.
The IOC Harmfull Algal Bloom Programme.
Legrand A.M., Chinain M., Pauillac S., Benoit E. and Molgo J.
Ciguatera and related health problems in the South Pacific
Y.Fukuyo The biology of Ciguatera causative microorganisms.
Diogene J., Reguera B. and Enevoldsen H.
Syndroms caused by Harmfull microalgae.

3-Discussions
Assessment of the problem of Harmfull algae in the South Pacific; how, who? Major needs in the region with respect to harmfull algae.

4- Recommendations.

12h30-14h00- LUNCH

Afternoon: Results of Working Group meetings, reports of chairmen; Recommendations:
Chair person: K. CROOK in association with the chairmen of all sessions, IOC, SOPAC, etc...:
Publication planning (J-M. AUZENDE, G. CAILLIET, G. GREENE, R. GRANDPERRIN)

17h00- **Closure session**

POSTERS

Allenbach M. and Thollot P.
The mangrove ecosystem of Boulari Bay (Nouméa, New Caledonia). Predictable impact of anthropogenic action (motorway by-pass build) and proposal developments.

Auzende J.-M., Lafoy Y., Van de Beuque S. and Grandperrin R.
ZoNéCo Programme: evaluation of the marine resources of the New Caledonia Economic Zones.

Barker B., Helmond I., Bax N., Williams A., Davenport S. and Wadley V.
A vessel-towed camera platform for seafloor surveys of the continental shelf.

Eagar S.H.
Benthic Ostracoda from Tarawa Atoll, Republic of Kiribati.

Fichez R., Newell P. and South R.
programme: looking at terrigenous and anthropogenic influences on coral reef lagoons of the Pacific.

Garrigue C. and Bour W.
Impact of a prawn farm on a coastal ecosystem, a case study: the seagrass meadow of the Chambeyron Bay, New Caledonia.

Greene H.G, O'Connell V.M., McRea J. and Wakefield W.W.
The Mount Edgecumbe offshore lava field: a diverse megahabitat for commercial demersal fish in SE Alaska, USA.

Hernandez-Alcanta A.P. and Solis-Weiss V.
Spatial distribution of the infralittoral annelids polychaetes in the Eastern coast of the Gulf of California, Mexican Pacific.

Henin C.
Oceanographic variability around New Caledonia.

Hoibian T. and Allenbach M.
The use of ecological distribution of benthic ostracods as a biotic gauge for shallow marine environments.

Lafoy Y., Auzende J-M., Van de Beuque S. and Missègue F.
Petroleum potential of New Caledonia: main results of recent field work studies.

Mazzocco M. and Chauvet C.
The peculiar pattern of the Forest site (abore Great Barrier Reef): are the coral pinnacles in a random position?

Metcalf S.

The Ocean is our Classroom: Marine Studies, Bay of Plenty Polytechnic.

Ponia B. and Roi N.

Several applications of mapping marine benthic habitats utilised by the Ministry of Marine Resources - Cook Islands.

Richer de Forges B. and Garrigue C.

First observations of a major coral bleaching in New Caledonia.

Richer de Forges B., Grandperrin R. and Bujan S.

The vulnerability of the biodiversity of the Norfolk Ridge Seamounts.

Slater D.

Delta submersible: an in situ tool for observation and sampling of habitats.

Thollot P. and Wantiez L.

ORC: a coral reef monitoring network in the South Province of New Caledonia.

Van de Beuque S., Auzende J-M., Lafoy Y. and Bouniot E.

Western New Caledonia Economic Zone: new results obtained during ZoNéCo 4 cruise.

Virly S. and Grandperrin R.

Demersal fishery resources and bathymetric ranges within the economic zone of New Caledonia.

Wright I.C., MacDiarmid A. Lewis K.B., Battershill C., Grange K., Mitchell J., Foster G.A. Thrush S., Garick R., Turner S. and Hume T.

Swath mapping near-shore and deep-sea marine habitats: examples from New Zealand.

Yolelavitch M., Steger J., Schwing F., Starr R., Greene H.G. and Malzone C.

Mapping benthic habitats and ocean currents in the vicinity of a marine protected area.

ZEPOLYF Program.

ZEPOLYF: Geophysical mapping of the French Polynesia EZ.

CALENDRIER DE LA CONFERENCE HABITATS BENTHIQUES MARINS

Lundi 10 novembre

Enregistrememement à l'ORSTOM: de 8h30 à 10h00

Session d'ouverture: 10h00

Allocutions de bienvenue:

M. Dominique Bur: Délégué du Gouvernement pour la Nouvelle Calédonie et Wallis et Futuna
M. François Jarrige: Directeur du Centre Orstom de Nouméa
M. Robert Dun: Directeur Général de la Communauté du Pacifique (ex CPS)
M. Alf Simpson: Directeur de la SOPAC
M. Geoffroy Holland: Président représentant la COI
M. Jean-Marie Auzende: IFREMER, Co-Président du Comité d'Organisation
M. Gary Greene: MLML, Co-Président du Comité d'organisation

Session I. TECHNIQUES DE CARACTERISATION DES HABITATS

Président: K. ABLE

14h00-14h20- Leach J.H.J.
Système d'imagerie semi-submersible.

14h20-14h40- McRea Jr.J.E., Greene H.G., O'Connell V.M. and Wakefield W.W.
Cartographie des Habitats marins avec des sonars latéraux haute résolution.

14h40-15h00- Williams I.M. and Leach J.H.J.
Relations entre profondeur, substratum et écologie: une étude par vidéo de la côte sud orientale de l'Australie.

15h00-15h20- Exon N.F. and Hill P.J.
Cartographie multifaisceaux du fond marin dans les zones de pêche démersale au large de la Tasmanie.

15h20-15h40- Fernandez J-M., Bellet S., Badie C., Fichez R., Chifflet S., and Bernard C.
Datation des enregistrements sédimentaires dans les dépots de lagon tropical: utilisation des microondes pour accélérer les procédures d'extraction du 210 Po.

15h40-16h10 - CAFE et SESSION POSTER

Président: J.H.J. LEACH

16h10-16-30- Pitcher C.R., Smith G.P., Wassenberg T.J., Cappo M., Doherty P.J. and Hooper J.N.A.
Utilisation d'un ROV pour étudier l'histoire naturelle de l'épifaune des pentes, importante pour les pêches et la biodiversité.

16h30- 16h50- Able K.W., Grassle J.F., Von Alt C. and Glenn S.C.
Etudes intensives du recrutement sur le plateau continental: utilisation des sondes à fibres optiques pour suivre l'évolution des facteurs abiotiques.

16h50-17h10- Moore S.W.
Réseau d'instruments d'observation à faible coût: une bonne technique pour caractériser l'environnement des récifs coralliens.

17h10-17h30- Gordon S.R., Kloser R. and Pitcher C.R.
Système acoustique digital pour la cartographie des habitats benthiques.

17h30-17h50- Kvitek R.K., Iampietro P. and Bretz C.K.
SIG marin multimédia: fusion des données de cartographie conventionnelle des habitats marins avec des données vidéo réalisées afin de produire des mesures quantitatives pour le suivi de l'environnement benthique.

17h50-18h10- McGoldrick M.C. and Leach J.H.J.
Le récif Draper: étude semi-submersible d'un récif côtier.

SESSION POSTER

19h00- COCKTAIL

Mardi 11 November

Session II. LAGONS PEU PROFONDS, BAIES ET RECIFS

Président: A.B. McDIARMID

8h00-8h20- Schlacher T.A., Newell P., Clavier J., Schalcher-Hoenlinger M. and Chevillon C.
Structure d'une communauté benthique de sédiments meubles dans un lagon récifal- proéminence de l'hétérogénéité spatiale et endémisme ponctuel.

8h20-8h40- Long B.G., Skewes T.D.,Taranto T.J., Dennis D.M. and Pitcher C.R.
Techniques d'évaluation rapide pour l'étude des ressources des récifs and la cartographie des habitats.

8h40-9h00- Auster P.J. and Malatesta R.J.
Etude des peuplements de poissons sur les récifs et bancs profonds en milieu tempéré: liaison entre les méthodes géophysiques et les observations directes.

9h00-9h20- Harris P., Fichez R., Golterman H.L. and Badie C.
Processus d'eutrophisation dans le lagon de Papeete (Tahiti, Polynésie française): utilisation de la géochronologie sédimentaire pour reconstruire l'évolution cyclique du phosphore pendant le dernier siècle.

9h20-9h40- Mary N., Smith B.J. and Ward J.B.
Influence de l'habitat sur la structure des macroinvertébrés benthiques des eaux douces de Nouvelle-Calédonie.

9h40-10h00- Labrosse P. and Chauvet C.
Le projet AQUATOLL: projet expérimental d'aquaculture extensive de juvéniles de poissons dans des conditions tropicales insulaires.

10h00-10h30 CAFE et POSTERS

Président: M. KULBICKI

10h30-10h50- Parrish J. D. and Friedlander A.M.
Effets des caractéristiques de l'habitat sur les peuplements des poissons du récif Hawaien.

10h50-11h00- Collen J.D.
Les foraminifères du Pacifique tropical.

11h00-11h20- Eagar S.H.
Les ostracodes benthiques de l'atoll de Tarawa, République de Kiribati.

11h20-11h40- Letourneur Y. Labrosse P. and Kulbicki M.
Comparaison des peuplements de poissons commerciaux des récifs frangeants Néocalédonien en liaison avec différents niveaux d'érosion des sols.

11h40-12h00- Kulbicki M. and Mou Tham G.
Structure des peuplements des poissons de trois baies de Nouvelle-Calédonie placées sous différents types d'influences anthropiques.

12h00-12h20- Cabioch G., Turpin L., Recy J. and Correge T.
Croissance des récifs frangeant et barrière en Nouvelle-Calédonie.

12h20-12h40- Tatarata M. and Serra C.
Réseau d'observation des récifs Polynésiens : méthodologie et évaluation des données après 8 années.

12h40- 13h30- LUNCH

Session III. PLATEAUX, PENTES, FOSSES, CANYONS ET MONTS SOUS-MARINS PROFONDS.

Président: G.M. CAILLIET

13h30-13h50- Greene H.G., O Connell V.M., Wakefield W.W. and McRea J.
Le champ de lave immergé du Mont Edgecumbe: un mega-habitat diversifié pour les espèces commerciales de poissons démersaux en Alaska du sud est, USA.

13h50-14h10- Bornhold B.D., Collins W.T., Harper J.R., Currie R.G. and Olynyk H.
Une approche multiparamétrique de la cartographie côtière: le cas de la Colombie Britannique, Canada.

14h10-14h30- Yoklavich M.M.
Détection des principaux habitats benthiques en eau profonde.

14h30-14h50- Bax N., Kloser R. Williams A., Gowlett-Holmes K. and Wadley V.
Définition acoustique des habitats sur le plateau continental du SW Australien et ses relations avec la faune d'invertébrés et de poissons.

14h50-15h10- - Kelley C.D., Mundy B.C. and Grau E.G.
Utilisation du submersible *PISCES V* pour localiser les zones de reproduction des vivaneaux profonds (Lutjanidés) à Hawaî.

15h10-15h30- Parrish F.E. Demartini E., Ellis D. and Moffitt R.
Importance des habitats dans la production du vivaneau profond (*Pristipomoides filamentosus*) d'Hawaî.

15h30-16h00- CAFE et POSTERS

Président: R.A. PICKRILL

16h00-16h20- Johnson K.A.
Spécificité des habitats et influences des paramètres océanographiques sur le recrutement des poissons de roche dans la baie de Monterey, Californie.

16h20-16h40- Cailliet G.M., Wakefield W.W., Andrews A. and Moreno G.
Comparaison de la faune de poissons à partir de traits de chalut à perche, de traits de caméra video et d'observations en submersible dans les zones d'habitats profonds au large de la Californie centrale.

16h40-17h00- Starr R.M.
Estimation directe et indirecte de la densité des poissons sur un banc rocheux.

17h00-17h20 - Malahoff A. and Chave E.H.
Distribution des poissons et du benthos sur Cross Seamount, Hawaii

17h20-17h40- Stone G., Kraus S., Martin S., Joy L., Hutt A. and Yoshinaga A.
Reduction des captures de mammifères marins: essais de pingers acoustiques en Nouvelle-Zélande.

17h40-18h00- Greaves J. and Garrigue C.
Estimation préliminaire des populations de baleines à bosse en Nouvelle Calédonie.

18h20-19h30- GROUPE DE TRAVAIL TECHNIQUES SUPERFICIELLES: (G. CAILLIET, V O'CONNEL, K. ABLE, M. YOKLAVITCH, M. KULBICKI) ; évaluation des techniques existantes. Comment peuvent elles être utilisées dans le SW Pacifique ? A quels types de questions répondent ces techniques ? Quels programmes pourraient être envisagés dans la région ?

- REUNION GOOS (W. ERB): relation entre HABITATS et GOOS : Que doit on mesurer et dans quel but ? Qui sont les utilisateurs potentiels? Préparation de la prochaine réunion GOOS à Suva (février 98).
- REUNION FFEM (J-M. AUZENDE-R. FICHEZ-J. LEGUERE): Discussion et écriture des propositions envisagées avec Fidji, PNG et Vanuatu, qui seront soumises pour financement au FFEM (Fond Français pour l'Environnement Mondial).

Mercredi 12 Novembre

Session IV. INTERPRETATION, ANALYSES ET MODELES

Président: J-M. AUZENDE

8h30-8h50- Greene H. G., Starr R., and Yoklavich M.
Schéma de classification des habitats benthiques marins.

8h50-9h10- Pickrill R.A.
L'application des géosciences à la recherche des habitats marins au Canada.

9h10-9h30- Grandperrin R., Auzende J-M., Richer de Forges B., Bouniot E., Durand Saint Omer L., Habault C., Henin C., Laboute P., LaFoy Y., Rivaton J., Thomas J., Van de Beuque S., and Virly S.
Les Ressources marines de la Nouvelle-Calédonie : Le programme ZoNéCo.

9h30-9h50- Bouniot E.
Organisation des banques de données à la SGVL : description de la structure générale.

9h50-10h10- Bouniot E.
Traitement de la bathymétrie : description du modèle crée par la SGVL du programme ZoNéCo.

10h10-10h40- CAFE et POSTERS

Président: H.G. GREENE

10h40-11h00- Van de Beuque S., Lafoy Y., Auzende J-M., Grandperrin R. and Bouniot E.
Apports de la bathymétrie multifaisceaux dans la partie sud de la zone économique de la Nouvelle-Calédonie.

11h00-11h20- Lafoy Y., Auzende J-M., Van de Beuque S., Grandperrin R. and Bouniot E.
Détermination de la structure des habitats et de leur lithologie: le programme de reconnaissance multidisciplinaire ZoNéCo.

11h20-11h40- Bonneville A., Beuzart P., Clouard V., Claucke R., Le Suavé R.
Loubrieu B., Saget P. and Thomas Y.
ZEPOLYF 1: reconnaissance géophysique d'une nouvelle chaîne de monts sous marins en Polynésie Française.

11h40-12h00- Clark M. R.
La pêche des " orange roughy " sur les monts sous marins de Nouvelle-Zélande.

12h00-12h20- Koslow J.A.
Protection des ressources halieutiques et des habitats benthiques sur les monts sous marins: l'expérience Australienne.

12h20-12h40- Kulbicki M. and Andrefouet S.
Utilisation des images SPOT pour estimer les stocks de poissons et pour modéliser la structure trophique dans les atolls des Tuamotu: résultats préliminaires sur trois atolls.

12h20-14h00- LUNCH

Session V. IMPACTS ET GESTION

Président: R. GRANDPERRIN

14h00-14h20- Pichon M.
Interactions entre l'océan, les récifs coralliens et les zones littorales.

14h20-14h40- Pitcher C.R., Burridge C.Y., Wassenberg T.J. and Poiner I.R.
Les effets des pêcheries au chalut sur les habitats à morphologie de type plateau.

14h40-15h00- Engel J. and Kvitek R.
Impact des chalutages commerciaux sur les organismes benthiques du sanctuaire marin national de Monterey Bay.

15h00-15h20- Grimes C.B., Koenig C.C., Fitzhugh G.R. and Scalon K.M.
Réserves de pêche aux Etats Unis, Atlantique Sud et golfe de Mexico : approche des problèmes et premiers résultats.

15h20-15h50- CAFE et POSTERS

Président: I.R. POINER

15h50-16h10- Davis G.W.
Gestion des ressources côtières à Guam.

16h10-16h30- Gawel M.J.
Protection de l'environnement benthique marin à Guam.

16h30-16h50- Poiner I.R., Skewes T.D., Long B.G., Taranto T., and Pitcher C.R.
Politique de conservation en faveur d'aide à la décision et de développement durable.

16h50-17h10- Koenig C. C. and Grimes C.B.
Approches pour la restauration d'une population marine profonde ayant pour habitat corallien *Oculina varicosa* dans la réserve de recherches d'Oculina, au large de Fort Pierce, Floride, U.S.A.

17h10-17h30- Lemonnier H. Herlin M. and Coatanea D.
Aquaculture de la crevette en Nouvelle-Calédonie : exemple d'un habitat marin artificiel.

17h30-17h50- Joannot P., Deveau J., Dubois J., Gerbault A. and Lucas M.
L'aquarium de Nouméa: un outil pour la recherche.

18h00-19h00- GROUPE DE TRAVAIL: TECHNIQUES PROFONDES (R. PICKRILL, G. CAILLIET, G. GREENE, J-M. AUZENDE) : évaluation des techniques profondes existantes. Comment elles peuvent être utilisées dans la région Sud-Ouest Pacifique ? Quelles questions ou quels problèmes permettent-elles de solutionner ? Quels sont les programmes qui pourraient être développés dans la région ?

REUNION "ZONES ECONOMIQUES" (A. SIMPSON) : discussion et rédaction de demandes pour la reconnaissance des zones économiques de la région ; convention sur le droit de la mer; évaluation des ressources marines vivantes et minérales.

Jeudi 13 Novembre

Session V. IMPACTS ET GESTION (suite)

Président: N.E. EXON

8h30-8h50- O'Connell V.T., Carlile D.C., Wakefield W.W. and Greene H.G.
Inventaire en terme d'habitat des espèces à longue durée de vie dans le Golfe d'Alaska : les implications en terme de gestion des pêcheries commerciales.

8h50-9h10- Rees J. G. Williams T. M. Weeks J., Sharp V. and Setiapermana D.
Evaluation des effets des eaux et des sédiments contaminés sur les faunes benthiques : développement de protocoles de suivi et de stratégies de gestion de la pollution.

9h10-9h30- MacDiarmid A.B. and Butler M.
Effets de la pêche : l'experience en Nouvelle-Zélande des réserves marines à langoustes à épines.

9h30-9h50- Pitcher C.R., Skewes T.D., Smith G.P., Gordon S.R., Long B.G. and Taranto T.
Méthodes pour la caractérisation, quantification et cartographie des habitats de type plateau.

9h50-10h10- Stanbury K.B. and Starr R.M.
Apports des Systèmes d'Information Géographique (SIG) à l'inventaire des habitats et à la gestion des ressources marines.

10h10-10h30- Davidson J.
La technologie vidéo haute résolution apporte-t-elle une vision plus claire en terme de gestion (des ressources) ?

10h30-11h00- CAFE et POSTERS

11h00-12h00- GROUPE DE TRAVAIL : IMPACT ET GESTION (I. PITCHER, M. YOKLAVITCH, V. O'CONNEL, R. STARR, Y. LAFOY)
AUTRES REUNIONS : GOOS, FFEM, Zones Economiques, etc... continuation des réunions des Groupes de Travail du mardi 11 novembre

12H00-13h00- LUNCH

A PARTIR DE 13h00 : EXCURSIONS

Vendredi 14 Novembre

Session VI. ALGUES TOXIQUES DANS LE SUD OUEST PACIFIQUE

Président : H. Enevoldsen

A partir de 8h30-
1- Introduction
2- Présentations

Enevoldsen H. and Diogene J.
Le programme " *Harmfull Algal Bloom* " de la COI
Legrand A.M., Chinain M., Pauillac S., Benoit E. and Molgo J.
Ciguatera et problèmes de santé associés dans le Pacifique sud.
Fukuyo Y.
Biologie des microorganismes responsables de la Ciguatera.
Diogene J., Reguera B. and Enevoldsen H.
Syndromes occasionnés par les microalgues toxiques

3- Discussions
Définition du problème des algues toxiques dans le sud Pacifique. Comment ? Qui ?
Besoins majeurs de la région concernant les algues toxiques.

4- Recommandations.

12h30-14h00- LUNCH

Aprés midi : Résultats des réunions des groupes de travail ; rapports des présidents ; Recommandations ;
Président : K. CROOK avec les présidents des sessions, COI, SOPAC, etc...;
Plan de publication (J-M. AUZENDE, G. CAILLIET, G. GREENE, R. GRANDPERRIN)

17h00- **Session de Cloture**

ENHANCED STUDIES OF RECRUITEMENT ON THE CONTINENTAL SHELF: DEVELOPMENT OF FIBER OPTIC LINKED SENSORS FOR MONITORING ABIOTIC FACTORS

ABLE K.W., GRASSLE J.F., VON ALT C. and GLENN S.C.

Rutgers University, Institute of Marine and Coastal Sciences, New Brunswick, New Jersey, USA

The role of episodic abiotic events in recruitment processes is seldom addressed because of inherent difficulties in tracking short-term events. We have developed a Long-term Ecosystem Observatory (LEO 15) on the inner continental shelf (15 m depth) off southern New Jersey, USA, that will enable us to identify short-term fluctuations of the physical environment and measure the fish response with particular emphasis during metamorphosis and settlement. To date, we have 1) characterized habitat types at several scales (cm to km) with sidescan sonar, sediment analysis and in situ video; 2) demonstrated significant, short-term changes in temperature (5°C in 2 min); 3) observed that stratification due to upwelling induces plankton blooms and resulting hypoxia; and 4) determined that fishes are represented by a relatively diverse fauna during the summer that either settle permanently on the inner shelf or are in transit into an adjacent estuary. In order to better and more continuously measure the relevant abiotic variables we have deployed a variety of sensors with a fiber optic link to our adjacent (7 km) field station. This real-time monitoring capability has provided an excellent record as well as the data to trigger more conventional sampling in response to unusual events (storms, upwelling, etc,...) as they occur.

THE MANGROVE ECOSYSTEM OF BOULARI BAY (NOUMÉA, NEW CALEDONIA). PREDICTABLE IMPACT OF ANTHROPOGENIC ACTION (MOTORWAY BY-PASS BUILD) AND PROPOSAL DEVELOPMENTS (POSTER)

ALLENBACH M. and THOLLOT P.

Université Française du Pacifique, BP. 4477, 98847 Nouméa Cedex, New Caledonia

The future motorway by-pass Nouméa-Mont Dore go across the marine littoral domain, in Boulari Bay, at the north-east of Nouméa city center. On 1,5 kilometer linear, the highway hug the coast or go across two mangroves areas for the first part of the road whose building is just beginning. Littoral mangrove importance led New Caledonian Southern Province authorities to decide the setting of an impact study, specific to the only problem of safeguard maxima areas of the threated ecosystem, one of the most important mangrove area around Nouméa. Made in collaboration with the South Province Civil-Engeenering Direction, foreman of the work, the study has two majors objectives. The first one was the definition of predictable impact of the motorway by-pass construction on the littoral ecosystem. The second one is to make proposals in order to reduce the negative effects of anthropogenic build action. First formed on a scheme absolutely unfavourable to the safeguard of the mangrove-trees, as a littoral parallel coastal sea-wall, fill up mangroves areas, in opposition with the water-transits, the project has been improved. Five thematics were studied on an annual period: sedimentology, littoral currentology and sedimentary dynamics, marine hydrology, biology and ecology of mangrove and nearshore areas, hydrology of internal mangrove channels. The results shows the wealth of vegetal species and communauties on the site of Conception mangrove. It was also found real halieutic potential on the same area. The proposal developments, on the only competence domain of the study: safeguard of the mangrove can be resumed by two kinds of actions. The first one is the keeping, at an high level, of the water transits under the road, by specific underground passages across the motorway, specially amenaged for this purpose. The second one is the reduction of mangroves areas destruction on the only one area of the road, during the construction period, using a special approach of working, in accordance of environment respect.

STUDIES OF FISH ASSEMBLAGES ON DEEP TEMPERATE REEFS AND BANKS: LINKING GEOPHYSICAL METHODS AND DIRECT OBSERVATIONS

AUSTER P.J. and MALATESTA R.J.

National Undersea Research Center, University of Connecticut at Avery Point, Groton, USA

Terrestrial ecology has benefited from multi-scale data provided by satellite, aerial, and ground based observations. Fish ecologists have not generally used such approaches and traditional sampling is generally at a single scale. A multi-scale study for defining deep reef and bank habitats has been initiated at Stellwagen Bank National Marine Sanctuary in order to evaluate such approaches for monitoring and assessment of fishes and associated habitats. Multi-beam bathymetry, side-scan sonar, ROV mounted sector-scanning sonar and high resolution color video are used to produce multi-scale data sets. Analytical approaches have utilized fractal geometry to describe bank habitat change based on gray scale distributions, spatial measurements of sector-scanning sonar for delineating habitat disturbance by mobile fishing gear, and multivariate analysis of data taken from video imagery for defining fish assemblages and functionally equivalent habitats. This approach has identified «sensitive» habitats and methods for monitoring habitat change using side-scan sonar and video imagery have been tested. Questions about structures which support reef fish assemblages, and ultimately what it is that define «reefs» have been addressed. While observational in nature, data have suggested a range of process studies which will allow predictive models to be developed to better deal with essential fish habitat issues of importance to fishery and sanctuary management.

ZoNéCo Programme: Evaluation of the marine resources of the New Caledonia Economic Zone (Poster)

AUZENDE J-M., LAFOY Y., VAN de BEUQUE S. and GRANDPERRIN R.

IFREMER/DRO/GM c/o ORSTOM, BP. A5, 98848 Nouméa Cedex, New Caledonia

As many are island states, the Territory of New Caledonia presents a limited land surface compared with the extension of its EZ. The aim of the ZoNéCo programme is to evaluate the marine resources of these EZ. As with most of the mining prospects, it has been divided in three phases:

- A strategic phase, the objective of which is mainly the analysis of existing data and the production of sea bed topography maps by swath mapping cruises on selected areas.
- A tactical phase, the aim of which is the identification and quantification of possible living and non living resources.
- A third phase named «target study» devoted to the evaluation of the economic potential of these resources.

The ZoNéCo programme constitutes an original integrated approach which due to its multidisciplinarity concerns the political authorities of France, of New Caledonia Territory, of New Caledonia Provinces and their Research Institutions. The limited life of the programme necessitates a rapid relay by applied actions involving the socio-economic partners of New Caledonia, France and Pacific Island Countries. The results already obtained in terms of fisheries leave us the hope that the transfer of the programme to the development actors will occur in a relatively short term (3 to 5 years). ZoNéCo appeared as an exportable programme in not only the French Territories and Departments but also the multitude of small island countries of the intertropical zone (ITZ) of the world oceans. Because of the over-exploitation of their coastal zones, the demographic pressures and the introduction of sophisticated fishing methods (nylon nets, motorised canoes, etc), the island countries have to identify a new sustainable fishing resource in order to insure the full employment of their citizens and avoid migratory fluxes toward the cities.

A VESSEL-TOWED CAMERA PLATFORM FOR SEA-FLOOR SURVEYS OF THE CONTINENTAL SHELF (POSTER)

BARKER B., HELMOND I., BAX N., WILLIAMS A., DAVENPORT S. and WADLEY V.

CSIRO Division of Marine Research, Hobart, Australia

Underwater video and still photography have been widely used for data collection in marine sciences. Platforms for camera equipment and modes of deployment vary according to the application, depth of operation, available budget, duration and extent of survey, and environmental conditions. We developed a towed camera platform to photograph sea-floor habitat types in the continental shelf fishery off southeastern Australia. The system is capable of transiting soft and hard bottom types at a constant height above bottom. This Towed Automatically Compensating Observation System (TACOS) has been successfully used to obtain both still and video images of the sea-floor over a range of bottom types including soft sand and mud, and rocky reef. In open ocean conditions it has been deployed to 200 m from our 66 m research vessel. The ability to tow the system over hard and rough bottom types at a constant and predetermined height above bottom makes it a unique solution for obtaining consistently high quality photographic and video records of sea-floor habitats for commercial fishes. Using off the shelf» video and camera equipment we were able to develop a relatively low cost system which provide s real time video, 35 mm still and high resolution in-situ video from a stable platform.

ACOUSTIC HABITAT DEFINITION ON THE CONTINENTAL SHELF OF SOUTHEAST AUSTRALIA AND ITS RELATIONSHIP TO THE INVERTEBRATE AND FISH FAUNA

BAX N., KLOSER R., WILLIAMS A., GOWLETT-HOLMES K. and WADLEY V.

CSIRO Division of Marine Research, Hobart, Australia

The importance of habitat to fisheries production on the shelf of southeast Australia is a part of a five year study to determine the functioning of the ecosystem in this area and its implications for sustainable fishery development. As part of this study, benthic habitat from 40 m to the shelf break (~200 m) was surveyed with a Simrad EK-500 single vertical beam sounder at 12, 38 and 120 kHz. and areas designated as soft, hard and rough from visual inspection of the echograms. Selected areas were sampled with a towed video camera, sediment sampler, benthic sled, demersal trawl, variable mesh gillnet and traps to determine the relevance of the acoustic habitat classifications to biological habitats. There were distinct differences in the benthic and fish communities between acoustic habitat types. There was also considerable structure within each habitat type and ongoing analysis is developing a set of acoustic habitat types that has relevance to biological habitat types as determined from photographic records.

ZEPOLYF1 CRUISE: COMPLETE GEOPHYSICAL SURVEY OF A NEW SEAMOUNT CHAIN IN FRENCH POLYNESIA

BONNEVILLE A., BEUZART P., CLOUARD V., KLAUCKE I., LE SUAVE R., LOUBRIEU B., SAGET P. and THOMAS Y.

Université Française du Pacifique, BP. 6570, Faaa Aéroport, Tahiti, French Polynesia.

A complete predicted bathymetric map of French Polynesia using shipboard and altimetry data recently revealed the importance of a seamount chain located 200 km southward of Tahiti. This chain, poorly covered by ship tracks and already named on previous maps «Savannah Seamounts», has been chosen as the first target for the ZEPOLYF program. In December 1996, expedition ZEPOLYF1 aboard the R.V *L'Atalante*, equiped with a multibeam echo-sounder EM12D, conducted a geophysical survey of a zone centered on the Savannah Seamounts. Bathymetry, acoustic imagery, seismic reflection, gravity and magnetic data have been collected over more than 107 000 km^2. Bathymetry revealed two distinct parts: the Savannah Seamount chain itself, 300 km long, N°115 elongated, from W°155/S°17 to W°150/S°20, and the Va'a Piti (double pirogue) alignment, 320 km long, N°90 elongated along latitude S°20 between W°150 and W°147. The Savannah Seamount chain is composed of 18 volcanic seamounts, lying on a 85 Ma old oceanic crust and oriented along the typical direction of the absolute Pacific plate motion since 45 Ma. Among these seamounts, we found 5 guyots ranging between 500 and 1000 m in depth covered by coral reef limestone. The basalt sample collected on the flank of the largest guyot, covered by a thick manganese incrustation, will probably confirm an age much older than the Society volcanism. To the East, the Va'a Piti alignment presents a different pattern: it is composed of two main parallel segments more than 300 km long, and a few other smaller parallel ridges with hundreds of eruptive cones. No apparent link could be established with the Savannah Seamounts.

A MULTIPARAMETER APPROACH TO NEARSHORE SEABED MAPPING - CASE STUDIES FROM BRITISH COLUMBIA, CANADA

BORNHOLD B.D., COLLINS W.T., HARPER J.R., CURRIE R.G. and OLYNYK H.

Geological Survey of Canada: Pacific Geoscience Centre, PO Box 6000, Sidney, British Columbia, Canada

A pilot seabed mapping project, using a variety of tools, was undertaken in the central Strait of Georgia, British Columbia, Canada in 1997. The survey work is to provide baseline information for a wide variety of users, including those concerned with seabed habitat assessment, environmental protection and coastal zone infrastructure development. The water depths surveyed were between about 3 m and 75 m and covered a broad range of seabed types from exposed bedrock to muds. The systems used were: dual-frequency (120 and 330 kHz) Simrad sidescan sonar (200% seafloor coverage) with a 200 m line spacing; dual frequency (50 and 200 kHz), Knudsen, narrow-beam echo-sounder; Quester Tangent Corporation QTC-VIEW seabed characterization system; ultra-high-resolution Seistec boomer seismic system; towed seabed video; and grab sampler. Navigation was by Differential Global Positioning System (precision 5 m). Sidescan sonar mosaics, with ground truth from seafloor video, grab sampling and seabed characterization, were the basis for surficial geological maps. Seismic data provided information on sediment thickness, character and structure. The use of a versatile GIS platform allows the geophysical, video and sample data to be readily integrated with biological and other information required by specific users.

BATHYMETRY PROCESSING: DESCRIPTION OF THE MODEL CREATED BY LOCAL MANAGEMENT AND PRACTICAL APPLICATIONS DEPARTMENT (SGVL) OF THE ZONÉCO PROGRAMME

BOUNIOT E.

SMAI, Nouméa, New Caledonia

To process an accurate bathymetric model over the entire EZ of New Caledonia it is necessary to combine different kind of data from old contour maps up to multibeam echosounder data acquired by R.V *L'Atalante* during the ZoNéCo programme cruises. Each kind of data needs a special processing. The next stage is to append them to the model. Several classes of scale were created to take into account the different resolutions of each kind of data. The final model combine the data from different origine to bring as much as possible useful information.

ORGANISATION OF THE DATA BANKS OF THE LOCAL MANAGEMENT AND PRACTICAL APPLICATIONS DEPARTMENT (SGVL): DESCRIPTION OF THE GENERAL STRUCTURE

BOUNIOT E.

SMAI, Nouméa, New Caledonia

At the beginning of the ZoNéCo programme in 1993, the SGVL had to define a strategy to achieve its goals : store, process and organise the data. The organisation defined at this time should integrate the several fields involved in the programme (geology/geophysic, physical oceanography, fisheries). Data from different fields should be able to be merge to allow special analyse. These criteria implies to build up a original organisation and to define the software and hardware to use.

GROWTH OF THE FRINGING AND BARRIER REEFS IN NEW CALEDONIA

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ORSTOM, BP. A5, 98848 Nouméa Cedex, New Caledonia

The «Grande Terre» of New Caledonia is surrounded by one of the largest reef systems in the world. A barrier-reef edges the island over some 1,000 km of coastline enclosing lagoons more or less opened to the ocean while the fringing reefs are more developped on the eastern coasts than on the western ones. Data on initiation and growth of the reefs are available from 50 cores recovered upon fringing reefs and lagoonal reef islets and 2 long cores retrieved close to the barrier-reef. The organisms of the core assemblages, which have a well-defined paleoecological significance by comparison to their modern counterparts (depending on the water-depth, light-intensity, etc,...), are used for the reconstruction of reef growth stages, and diagenetic features for distinguishing the subaerial expositions. The fringing reefs are only constituted by 125 ky and Holocene formations. The Holocene reefs are individualized in reefs initiated prior to 5,000 yrs B.P. and after 4,200 yrs B.P. This difference is due to the availability of karst limestone surfaces, probably the most suitable for coral-larval recruitment, and probably to the sea surface temperatures. The recent sedimentological and stratigraphic analysis of the 128 m long core drilled on the Amédée islet (30 km offshore Nouméa) provide valuable information on the growth stages of the barrier reef. Each stage, corresponding to a Quaternary high sea level, is separated by an unconformity more or less marked by a fine calcareous crust or a fossil soil. Morever, the good preservation of aragonitic coral skeleton from 0 to 70 m depth yields opportunity to make some accurate datations.

A COMPARISON OF THE FISH FAUNA FROM BEAM TRAWL SAMPLES, CAMERA SLED VIDEOS AND SUBMERSIBLE OBSERVATIONS IN BENTHIC DEEP-SEA HABITATS OFF CENTRAL CALIFORNIA

CAILLIET G.M., WAKEFIELD W.W., ANDREWS A. and MORENO G.

Moss Landing Marine Laboratories, Moss Landing, CA. USA

Beam trawl, camera sled and submersible data from 2,000-3,200 m off central California produced similar fish faunal composition, but different density estimates. All species caught in trawls were observed in camera-sled and submersible observations. However, some rare species that were observed were not caught in trawls. The fish fauna was dominated by the families Macrouridae, Zoarcidae, Moridae, and Rajidae. Fishes both trawled and observed were the macrourids *Coryphaenoides leptolepis*, *C. armatus*, and *C. filifer*; the zoarcids *Bothrocara* spp., *Pachycara lepinium* and *Lycenchelys* spp.; the morid *Antimora microlepis*; the rajid *Bathyraja trachura*, and the liparidid *Careproctus ovigerum*. One unidentified liparidid (*Paraliparis* sp.) and two unidentified *Lycenchelys* spp. were trawled and may have been seen but also could not be identified to species from photographs. Observed only in photographs were *Corypaenoides acrolepis*, the liparidids *Paraliparis rosaceus* and *Careproctus melanurus*, bythitid *Spectrunculus grandis*, synodontid *Bathysaurus mollis*, and notocanthid *Notacanthus chemnitzii*. These three techniques differed in their ability to provide specimens for accurate identification, counts, and later life history (feeding habit, age and growth, and reproduction) studies, and to provide information on dispersion, habitat utilization, behavior and interactions. Accurate density estimates were undoubtedly hampered by trawl avoidance, escapememt, and uncertainties concerning the area trawled. Camera sleds produced higher (and perhaps better) estimates of density. Submersible observations from the DSV *Alvin* produced a similar species list but little additional, quantitative information. Both visual techniques allowed habitat characterization.

ORANGE ROUGHY FISHERIES ON SEAMOUNTS IN NEW ZEALAND

CLARK M.R.

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Commercial fisheries for orange roughy (*Hoplostethus atlanticus*) occur throughout the New Zealand region. Although they take place on a range of bottom types, in a number of areas the fishery is focussed on seamount-type features. Some of these, like the Ritchie Bank and Challenger Plateau, have sustained large catches over a decade or so of exploitation, but others have seen stock size, and the fishery, decline rapidly. On the Chatham Rise, there has been a pattern of fishery development, and serial depletion, of orange roughy on seamounts. Careful management of such fisheries is required to avoid overfishing, and associated impact on the benthic habitat.

TROPICAL PACIFIC FORAMINIFERA

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Foraminifera are an important component of Pacific marine ecosystems, but as yet they are relatively poorly known for this region. The fauna is diverse and many species appear to be widespread, although mechanisms of dispersal are uncertain. The taxonomy of some groups, particularly the miliolids which show very variable morphology, also requires considerable study. Many species are useful as sediment tracers and as indicators of environmental stress. The shallow-water and symbiont-bearing larger foraminifera are particularly important to carbonate sediment budgets; because of their size, high rates of carbonate production and resistance to both abrasion and dissolution, their tests contribute much of the sand that makes up the land areas of atolls. For example, although foraminiferal tests make up only 35% or less of the shallow lagoon sediments of Funafuti, they comprise up to 80% of the sediments of the land area. A range of studies are underway to determine the taxonomy and distribution of the total fauna, the ecology and life cycles of important species, and the contribution of the larger foraminifera to the sediment budgets of atolls. Collections have been made at monthly intervals at sites on Viti Levu and Funafuti, and suggest life cycles of 6 to 24 months for some of the larger species.

DOES HIGH RESOLUTION VIDEO TECHNOLOGY MEAN A CLEARER VISION FOR MANAGEMENT ?

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The attraction of the video transect is that it combines a well established sampling routine with modern technology to produce a continuous series of high resolution, archivable images. The expectation is that this technology will allow both the description of habitats and the detection of temporal change with a precision equal to the high resolution images and with a speed matching the rapid field technique. While this may be possible with the future development of advanced image-processing software and rapid data compression hardware, the analysis of video transects at present is dependent on skilful interpretation and experienced intuition. This presentation addresses the expectations and limitations of high resolution video monitoring. I present examples of how the technique can be used strategically by resource managers to provide reliable information for decision making purposes.

MANAGEMENT OF GUAM'S COASTAL RESOURCES

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As throughout the tropical Pacific islands, Guam has always depended on coastal resources as a food source, a social fabric of the community and in general, a way of life. The management of these resources has had to evolve with recreational, social, and economic changes affecting coral reef use and health. Increased demand for seafood, management and monitoring of chemical and physical pollution, the impacts from over a million tourists a year seeking water related activities, and poor land management have all contributed significantly to degraded habitat and reduced coastal biomass. More than 10 years of coastal harvest data was used to support changes in legislation to create marine preserves and revise and update existing fisheries regulations. Community education, awareness and involvement are the key to success.

SYNDROMS CAUSED BY HARMFUL MARINE MICROALGAE

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Several species of marine microalgae are producers of potent toxins that cause important losses to the marine food industry and that constitute serious hazard to public health. Some of these toxins are responsible for syndromes of human intoxication which present a pathology in accordance with the mechanism of action of the toxin. The toxin(s) are in general transfered through the food web, and the among vectors are found organisms from benthic habitats (bivalves, gasteropods, crustaceans,..) and fish associated to coral reef areas (ciguatera). Occasionally humans are exposed by marine aerosols. Syndroms of marine intoxication have been classified according to the symptomatology described. The most important syndroms related with marine microalgae are Paralytic Shellfish Poisoning (PSP), Diarrhetic Shellfish Poisoning (DSP), Neurotoxic Shellfish Poisoning (NSP), Amnesic Shellfish Poisoning (ASP) and Ciguatera. Each of these syndroms is associated to particular toxins (most of them well characterized) and microalgal species; dinoflagellates constitute the most problematic group but some diatoms and cyanobacteria are also toxin producers, the latter mainly in brackish and freshwater. Although most syndroms have been associated to toxic phytoplankton species, microalgae from the benthic habitat are also directly implicated. Examples are 1) the benthic/epiphytic dinoflagellate Gambierdiscus toxicus which is the culprit species for the production of toxins involved in ciguatera intoxication and 2) the presence of resistance forms in the sediments, such as cysts of toxic phytoplankton populations. Monitoring programmes which detect potentially toxic microalgal species in the water and toxin content in food marine products are developped as preventive and remediating policies to preserve the marine industry and protect public health.

BENTHIC OSTRACODA FROM TARAWA ATOLL, REPUBLIC OF KIRIBATI (POSTER)

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The preliminary results of a study of the benthonic ostracods of Tarawa Atoll, Republic of Kiribati, are discussed. The ostracods were obtained from the intertidal zone, from samples dredged from the lagoon floor and from two boreboles. A decrease in the number of species reflects sea level change and the effects of the construction of causeways. Most of the samples were collected from South Tarawa, supplemented with further material from North Tarawa. All of the twenty-four species of ostracods are shallow water forms. No deep water species were noted, not even those which might have been washed in with storms. The ostracod fauna is small and some of the species are similar or the same as those from other Pacific Islands. Changes in the composition of the ostracod fauna over various time scales have taken place. The short term is one due to the construction of the causeways and the longer one found in the bore-holes due to the environment changing from an oceanic to lagoon environment with time. Consideration has also been given to the effects of pollution from the sewage levels in the lagoon arising from the dense population. Comparison will be drawn from a study of the distribution of ostracods around a coastal sewage discharge.

EFFECT OF COMMERCIAL TRAWLING ON A BENTHIC COMMUNITY WITHIN MONTEREY BAY NATIONAL MARINE SANCTUARY

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Bottom trawling is one of the most disruptive and widespread human induced physical disturbances to marine bottom communities. We used a comparative approach to test the general hypothesis that persistent trawling decreases bottom habitat complexity and biodiversity and benefits prey important in the diet of some commercial fish species. We compared an area subjected to the highest levels of trawling intensity ("HT" area) to an area subjected to the lightest levels of trawling itensity ("LT" area). Significantly more trawl track and shell fragments were found in the HT area while rocks greater than 5 cm diameter, flocculent material, and mounds were more abundant in the LT area. Invertebrate epifauna, rockfish, and flatfish were significantly more abundant in the LT area. Significant differences in infauna included 30% to 70% more oligochaetes in the HT area, 25% to 70% more ophiuroids in the HT area, and over 25% fewer polychaete species in the HT area Fall seasons. The amphinomid polychaete, *C. pinnata*, was 3 times more abundant in the HT area Fall seasons and had 25% to 75% higher biomass in the HT area. Polychaete community trophic structure shifted from sedentary to motile life styles and from deposit feeding to carnivorous feeding modes as we moved from the LT to the HT area. Fish gut content analysis showed that flatfish diets consist of a high proportion of *C. pinnata*. One of the most interesting results is the positive relationship between *C. pinnata* abundance and biomass and trawling intensity and *C. pinnata*'s abundance in flatfish diets. This association suggests that some prey species and commercially important fish may be enhanced by some level of trawling disturbance. Setting the optimal level of allowable disturbance, however, will not only require additional research, but also balancing societal values for biodiversity and fisheries enhancement. This study helps clarify the potential impacts of high intensity trawling and provides incentive to conduct large scale, long-term manipulative studies that will more broadly assess the impact of trawling on the many interdependent inhabitants of marine bottom communities.

THE IOC HARMFUL ALGAL BLOOM PROGRAMME

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In view of the global interest in problems of phytoplankton blooms, red tides and the associated mass mortality of marine organisms expressed through various recommendations of major Intergovernmental Oceanographic Commission (IOC) scientific and regional subsidiary bodies, the first steps were taken in 1987 to establish the IOC Harmful Algal Bloom Programme. One particular aspect of this problem is the possible relationship of harmful algae blooms to increased runoff of nutrients and other elements due to land based human activities. The scientific and managerial questions which need to be addressed to better mitigate the harmful effects of some marine microalgae are thus closely related to improved knowledge about how the marine environment is influenced by land-based activities. Since the establishment of the IOC HAB Programme in 1992, a Harmful Algal Bloom Programme Office has been established at the IOC Secretariat and the Programme has developped into a major activity of IOC. Achievements include: (i) publishing of the Harmful Algal News to 2500 subscribers; (ii) establishment of IOC Science and Communication Centres on Harmful Algae; (iii) implementation of several training courses on taxonomy of harmful marine phytoplankton, toxin chemistry and toxicology for scientists from developping countries; (iv) implementation of several workshops on: training requirements in the fields of eutrophication and harmful algae; on algal blooms and mass mortality of marine organisms; (v) establishment of an ICES-IOC Working Group on Dynamics of Harmful Algal Blooms and a SCOR-IOC Working Group on the Physiology and Ecology of Harmful Blooms; and (vi) establishment of related data bases.

SWATH-MAPPING OF THE SEA BED BENEATH BENTHIC FISHERY AREAS OFF TASMANIA

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In 1994 and 1997, AGSO ran multibeam sonar surveys over about 220,000 km of sea bed beyond the continental shelf west, south and east of Tasmania, producing high-quality bathymetric maps and acoustic backscatter maps. The first and major survey was done from the French R.V. *L'Atalante*, and the second from the American R.V. *Melville*. The EM12D system on R.V. *L'Atalante* generates 162 stabilised beams, fanning across the track. The widest sector of 150 gives a swath width of 7.4 times water depth, to a maximum of about 20 km. The SeaBeam 2000 system on R.V. *Melville* is similar in principle to the above system, but with a maximum swath-width of 3.7 times water depth. For geologists, the maps provide essential topographic information, and an idea of the distribution of rocks and of sea bed structures. For example, after the *L'Atalante* survey west and south of Tasmania, we could map giant sea bed faults, and rocky fault scarps up to 2000 m high, later sampled from R.V. *Rig Seismic*. The result was a complete reassessment of the geology and resource potential of a huge area. Deepwater areas off Tasmania are host to major bottom fisheries - for orange roughy on volcanic seamounts south and east of Tasmania, and for blue grenadier in canyons west of Tasmania. The fishermen run their trawls just above the sea bed, so high-quality maps are needed. Detailed bathymetric maps and images of the western and southern fishing grounds have been released. Because of concern for the impact of orange roughy trawling on diverse benthic assemblages restricted to the seamounts, the Australia Nature Conservation Agency and Australian Fisheries Management Authority declared an area of newly discovered seamounts south of Tasmania an interim marine reserve. CSIRO is presently carrying out research to assess both the impact of orange roughy trawling on the benthic environment and the conservation value of the interim reserve. Another important orange roughy fishery off eastern Tasmania near St Helens and St Patrick's Head was mapped recently. The survey, in water depths of 800-1600 m, showed a generally hard and fairly flat sea floor, but scarps formed by resistant flat-lying strata form protective habitats for orange roughy. Sampling suggests that the sea floor consists largely of Miocene shelf limestones. The volcanic cone of St Helen's hill, a major spawning ground, rises from the sea bed 1000 m deep to less than 600 m.

DATING SEDIMENTARY RECORDS IN TROPICAL LAGOON DEPOSITS: THE USE OF MICROWAVES IN ACCELERATING EXTRACTION PROCEDURES FOR 210Po

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The present work is part of a research action that investigates how sediment records can be used to gain information on environmental changes during the past century. This action is more globally part of the ECOTROPE programme which goal is to determine how terrigeneous and anthropogenic inputs influence South Pacific lagoon ecosystems. In order to reveal sedimentary records isotopic clocks such as 210Pb have been widely used to give a proper estimate of the chronology in sediment deposition. However, 210Pb analysis is relying on heavy radiochemical preparation of the sample and despite widespread use significant progress are required if 210Pb activity is to be measured on a routine basis. Due to the number of samples required by the projected study it was necessary to adapt the techniques to the sampled sediments and to significantly improve the extraction protocol by combining acid attack procedures with microwave heating in hyperbaric conditions. The results presented demonstrate that the new designed analytical protocol proved highly efficient in extracting 210Po which is used to assess 210Pb by alpha activity counting. Moreover, this technique appeared strongly profitable in term of decreasing sample preparation time, lowering analytical cost (reduction in required acid volumes) and improving sample preservation.

THE ECOTROPE PROGRAMME: LOOKING AT TERRIGENEOUS AND ANTHROPOGENEOUS AND ANTHROPOGENIC INFLUENCES ON CORAL REEF LAGOONS OF THE PACIFIC (POSTER)

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Economic development in the tropical zone corresponds with extensive modifications of the coastal environment. Pacific island states with limited resources and limited land are particularly sensitive to the conflict between their short term needs for economic development and long term concern about environmental conservation. The ECOTROPE programme is a recent joint ORSTOM (L'Institut Français de Recherche Scientifique pour le Développement en Coopération) and USP (The University of the South Pacific) scientific action looking at the influence of terrigeneous and anthropogenic inputs on the lagoons of Suva (Fiji) and Nouméa (New Caledonia). The general questions to answer are the following : 1) What are the origin, nature and amount of terrigeneous and anthropogenic agents entering the lagoon ? 2) How are those agents transported and modified in the coastal zone ? 3) How do terrigeneous-anthropogenic inputs modify pelagic and sedimentary environments? 4) How do shifts in environmental conditions modify living communities (pelagic, benthic, and fish) ? 5) What information can be gained from these results in term of management of tropical coastal zones ? The final aim of this programme is to provide useful applications for decision makers who have to deal with sustainable development. The ECOTROPE programme is aimed at defining some of the scientific basis necessary to reach environmental diagnosis. Beyond diagnosis, research will be directed toward predictive approaches mainly relying on modelling in different fields (hydrodynamic, particle transport, geochemistry). Information and results will be made available through various communication means (books, atlas, education videotape) for a more efficient transfer of the research effort toward the public.

IMPACT OF A PRAWN FARM ON A COASTAL ECOSYSTEM, A CASE STUDY: THE SEAGRASS MEADOW OF THE CHAMBEYRON BAY, NEW CALEDONIA (POSTER)

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A prawn farm was built at Ouano peninsula, New Caledonia. The exploitation began in March 1995. It contains eight pools to grow the species *Penaeus stylirostris*. At the same time a study of the benthic ecosystem of the bay of Chambeyron began in order to evaluate the impact of the farm on the coastal environment. The first survey occurred in May 1995. The second that occurred in May 1997 permits a preliminary evaluation of the impact. Seagrass meadows grow on the soft bottom of the bay. The main species are *Halodule uninervis*, *Cymodocea serrulata*, *Cymodocea rotundata* and *Thalassia hemprichii*. The secondary ones are *Syringodium isoetifolium*, *Halophila ovalis* and *Halophila decipiens*. The specific composition has not changed between 1995 and 1997 but the relative importance of each species has been modified in terms of biomass. Concerning the whole bay the average of the above-ground biomasses, all species together, are not statistically different between 1995 and 1997 (1995 : 50.61 ± 18.76 g AFDW/m2 ; 1997 : 60.12 ± 23.82 g AFDW/m2). The *Cymodocea* genera dominant in 1995 has been replaced by *Halodule* and *Thalassia*. The above-ground biomass of *Halodule uninervis* shows an increase that is statistically significant between the two surveys from 9.24 ± 4.86 g AFDW/m2 in 1995 to 24.05 ± 11.22 g AFDW/m2 in 1997. Aerial imagery was used to evaluate the total above-ground biomass of the bay. This method increases the accuracy of the computing by giving a weight to each station. The weighted biomass is slightly higher than the unweighted biomass : 106.4 to 102.6 t AFDW for the whole bay in 1995 to 135.0 t AFDW for the whole bay in 1997.

PROTECTION OF THE MARINE BENTHIC ENVIRONMENT OF GUAM

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Guam consists of a single main island surrounded by shallow fringing coral reefs, with two deeper lagoonal areas protected by barrier reefs. The marine species and ecology of Guam's reefs have been studied extensively, especially through programs of the University of Guam's Marine Laboratory. In addition to overfishing and destructive fishing practices, the marine benthic communities of Guam have been damaged by destruction of major storm waves; loss of corals to crown of thorns starfish predation, damage by recreational swimmers, divers and watercraft operators; grounding of ships and pollutant discharges of sewage and stormwater. But the most serious damage is cue to accelerated silitation, sedimentation and turbidity due to erosion related to land use practices. Steps are taken to protect Guam's coral reefs and coastal zone through legislation, regulations, permit systems and policies. Environmental impact assessments, Guam's Coral Reef Initiative and Guam's Seashore Protection Commission controls help greatly in the protection of Guam's marine benthic environment, while new legislation and research to protect Guam's coral reefs is underway.

A DIGITAL ACOUSTIC SYSTEM FOR BENTHIC HABITAT MAPPING

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Our knowledge of the distribution of seabed habitats is far from complete. Currently, sampling for mapping of these habitats is limited to relatively few sites due to the time and costs of deploying gear and, because only a minor fraction of a study area can be sampled, detailed maps are difficult to produce. Above water remote sensing tools are severely limited for mapping seabed habitat. In order to address these limitations CSIRO is developing a system for analysing reflected hydroacoustic signals from echo sounders to classify the benthic environment, permitting rapid and continuous mapping of the seabed, even over terrain too rugged for conventional sampling techniques.The CSIRO digital acoustic system consists of analogue pre-amplification and signal conditioning circuitry and makes use of existing computer and data acquisition technology to allow continuous digital sampling of complete acoustic signatures. By using conventional echo sounders and GPS navigation systems the instrument would fit most vessels. The system has high temporal resolution and a large effective dynamic range, allowing the resolution of seabed habitat features. Currently the detailed signal analyses required for benthic habitat discrimination is carried out post-hoc. Field trials of the acoustic system have been carried out in conjunction with benthic habitat studies in Eastern Torres Strait, the Great Barrier Reef, Moreton Bay and the South East Fishery. Databases consisting of approximately 8 Gb of hydroacoustic data, were collected during 1996/97, as well hundreds of hours of concurrent ground-truth video, sediment grabs and benthic dredge data. The hydroacoustic and ground-truth data sets are cross-referenced by location, in order to benchmark the systems functionality. Currently these hydroacoustic data sets are being analysed and discriminatory functions developed to provide algorithms for mapping benthic habitat.

MARINE RESOURCES OF NEW CALEDONIA: THE ZONÉCO PROGRAMME

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Following the establishment of the Economic Zones (EZ) in 1979, many countries and territories undertook programmes aimed at mapping their part of the seabed and inventorying its living and non living resources. In New Caledonia such a programme, named ZoNéCo, was launched in 1992. The aims of ZoNéCo are: analyse the earlier data collected prior to the programme, produce base map and images of the seabed using a multibeam echosounder (EM12), identify mineral and biological resources, describe the environment in which they are found and assess the potential for economic developpement that such resources represent. ZoNéCo is a multi-disciplinary programme regrouping a number of partners. The programme has developped its own computer facility the role of which is the archiving, processing, analysis and distribution of the data and results. At this stage, four synthesis on earlier data have been produced (mineral resources, hydrocarbon deposits, tuna fisheries activities, deep bottom living resources), eight surveys have been carried out (seabed mapping, deep bottom long-lining 300-800 m, bottom trawling 300-1850 m) and numerous thematic maps have been made. All the data are available to scientists and development planners and actors. A booklet describing the programme has recently been produced.

PRELIMINARY POPULATION ESTIMATION OF HUMPBACK WHALES IN NEW CALEDONIA

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Humpback whales, *Megaptera novaeangliae*, have been studied in the waters of New Caledonia in the South West Pacific (22°S, 166°E) since 1991. Aims of the study are to estimate the size of the population, and, to determine whether the whales return to the site year after year. The whales are present only over the winter months, with numbers peaking in July-August. The presence of mother-calf pairings and observations of reproductive behaviour in groups of humpback whales suggests that New Caledonia is a reproductive zone. Of the animals identified in 1996, 19% were re-sightings of animals previously photo-identified, an increase from the 7% re-sighting rate of 1995. This, along with preliminary population estimates, implies that the population is small. A Jolly-Seber estimate for 1995 was 126±77, while a Petersen Estimate with Chapman modification for the same year was 243±96.

THE MOUNT EDGECUMBE OFFSHORE LAVA FIELD - A DIVERSE MEGAHABITAT FOR COMMERCIAL DEMERSAL FISH IN SE ALASKA, USA (ORAL PRESENTATION AND POSTER)

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Habitats of rockfish (*Sebastes*) and other bottom fishes of the offshore Edgecumbe lava field, an important commercial fishing ground in southeast Alaska, were characterized using side scan sonographs and direct observations from a submersible. Mount Edgecumbe, a Holocene shield volcano, last erupted over 7000 years ago when it deposited lava upon a flat glaciated surface that covered at least 700 sq. km west of Kruzof Island. The lava surface exhibits well defined and little eroded aa and pahoehoe lava, lobate lava fronts, compression ridges, collapsed lava tubes and volcanic cones and necks. The presence of these features along with the absence of pillow lavas suggest that the lava field was formed subaerially in which case the field has subsided at least 300 m, based on the depth of the outer limits of the field. Edgecumbe lava field is classified as marine benthic megahabitat. The geologic features within this megahabitat produce eight macrohabitats: pinnacles, caves, boulders, cobbles and pebbles, cracks and crevices, ridges, lava flow surfaces, and sharp, cliff-like interfaces. The diversity and distribution of rockfish species varies considerably with habitat and depth. The presence of suitably-sized refuge spaces appears to be key to the occurrence of yelloweye rockfish, a commercially important species. Typical refuge spaces occur as crevices and caves or overhangs in bedrock or in boulder fields where the clast size and clast-to-void ration are both large.

A Classification Scheme for Marine Benthic Habitats

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A general benthic habitat classification scheme has been developed by us to standardize the description of habitat types. The scheme is divided into System based on salinity and proximity to seafloor. We refer to only one system and that is the Marine Benthic system. System are broken down into Subsystems based on physiography and depth and Subsystems are broken down into Classes based on bottom morphology. Classes are also broken down into Subclasses based on substratum textures. We also use a series of modifiers for bottom morphologies and bottom textures and for physical, chemical and biological processes. Examples of the classification scheme will be presented and case histories where used will be highlighted.

MARINE HARVEST REFUGIA IN THE U.S. SOUTH ATLANTIC AND THE GULF OF MEXICO: PROBLEM'S APPROACHES AND INITIAL RESULTS

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One longterm strategy being considered to improve reeffish management in the U.S. South Atlantic and Gulf of Mexico is establishing no harvest reserves. In 1994 the South Atlantic Fishery Management Council established the Experimental Oculina Research Reserve (EORR), a 4x24 nm (27000 hectare) 90-110 m deep area off Ft. Pierce, Florida for 10 years. In 1995 we began a comprehensive study in the EORR and adjacent control to map the habitat, monitor changes in fishery species abundance and community structure and evaluate the effects of fishing on grouper spawning aggregations using bathymetric, side-scan sonar and laser-line scan (planned) mapping, submersible and ROV observations, and fishery acoustic methods in a GIS geo-referencing and layering approach. The primary habitat structuring organism, the delicate slow-growing (1.6 cm per year) coral, *Oculina varicosa*, that forms several meter high thickets atop 10-30 m relief Pleistocene limestone pinnacles, has been heavily damaged by dredging and trawling. The once rich and abundant fish fauna, including many variable grouper and snapper species, has dramatically declined, along with a loss of grouper spawning aggregations. In the Gulf Mexico we are using the approaches described above to identify prime reserve sites associated with drowned Pleistocene high relief reef habitats 55-110 m deep along the outer continental shelf. Circulation models are being used to identify habitats that are sources for reef fish recruits and sinks for settlement.

EUTROPHICATION PROCESS IN THE PAPEETE LAGOON (TAHITI, FRENCH POLYNESIA): USING SEDIMENT GEOCHRONOLOGY TO RECONSTRUCT PHOSPHORUS CYCLING EVOLUTION DURING THE PAST CENTURY

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ORSTOM Papeete, French Polynesia

Sediment deposition rate during the past century was assessed by measuring ^{210}Pb activity in sediment cores from the Papeete lagoon (Tahiti, French Polynesia). Five fraction were separated using a sequential extraction method: loosely sorbed P, iron-bound P, $CaCO_3$-associated P, refractory inorganic P, and organic P. The total P accumulation rate was 500 µg cm^{-2} y^{-1} at the core bottom (age 1850) and increased to a maximum of 1400 µg cm^{-2} y^{-1} after 1960. During the past century there has been no significant evolution for loosely sorbed P, increase of iron-bound P from 30 to 300 µg cm^{-2} y^{-1}, moderate decrease of $CaCO_3$-associated P from 250 to 200 µg cm^{-2} y^{-1}, increase of refractory inorganic P from 100 to 500 µg cm^{-2} y^{-1}, and increase of organic P from 20-50 to 350-400 µg cm^{-2} y^{-1}. Significant modifications in the relative importancee of the five P reservoirs are observed after 1960. We observed no significant modification in the CNP ratio during the last century but organic carbon, nitrogen and phosphorus concentrations increased dramatically after 1960. In complements, present issolved and particulate phosphorus cycling was investigated in the Papeete lagoon and a budget of the phosphorus cycle is presented. In the lagoon ecosystem, terrestrial phosphorus contrib uted to more than 70% of the inputs. The average sedimentation rate of particulate P was close to 3000 µg cm^{-2} y^{-1}. Nearly 50% of this contribution is incorporated in the sediments, while desorption processes that mostly occurred under anoxia were of low significance in the considered system.

OCEANOGRAPHIC VARIABILITY AROUND NEW CALEDONIA (POSTER)

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The oceanographic variability around New Caledonia covers a large range of time and space scales. Various data types collected in the tropical Pacific are analyzed to assess the regional impacts of past (1972-1996) El Nino Southern Oscillation (ENSO) events. Ships of opportunity, satellites and coastal stations provide these data. Focus is made on the regional changes in sea-surface temperature and salinity, surface wind stress, satellite-derived and in situ precipitation together with altimeter-derived and XBT-derived sea level. Sea surface temperature (SST) and salinity (SSS) react in opposite way to the western equatorial. They are linked to rainfall and currents systems related to the positions of the South Pacific Convergence Zone and the anticyclonic gyre of the southern hemisphere. New automatic techniques are used on commercial vessels which were recently equipped with thermosalinographs. They allow to monitor the salinity and temperature surface distribution and variability around New Caledonia and to describe frontal structures between open ocean waters and lagoon. At smaller time scale the upwelling occurrence along the western coastline of New Caledonia is studied. The coastal oceanographic (Temperature and Salinity) and meteorological stations (Wind) provided high density flow of data to study the wind driven upwelling which was observed for periods of 7 to 10 days. Waters from approximately 100-150 meters rich in nutrients are lifted to the surface and might invade the lagoon. Their distribution around New Caledonia and their extension is described from satellite infrared imagery and might be predicted from real-time wind monitoring.

SPATIAL DISTRIBUTION OF THE INFRALITTORAL ANNELID POLYCHAETES IN THE EASTERN COAST OF THE GULF OF CALIFORNIA, MEXICAN PACIFIC (POSTER)

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Spatial distribution of polychaetes, density and diversity in the continental shelf of the Gulf of California, is analysed. The polychaetes were represented by 9425 organisms, 212 species, 129 genera and 37 families. Highest species richness was found among the families Spionidae and Lumbrineridae (19 and 17 species respectively), but with low abundance values, except for the spionid *Paraprionospio pinnata*. Dominant species in the Gulf of California along with *P. pinnata*, were *Aricidea simplex* (Paraonidae), *Eclysippe trilobata* (Ampharetidae), *Aglaophamus verrilli* and *Ceratocephale papillata* (both Nereididae). Diversity was estimated with species richness values, Shannon-Weaver's index (H') and Pielou's equitability index (E'). Density values in the area show a tendency to higher abundances towards the south, with variations due to depth: highest densities (100,94 orgs./0.1 m^2) were found at intermediate depths (64.16 m), while lowest values (44.84 orgs./0.1 m^2) correspond to stations deeper than 100 m. Diversity and species richness values also show an increase towards the south except in the central region where local highest densities of the dominant species *P. pinnata* probably prevent the development of other polychaete species. Species richness is inversely related to depth and this determines the overall diversity distribution patterns. In shallow stations the average is 51 species and 3.87 bits/indiv., at intermediate depths it is 37 species and 3.46 bits/indiv., while at deepest stations it is 27 species and 3.24 bits/indiv. Sediment composition, mainly fine sands, is influenced by local discharges and determines species composition, with highest abundances found when silts are present in combination with medium size sands. This together with depth, controls distribution and abundance of the polychaete populations in the Gulf of California.

THE USE OF ECOLOGICAL DISTRIBUTION OF BENTHIC OSTRACODS AS A BIOTIC GAUGE FOR SHALLOW MARINE ENVIRONMENTS (POSTER)

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Micro-fauna and more precisely ostracods are useful gauges for shallow marine environments such as bays, lagoons and estuarines. They may give interesting indications on the quality of hydrological parameters and on the global functionning of the environment as circulation, exchanges and ecological stress. They are a part of the trophic chain of number of species of juvenile fishes as *gobiids, galaxiids, cyprids...* Their contribution to the biomass may become as important as the one of other marine organisms. In brackish and lacustrine environments, density of individual raise upon 1,8 x 10^6 ind. / m2 corresponding to 50 gr. of dry organic matter by square meter. Ecological distribution of benthic ostracods have been observed in deltaic transitional environments of river «La Nera», shallow marine waters of the bay of «La Roche Percée» and on adjacent fringing reef plates (Bourail, New Caledonia). An euryece species, *Cyprideis* cf. *torosa (ostracoda)* is dominant in sheltered areas such as lagoonal ponds and deserted meander invaded by marine water where allochtonous organic matter is benefical to their detrital nutritional habits. There, humic acids induce slight acidity and anaerobic conditions which disadvantage other species and allow this one to make up swarmy and monospecific assemblages. This high individual density and poorly diversified assemblage is reflecting the importance of the primary production and chemical stress of this type of areas. Conversely free marine areas show high diversified assemblages with variable individual density increasing off shore. Phytophagous species found in the marine samples of bay of «La Roche Percée», only covered by thin sands are growing on the adjacent coral plates where important marine algae and seagrasses constitute sheltered areas for thoses species. They represent an allochtonous microfauna carried inside the bay by tidal currents and by trade winds led drift. As demonstrated by this example, ostracods by their population structure represents a very sensible indicators of the shallow marine environments and should be use as biotic index.

THE NOUMÉA AQUARIUM: A TOOL FOR RESEARCH

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Since its creation in 1956, the Nouméa Aquarium is sort of a natural laboratory where discoveries and observations of some major phenomenons were made: discovery of fluorescent corals, observation of corals spawning and bleaching, spawning of *Nautilus* and sexual inversion of the labrid fish *Gomphosus varius*. Beyond its potential as a tool for research, the Nouméa Aquarium could be an observatory in the field of marine ethology.

HABITAT SPECIFICITY AND OCEANOGRAPHIC INFLUENCES OF ROCKFISH RECRUITMENT IN MONTEREY BAY, CA

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Recruitment of juvenile fishes is often habitat specific, influenced by environmental factors and both spatially and temporally variable. A clearer understanding of species recruitment is important in assessing adult fish biomass and fishery status. I monitored species composition, densities, and standard lengths of juvenile rockfish over soft bottom habitats in Monterey Bay, CA during 1995 using a towed bottom trawl. I also determined daily growth rates and back-calculated birthdates using daily growth rings in sagittal otolith sections. GIS was used to compare and analyze spatial distributions and compare densities to sediment type. Temporal distributions and birthdates were ccompared to oceanographic conditions (sea surface temperature and ocean transport). Species composition of juvenile rockfish over soft bottom differed substantially from that of hard bottom and kelp bed habitats currently monitored by the California Department of Fish and Game. The use of GIS allowed greater understanding of distribution and habitat associations of dominant species over soft bottoms; mapping analysis showed that densities and standard lengths increased with depth, and that high densities were associated with the interface between fine sand and silt/clay. Upwelling appeared to influence both survival and timing of recruitment of juvenile rockfish; highest survival occurred during periods of high upwelling, and recruitment began after periods of relaxed upwelling were evident. Combining aspects of habitat type and ocean condition, along with juvenile densities, can increase our understanding of the complex processes affecting rockfish recruitment.

THE USE OF THE PISCES V SUBMERSIBLE TO LOCATE NURSERY GROUNDS OF COMMERCIALLY IMPORTANT DEEPWATER SNAPPERS, FAMILY LUTJANIDAE, IN HAWAII

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Seven of the twelve commercially important deep slope fish species in the Hawaiian Islands are snappers (family Lutjanidae). Several of these species have been overexploited, prompting the initiation of research to improve the management of this fishery. As part of that effort, we recently conducted 3 dives in the *Pisces V* submersible to locate nursery grounds of these fish off the island of Oahu. The protocol for each dive was similar; the submersible descended to a depth of 1,000 ft, then surveyed along a predetermined transect line extending up to 400 ft. A bait stand containing a 50/50 mixture of smelt and squid was periodically deployed along the transect in an effort to attract juvenile snappers. Each of these stations was videotaped for twenty minutes to document the size and number of fish attracted to the bait. As a result of this study, we located and identified juveniles of the ehu, *Etelis carbunculus*, and either the kalikali, *Pristipomoides sieboldii*, or the opakapaka, *Pristipomoides filamentosus*. Both species were associated with low relief carbonate reef formations found at approximately 900 and 600 ft depths, respectively. Ehu juveniles occurred as solitary individuals that sought cover on the submersible's approach. In contrast, kalikali/opakapaka juveniles were found in a large aggregation and were immediately attracted to the bait. In general, because of its range (1-3 miles), its ability to carry and deploy bait, and its standard equipment package (video and slide cameras, CTD, GPS tracking system etc,...), we found the *Pisces V* submersible to be a suitable vehicle for obtaining important information on deepwater fishery resources.

DEVELOPMENT OF NORMAL INCIDENCE MULTI-FREQUENCY ACOUSTIC METHODS FOR SEABED HABITAT MAPPING ON THE CONTINENTAL SHELF (POSTER)

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Describing the nature of the seabed is important in obtaining an understanding of the physical and biological processes that relate to it. In our study of the Australian continental shelf we were setting out to describe the relationship of the benthic and bentho-pelagic fish and invertebrate communities to different seabed types. We collected calibrated normal incidence pulsed echo sounder acoustics at 12,38 and 120 kHz. Each ping was digitised by the Simrad EK 500 echo sounder to include both the first and second echoes with an expansion of the bottom referenced first echo. Our software package «ECHO» was enhanced to acquire, store and quality assure the ping based acoustic data. Quality assurance removes pings that are corrupted due to poor bottom detection, aeration in bad weather, excessive vessel movement and noise. Simple algorithms have been introduced to routinely process the first and second echoes and compensate for depth and noise. This data is imported to an Oracle data base where it is combined with video, trawl, grab and sled information. Presently simple processing on the first and second echoes show hardness and roughness features of the seabed as observed from photographic and video records. The hi-resolution bottom referenced data is currently exported to MatLab for feature extraction and processing of the normalised by depth echo returns.

APPROACHES TO THE RESTORATION OF A DEEP-WATER POPULATION OF THE HABITAT-STRUCTURING CORAL OCULINA VARICOSA IN THE OCULINA RESEARCH RESERVE OFF FT. PIERCE, FL. USA

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Benthic surveys of the 92 nm2 Oculina Research Reserve off Ft. Pierce, FL. USA indicate extensive trawl-induced damage of the habitat-structuring coral *Oculina varicosa* and attendant loss of reef fish populations and biodiversity. Although hard substrate apparently suitable for settlement exists in destroyed reef areas, *Oculina* has not recolonized. Lack of recolonization may be the result of adverse environmental conditions, unsuitable substrate, lack of larval supply (recruitment failure), or multiple interacting factors. Restoration strategies are designed to investigate causes for recruitment failure, determine distribution of the remaining living coral colonies, and to implement recovery. The following studies are underway: (1) investigation of the reproductive biology of *Oculina varicosa* focused on seasonality and larval dispersal potential; (2) a survey of the distribution of living/dead *Oculina* using laser-line techniques and ROV video; (3) *Oculina* transplant studies to evaluate survival of the transplants in destroyed areas relative to intact, live *Oculina*, areas; (4) settlement substrate experiments in areas of living and areas of destroyed *Oculina*. Investigations to date suggest that *Oculina* has poor dispersal capabilities, can be successfully transplanted to destroyed sites, and would require 30 years to form colonies one meter in diameter.

CONSERVATION OF SEAMOUNT FISHERIES AND BENTHIC HABITAT: THE AUSTRALIAN EXPERIENCE

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The discovery in 1989 of orange roughy (*Hoplostethus atlanticus*) aggregations on seamounts around Tasmania led to rapid expansion of the trawl fishery beyond sustainable levels. Commercial landings exceeded 50,000 t in 1990. An intensive scientific assessment program of acoustic and egg surveys began in 1990. Within several years, the program established the biomass of the virgin stock and Total Allowable Catch (TAC) that could be harvested sustainably. The orange roughy catch in 1995 was 4000 t. However, modern technologies, such as broad-swath mapping of the seabed, highlighted the vulnerability of the seamount benthic habitat and its unique, associated fauna to disturbance by deepwater trawling. In 1995, the Australian Nature Conservation Agency (ANCA), the Australian Fisheries Management Authority (AFMA), and the fishing industry agreed to set aside an area encompassing about a dozen deep, previously unfished seamounts as an interim marine reserve, pending results of a research program to assess the impact of trawling on the seamount benthos and the efficacy of the proposed reserve to meet conservation needs. A benthic survey of fished and unfished seamounts was carried out off Tasmania in January 1997. The summit and slopes of unfished seamounts peaking at depths to ~1500 m were covered by a diverse fauna dominated by a colonial stony coral, *Solenosmilia variabilis*. This fauna was virtually entirely removed on heavily fished seamounts. Comparison of the Tasmanian seamount fauna with that found around New Zealand indicated a high level of endemism at even this relatively restricted range. These findings highlight the need, when developing deepwater fisheries, to rapidly assess the conservation requirements of both the fishery and its associated benthic habitat.

USE OF SPOT IMAGES TO ESTIMATE FISH STOCKS AND TO MODEL TROPHIC STRUCTURE IN TUAMOTU ATOLLS: PRELIMINARY RESULTS FROM THREE ATOLLS

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The lagoon fish communities of 10 morphologically different atolls of the Tuamotu archipelago (French Polynesia) were studied using underwater visual censuses (UVC). This study allowed to obtain information on the density and biomass in each atoll for more than 250 species. It was also possible to determined the trophic structure of these fish communities in each of these atolls. The UVC were done according to a stratified sampling, based on the relative importance of geomorphologic strata (motu, hoa, bare reef crest, pinacles and passes), intervals of depth, nature of substrate and exposition. In order to estimate the stock of these fish assemblages and to understand their trophic functioning, it was necessary to estimate the area of each of these strata. The only available method was by using high resolution satellite imagery. The analysis of SPOT images from these 10 atolls indicates that only a part of the atolls was accessible. In particular, to obtain a high degree of confidence, bathymetric information was limited to 12 m and substrate information was limited within the 0-5 m stratum. The radiometric substrate information obtained from SPOT was related to 4 major categories of habitats. The consequences on stock assessment, in particular its precision, are analyzed for three lagoons of increasing size: Tekokota (5.11 ± 0.05 km2), Haraiki (12.40 ± 0.05 km2) and Marokau (217.50 ± 0.05 km2). The width of the confidence intervals on fish stock increases with atoll size, in particular for the deeper living species. The trophic structure of these fish assemblages are better defined in small atolls, the imprecision becoming important for the deepest strata and also for the pinacles and passes which actually represent only a small percentage of the total surface of the atolls.

STRUCTURE OF THE REEF FISH ASSEMBLAGES IN THREE BAYS OF NEW CALEDONIA, SUBJECTED TO DIFFERENT ANTHROPOGENIC DISTURBANCES

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The fish communities from fringing reefs were investigated in two bays around Nouméa, which are considered as moderately disturbed by human activities, and in one bay further south, where human activities are minimal. The fish were sampled using underwater visual censuses. The sampling was stratified according to wind exposure and to the location in the bays (end of the bay, middle of the bay, bay entrance). There were no significant differences between bays for species richness, density or biomass. There was an increasing gradient in species richness and average weight from the end to the entrance of the bays. Density and biomass were maximum in the middle of the bays. Windward sides of bays had higher values than leeward sides for species richness, density and biomass. Species composition is dominated by microherbivores, microcarnivores and zooplanktivores, with no gradient according to exposure, position or human disturbance. These species are essentially sedentary, of small size and tend to school. Density is dominated by small sedentary and schooling zooplanktivores. this dominance is greater in undisturbed bays than in disturbed ones. Biomass is dominated also by these palnktivores, but microherbivores and carnivores make also a sizeable contribution to biomass. There are larger fish in the undisturbed bay, but their contribution to the structure in density is not significant. Most of the fish paramcters are well correlated to the amount of hard substrate and coral. In particular, zooplanktivores are highly correlated to the presnce of branched coral. The presence of algae is usually correlated with low densities and biomasses.The presence of diadema urchins is well correlated to the presence of fish and coral in the undisturbed bay, but these urchins are found on the stations with the lowest fish and coral densitites in disturbed bays.

MULTIMEDIA MARINE GIS: FUSION OF CONVENTIONAL MARINE HABITAT MAPPING WITH VIDEO DATA CAPTURE TO PRODUCE QUANTITATIVE VIRTUAL SITE VISITS FOR BENTHIC ENVIRONMENTAL MONITORING

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The integration of new and rapidly evolving spatial technology has greatly enhanced our ability to acquire, combine, analyze and display environmental data across a wide range of scales. Here we illustrate our fusion of GIS, GPS, SCUBA, ROV, video, remote sensing and acoustic techniques to not only rapidly acquire and synthesize comprehensive and quantitative data from benthic habitats, but also to express these data in 3D «virtual field trips» covering kilometers of sea floor. We will use examples from California and Washington kelp forest, Arctic, and Antarctic studies to show: 1) how low cost video techniques can be used to rapidly and accurately acquire quantitative data on species abundance, size, biomass and percent cover, 2) how sidescan sonar data can be used to both direct and extrapolate SCUBA and ROV-based data collection, 3) how multimedia GIS can be used to combine, analyze and render image and numerical data from many sources in a highly informative 3D presentation, and 4) how undergraduate students are being trained in the hands-on application of these techniques.

THE AQUATOLL PROJECT: EXPERIMENTAL PROJECT OF EXTENSIVE AQUACULTURE OF JUVENILE'S MARINE FINFISHES UNDER TROPICAL INSULAR CONDITIONS

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The AQUATOLL project objectives are to promote and transfer production techniques of marine juvenile fishes adapted to a commercial scale, and to the geography of the islands and insular populations. The hatchery production of juvenile fish requires specific conditions for each species and for each site. A few species with economic interest are already the object of aquacultural research in the Pacific region. Some results are encouraging and the laboratory culturing is mastered in some cases. The prospects for exploitation still present some biological uncertainties, especially the risks associated with the weaning of alevins, that must be reduced through appropriate research. This is partly explained by the present isolation of the research structures and the lack of infrastructures capable of ensuring the transfer of research results to industrial or artisanal production. With the scientific support of the French University of the Pacific, the AQUATOLL project will improve extensive techniques of juvenile fish production in floating cages. The two species chosen shoud be the mahi mahi (*Coryphaena hippurus*) and the coral trout (*Plectropomus leopardus*). Later, AQUATOLL activities should be directed towards such species as Siganidae (goldlined rabbitfish), Acanthuridae (unicornfish), Mugilidae for the «Poutargue» or «Karashumi» or for aquarium fish. This high quality production would be capable to develop a market oriented principally towards South East Asia and Japan, either for the export of sashimi-quality fish or for aquarium fish.

DETERMINING HABITAT STRUCTURE AND LITHOLOGY: THE ZONÉCO PROGRAMME MULTIDISCIPLINARY SURVEYS

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The multi-disciplinary ZoNéCo programme aims at assessing the non-living and living marine resources of New Caledonia's E.E.Z. Between 1993 and 1996, four seafloor mapping, geophysical and physical oceanography cruises (ZoNéCo 1 to 4, aboard *L'Atalante*) that aimed at surveying potential sites of interest for fishery and mineral resources, and three related exploratory fishing surveys, have been conducted. Sampling surveys (fishing and dredging cruises) are still necessary to ground-truth the newly discovered shallow areas, potential non-living and living resource targets. From a deep water fisheries point of view, habitat is defined as the physical seafloor condition (e.g. rock, sand, or mud) that allows for sustainability of a targeted species. Distribution and exploitation of resources are mainly linked to: (1) the morphology and depth of the bottom; (2) the nature of the substratum. Consequently, production of integrated maps (after compilation of swath bathymetry, acoustic imagery, and physical oceanography data) will help both in selecting potential resource targets, and in optimising their exploitation with appropriate sampling tools (substratum - fauna relationship, habitat concept). Because most of the benthic habitats are defined by their geology, their depth, their chemistry, and by and other attributes such as, temperature, nutrients, and currents, multidisciplinary techniques are critical in determining habitat structure and lithology. The multidisciplinary ZoNéCo programme data, classified and recorded into specific and topic-oriented data bases can, at any time, be correlated and superimposed to generate specific «products» or «decision-making» maps, to match the needs of various professionals (fishermen, geologists, oceanographers, planning authorities).

PETROLEUM POTENTIAL OF NEW CALEDONIA: MAIN RESULTS OF RECENT FIELD WORK STUDIES

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The potential for finding commercial reserves of hydrocarbons in New Caledonia is considered good for six main reasons: 1) oil seeps associated with Cretaceous and Eocene rocks have been found along the West Coast basins; 2) two wells (Gouaro-1 and Gouaro-2) drilled in 1954-55 on the most prospective structure, the Gouaro anticline (160 km northwest of Nouméa), had numerous shows of oil and gas; 3) potential producing horizons represented are Triassic, Jurassic, Cretaceous and Eocene; 4) potential reservoirs could be intra-Senonian sandstones and/or fracturated Eocene flysch; 5) seals could be the Eocene flysch; 6) geochemical (SREPNC, 1954; AMOCO, 1982-83) and radiometric (PLAINS RESOURCES and NEW CALEDONIA ENERGY, 1993) surveys indicate hydrocarbons to be present. In 1993, the Institut Français du Pétrole (IFP) sampled all levels appearing to have any petroleum potential in the West Coast basins. The study identified the Senonian coals as the main potential source rocks in New Caledonia (Vially and Mascle, 1994). More recently, geological mapping (1994, 1995) of the Gouaro anticline was carried out (Blake, 1995) previously to a multichannel survey necessary to evaluate the subsurface structure of the anticline. The field work studies have shown the deep extension of the anticline, both onshore and nearshore. Consequently, a multichannel seismic survey was carried out in 1995. On the basis of the seismic interpretation, a test well for the Gouaro anticline is planned to be drilled in January 1998, for an average estimated cost of 1, 200, 000 US$. The prognosed total depth of 1600 m should allow a full test of the hypothetical gas cap with an oil leg scenario for either the base flysch sand reservoir or the fractured chert reservoir (Blake, 1996). However, new multichannel seismic data are needed, especially offshore. The «Lagoon prospects» remains an entirely unknown area. Offshore, the thickness of the sedimentary series in the basins, and the relative high geothermal flux values are compatible with the formation of hydrocarbons. The discovery of the Late Cretaceous black shale, potential source rock, dredged on the Norfolk Ridge, should boost the petroleum interest of New Caledonia and its offshore dependences that still remain underexplored.

SEMI-SUBMERSIBLE IMAGING SYSTEMS

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To provide objective and precisely located ground truth data for satellite and airborne imagery, we have developed a semi-submersible vessel, named the *Korrong*. It is designed to provide high resolution imagery of the marine environment. The most important component of the *Korrong* system is the retractable observation pod that is lowered into position through a moon pool. When fully extended, the floor of the pod is one meter below the surface. The observation pod is designed to carry an observer with ports to provide forward, port and starboard viewing. There are also four camera ports in the floor of the pod. The system is designed to be flexible enough to take any reasonable imaging system with only minimal modifications. In the south of Port Phillip Bay this system has been able to supply imagery detailed enough for algal species identification. This imagery provides a detailed indication of the spatial complexity within the broad terrain types mapped by satellite. It has been able to establish the broad bottom characterisations which relate to the satellite reflectance classification. The *Korrong* has also been used to map the area infestation by a Japanese kelp species in the Geelong Arm of Port Phillip Bay and the location and species type of sea grass beds in the Gippsland Lakes. Current projects include an investigation into the relationship between substrate and oceanographic conditions and the sea floor ecology, and the detailed mapping of several historic shipwrecks within Port Phillip Bay. The project is being expanded to include development of a small Towed Semi-submersible Vessel. This will be an unmanned vehicle, smaller and lighter than the *Korrong* which will enable easy transport and operation from small vessels of opportunity. It will also operate to greater depths.

CIGUATERA AND RELATED HEALTH PROBLEMS IN THE SOUTH PACIFIC

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Proliferation in tropical marine benthic habitats of harmful algae producer of phycotoxins can be responsible for different types of seafood poisonings as benthic microalgae are critical food for invertebrates and fish grazing on coral surfaces. Ciguatera fish poisoning (CFP), the most frequently occuring seafood poisoning in the Pacific Island Countries, results from the consumption of reef fish contaminated by the ciguatoxin class (CTXs) of lipid soluble polyether toxins. Largely distributed in the insular countries, ciguatera affects in any concerned island spotty distributed areas of the coral ecosystems. The benthic origin of the phenomenon as well as the nude surface and food chain theory have been progressively demonstrated by the isolation of CTXs either from toxic herbivorous and carnivorous fish or from certain cultured strains of the benthic dinoflagellate *Gambierdiscus toxicus* Adachi and Fukuyo. The main toxins involved in human intoxication have been screened. Some of them have been structurally identified and shown to bind specifically to sodium channels of excitable membranes and to alter the basic mechanism of synapses. Epidemiological studies are consistent with the occurence at very low concentrations of such very potent neurotoxins. Prospection for analytical methods to detect the tiny concentrations of CTXs in fish muscles has lead to the current development of different chemical, biological, biochemical and immunochemical methods which need to be validated and, for some of them adapted for field applicability in order to determine the best strategy of a monitoring program adapted to the Pacific Island Countries. Moreover, it is now better understood that multiple environmental factors leading to the proliferation of ciguatoxin-producer strains of *G. toxicus* as well as biological factors influencing the accumulation of CTXs in fish muscles determine the spotty distribution of ciguatera endemicity in benthic habitats. Studies on the biodiversity of the dinoflagellates assemblages and on the environmental factors which emphasize the ciguatoxins biosynthesis may in the future allow to reduce ciguatera through the appropriate control of the causative organism.

SHRIMP AQUACULTURE IN NEW CALEDONIA: AN EXAMPLE OF ARTIFICIAL MARINE HABITAT

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Largely because of geographic isolation constraints, there are few examples of shrimp aquaculture on small tropical islands. In that respect, New Caledonia offers an original model of an emerging shrimp aquaculture. Resulting from a 20 year-long voluntary and concerted developmental process initiated by the public and private sectors, the annual production increased from 65 t in 1986 to 992 t in 1996, with an average yield of 2.8 $t.ha^{-1}.yr^{-1}$. Today there are 9 operating farms totalizing 430 ha which aim to produce a high quality product. The shrimp industry directly generates 250 jobs, plus about another 150 indirect ones, for an annual turnover that exceeded around US$ 10 million in 1996. Shrimp farms in New Caledonia are set up on the interdidal zone in respect with environment protection concerns, inducing no mangrove wetland destruction, and the impact of shrimp farming on the coastal habitats is thus limited to aquacultural effluents. Because no antibiotics are used by shrimp farmers, the impact of these effluents on the environment is low compared to major shrimp producing countries. However a few concerns which limit the development of the industry have been identified in recent years. Difficulties such as poor incoming water in some farms, pond erosion, increase of rearing densities bringing along disease outbreaks, are occasionnally encountered and may affect habitat quality and farms profitability. With numerous sites still available and the importance of aquaculture for the local economy and employment, this industry should record a strong growth in the years to come. Sound environmental management at both farm and political levels is essential in order to develop a sustainable aquaculture industry by improving pond quality and allowing the integration of production tools in their environment.

COMPARISON OF COMMERCIAL FISH ASSEMBLAGES OF NEW CALEDONIAN FRINGING REEFS SUBJECTED TO DIFFERENT LEVELS OF GROUND EROSION

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A comparative study was conducted in two zones of the Northern Province of New Caledonia, one located windward (East coast) and the other located leeward (West coast). In each zone, three major sectors were investigated; fringing reefs close to areas subjected to important mining activities, fringing reefs close to areas subjected to moderate mining activities, and fringing reefs close to areas free of mining activities. In addition, on the west coast, fringing reefs close to areas subjected to high natural ground erosion were also studied. Only commercial species *sensus lato* were censused, along 50 m transects using visual censuses. A total of 153 stations are considered, concerning approximatively 155 fish species. Substrate characteristics were not statistically different between zones and sectors. However, significant differences were observed for living organisms: the live coral cover was higher on non-mining sectors than on the mining ones, and the algal coverage increased in mining sectors and in sector subjected to high ground erosion. The structures of fish communities (trophic, demographic, ecological, potential size, and size of schools) differed between sectors, but without a clear link with mining activities or ground erosion. The three main descriptors of the commercial fish communities (e.g. mean species richness, density and biomass) have all shown lower values in sectors not subjected to mining activities or ground erosion, although these trends were not all statistically significant. Similar results were found for some of the major fish families, such as the Acanthuridae and Siganidae, whereas other families had no specific pattern, such as the Lutjanidae, or a «partial» pattern (i.e. a trend on only one coast), such as the Serranidae, Lethrinidae, Mullidae, Labridae and Scaridae. Among the 66 major species, 23 have increased in densities and/or biomasses with increasing mining and/or ground erosion levels, and 6 displayed the opposite trend.

RAPID ASSESSMENT TECHNIQUES FOR SHALLOW REEF RESOURCE SURVEYS AND HABITAT MAPPING

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CSIRO Division of Marine Research has developed techniques to rapidly quantify the distribution and abundance of important shallow reef resources, and to map shallow reef habitats. The technique uses GIS for sample design, data analysis and reporting; diver surveys to collect field data; and remote sensing to map potential shallow reef habitats. This information is useful for managing marine resources, assessing potential impacts of development or marine disasters, and for conservation planning. These techniques were used to survey the shallow reefs in a ~30,000 km2 area of Torres Strait. A total of 1,648 sites were surveyed on 43 reefs. At all sites the substrate type and other environmental parameters were recorded as was the percentage cover of the dominant and conspicuous sessile flora and faunal megabenthos. Holothurians, giant clams, pearl shells and other large gastropods and conspicuous solitary megafauna were counted and the holothurians were weighed to provide population size structure and biomass data. This data was used to produce maps of the main environmental and biotic components of the shallow reef, and to describe the abundance and distribution of several species of commercial holothurians (beche-de-mer). The main habitats on the reefs were identified by cluster analysis of Landsat TM satellite data, and discriminant function analysis of corresponding field data. From this analysis, seven main habitat types were identified and allowed the reefs in Torres Strait to be grouped into three main regions. Results from the survey were entered into a GIS for easy access by researchers, fisheries managers and environmental planners.

THE INFLUENCE OF HYDROTHERMAL ZONES ON ACCUMULATION OF MERCURY BY TRADE KINDS OF THE SQUIDS

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The system of mid-ocean ridges is natural model of pollution of an environment. At the bottom of rift valleys on an extent of long-duration time is regular flow metalliferous solutions, polluting seawater by metals. In 1988 was made attempt to estimate influence of flowing near-bottom metalliferous solutions on inhabiting organisms in a surface layers of water. At the same time with hydro- and geochemical sampling of «black smoker vents» of East-Pacific Rise (13°N) a few of individuals of the squids (*Dosidicus gigas*) were catch directly over rift valleys and other ones were in significant distance. The tissues of molluscs were analysed on the contents of mercury by a method of flameless atomic absorbtion spectrophotometry. Results have shown, that the contents of mercury in molluscs from the rift zone make 0,250 mkg/g wet weight, that is much higher, than in the invertebrates from background regions (0,030 mkg/g). In the tissues of the squids caught over rift, the content of mercury exceeded extreme allowable concentration, and them edible tissues had unpleasant taste. The hydrochemical researches have established existence of near-bottom anomaly of weighed mercury. We assume direct or by means of a food circuit influence of mercury to active of pelagic organisms and on their commodity qualities. We propose a technique of an estimation of influence of natural and anthropogenic pollution of sea waters in places of display of geochemical anomalies. The essence of this technique consists in direct measurement of the contents toxic elements as directly in environment, as in tissues of pelagic marine animals belonging to higher trophic levels. Such measurements can characterize location of a source of the pollution.

EFFECTS OF FISHING: EXPERIENCE IN NEW ZEALAND WITH MARINE RESERVES AND SPINY LOBSTERS

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Changes in the abundance, size structure and sex ratio of populations can have large and consequential effects on mating systems, and thus on reproductive output. Yet, we know relatively little about these effects on the large, mobile marine species commonly exploited by humans. These species are generally difficult to observe and their populations are not generally amenable to manipulation at the requisite scale. There is the additional problem that in most cases the virgin population was poorly, or never, studied and there are no unexploited populations with which to make contemporary contrasts. The advent of marine sanctuaries and the recovery of exploited populations within some of them, offers opportunities to contrast the effects of changes in population structure on reproductive dynamics at appropriately large scales. Spiny lobsters (Palinuridae) are excellent models for such studies as they are widely distributed and heavily exploited, and although mobile, their movements are limited enough that their populations respond to the protection afforded by many marine sanctuaries. In New Zealand spiny lobster populations have been protected in marine reserves since 1975. We compare spiny lobster abundance, size structure, sex ratio and reproductive activity among protected and adjacent fished populations. In protected populations mating is dominated by the numerous large males. In fished populations, where large males are rare or absent, small males court and mate. Laboratory experiments on spiny lobsters in New Zealand and the US show that the weights of clutches fertilised by small males are significantly less than clutches fertilised by large males. We discuss the implications of these findings on wild production of eggs and larvae.

DRAPER'S REEF: A SEMI-SUBMERSIBLE STUDY OF A NEAR SHORE REEF

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Draper's Reef is a sheltered reef located inside the entrance to Port Philip Bay, on the south-eastern coast of Australia. The reef is adjacent to the Harold Holt Marine Park, and rocky shelf environments of national significance. The purpose of the study was to establish the relationships between the depth of the reef, the substrate geomorphology, and the relative exposure to the oceanographic environment of the Bay, both above and below the sea surface. The study was carried out using a semi-submersible imaging vessel. The vessel has an in-built observation pod which can descend to a metre below the surface, and allows the occupant to observe the seabed in a true submarine environment, free from surface effects such as reflection. Video imaging and still photography were obtained using camera ports in the base of the observation pod. Seven video transects were recorded across the reef. DGPS (Differential Global Positioning System) positions, and depth were recorded at regular intervals along each video transect to provide locations in three dimensions. It was established from the video transect data that the reef is not made up of a purely depth/substrate relationship, but is affected by oceanographic exposure. The reef at it's shallowest is only around one and a half metres deep. The exposed edge of the reef, facing a shipping channel, has semi-fixed sand with seagrass and green weed at depth, transiting to a dense and complex algal community prior to the exposed, rocky crest. The crest itself consists of exposed rock with encrusting algae and dense kelp cover. On the sheltered side, a dense and diverse kelp community gives way to seagrass meadows and large areas of bare, mobile sand.

MAPPING MARINE HABITATS WITH HIGH RESOLUTION SIDESCAN SONAR

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The application of marine geophysics and GIS techniques to the characterization of benthic habitats has increased the ability of fisheries managers to assess distribution and habitat types beyond common practices. We report upon a 150 kHz sidescan sonar survey offshore of Kruzof Island, Alaska undertaken to characterize rockfish (*Sebastes*) habitat. Using GIS, Mapgrafix and Map*Factory we determined the percentage of seafloor cover that exists in our survey area. Final results were converted into Adobe Illustrator format using Maptrans. Bathymetry in the study area was determined with sidescan sonar interferometry. All XYZ data were gridded using surfer and plotted in shaded relief, bathymetric contour, and 3-dimensional formats. Contoured bathymetry was used as an overlay in Mapgrafix. Small sub-areas were extracted from the bathymetric data for closer study, and gridded in Surfer with a higher level of acccuracy. Areas of the mosaic where backscatter patterns were not distinct were verified with hand samples and video collected with the submersible *DELTA*. The use of submersibles for verification of interpreted lithologies and surface textures enable a high degree of accuracy for the interpretations. Lithotypes were lumped into larger groups based on morphology and fish associations with different morphologies were verified using the submersible. The accuracy of digital maps from high-resolution side scan sonar data allows a close quantification of the aerial extents of these important features, directing the application of management strategies to critical areas.

DISTRIBUTION OF FISH AND BENTHOS ON CROSS SEAMOUNT, HAWAII

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Cross Seamount is a Cretaceous age extinct volcano, originally formed off South America about 84 million years ago and is now located at a water depth of 350 meters, about 200 miles south of the Island of Oahu with flank deposits of cobalt-enriched ferromanganese crusts. The seamount edifice is star-shaped as a result of downslope mass wasting. The summit contains rounded boulders and worn basalt pinnacles that protrude through sandy areas, suggesting that the seamount was at sea level at one time. Massive elongate dikes radiate out from the summit along the present ridges and down its flanks with erosional chutes filled with broken crust and talus extending down from the summit. The distribution and species of benthic and pelagic animals was mapped with a series of 20 camera tows to depths of 5,000 meters and traverses with the submersible *Pisces V* to depths of 2,000 meters. Few live benthic animals were observed in the chutes. The greatest density of animals was observed as clusters around protruding rocks, ridges and at the summit. The most common coral forms mapped include gold parazoanthids, blue and tan paramuricid gorgonians and black corals. Currents carrying nutrients sweep along the north rim of Cross Seamount's summit and over steep ridges along its flanks which is probably why many cnidarians are found in these areas. Almost all of the commonly-occurring fishes, such as alfonsin, were observed from the top and rim of the seamount, down to depths of 700 meters. Large aggregations of alfonsin were photographed in mid-water at night and near cliff and ridge faces during the day, and schooled within the steep upper valleys of the chutes. From 700 to 900 meters depth where the tops of ridges are swept by strong currents, tan and blue paramuricids and *Keratoisis* sp. 4 (a bushy bamboo coral) form small compact communities. Small precious corals and a white stony coral (*Enallopsammia*) are occasionally found at these depths as well. Along flatter areas of the seamount, the primnoid gorgonians (*Narella bowersi, Narella* sp. 4, and *Narella* sp. 5) anchor to basalt or manganese crust. From 900 to 1,300 meters, the three *Narella* species predominate. From 1,500 to 1,700 meters depth, *Keratoisis* sp. 4 appears again on basalt ridges. From 1,700 to 1,900 meters depth, small colonies of chrysogorgiid gorgonians predominate. Sharks were observed only along the summit.

INFLUENCE OF HABITAT ON THE STRUCTURE OF BENTHIC MACROINVERTEBRATE COMMUNITIES IN NEW CALEDONIAN FRESHWATERS

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Starting in 1995, a biotic index based on benthic macroinvertebrates (larvae of insects, crustacea, worms, etc,...) for assessing water quality of New Caledonian rivers and streams has been under development. These organisms serve as valuable indicators of stream degradation because the presence or absence of some species indicates the quality of the water in regard to specific pollutants. However, benthic community structure may be influenced by habitat characteristics as well as water quality. The specific aim of this study is to analyse the relationships between habitat conditions and benthic macroinvertebrates in several rivers and streams. The main physical factors (substrate, organic matter, current velocity, channel characteristics, etc,...) which determine the dynamics and the structure of the macroinvertebrates associations will be discussed. In addition, the use by aquatic insects of their environment for their food and shelter will be highlighted. These results will improve knowledge of the environmental variability of fauna, and help to assess the influence of physical habitat on benthic macroinvertebrates in New Caledonian rivers and streams for development of a biotic index.

THE PECULIAR PATTERN OF THE FOREST SITE (ABORE GREAT BARRIER REEF): ARE THE CORAL PINNACLES IN A RANDOM POSITION ? (POSTER)

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In the southern part of the Abore Great Barrier Reef is an unusual sight: the Forest site. This coral spot is made of a lot of pinnacles with a peculiar pattern. Why is there such an arrangement of pinnacles ? Is it a random result ?

THE OCEAN IS OUR CLASSROOM. MARINE STUDIES, BAY OF PLENTY POLYTECHNIC (POSTER)

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In the past, the only direct training available in New Zealand for people wishing to enter the marine area as a field technician or research officer was through the traditional university programs of BSc, MSc and PhD. Other vocational training opportunities in areas such as marine tourism, fishing, aquaculture, and the recreational/leisure industries have been practically non existent. In 1991.The Marine Studies Certificate was established through the Bay of Plenty Polytechnic, Whitianga Campus with the intention to combine a broad range of marine subjects together in a one year full time course that would provide knowledge and skills for people wanting to work in the marine environment. By 1993 the course was moved to Tauranga campus and expanded into a two year Diploma program, focussing on further developing skills for employment. Increased support and recognition of the two programs has since resulted in a Graduate Option Diploma offered this year (1997) for students with three to four years of tertiary education experience. Marine Studies has experienced tremendous growth in student numbers over the past six years and an increased public and industry support network. Our potential is still great with plans to develop the graduate stream further and to become more involved in the aquaculture sector, local Maori issues and developing links with other Polytechnic and University institutions. The Marine Studies philosophy is to expose students to a wide range of marine topics (from marine biology to environmental legislation) and develop confidence and ability through hands-on practical and applied experience both on the shore and underwater.

LOW-COST DATA-LOGGING INSTRUMENT ARRAYS: A VALUABLE TECHNIQUE FOR CHARACTERIZING CORAL REEF ENVIRONMENTS

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Coral Reefs have complex topologies that interact with their environment to create intricate small-scale (cm to tens of meters) spatio-temporal patterns of water flow, light, and temperature. These patterns define localized microhabitats that dictate the distribution and growth rates of benthic organisms, including the reef-building corals and algae themselves. Thus, to understand the physical processes that link reef structure to reef ecology and vice versa, we must be able to measure and compare small-scale flow, light, and temperature patterns at different locations on a reef. Moreover, if we wish to characterize spatial patterns on the reef as a function of time, measurements must be made simultaneously (or nearly so) at different locations. Continued rapid progress in semiconductor technology has made available a wide variety of sensors, microprocessors, and other instrumentation «building blocks» useful for environmental measurement. Remarkably, the dramatic increases seen in the capabilities, reliability, and convenience of these integrated circuits have coincided with equally dramatic decreases in their size, power consumption, and price. Today, anyone with moderate training in contemporary analog and digital electronics plus some experience building underwater housings can design and assemble reliable, compact, underwater, data-logging instruments from parts totaling less than $100 (US) per completed instrument. Consequently, arrays of small, inexpensive, «home-made» data-logging instruments have become a viable solution to the challenge of simultaneous, multi-point measurements of reef environments. These arrays can provide better spatial and temporal resolution than is presently possible with satellite-based remote sensing. They can also perform simultaneous measurements at more locations, for longer time intervals, with less disturbance, and at lower overall costs than ROVs, instrument-laden SCUBA divers, and most commercial data-logging oceanographic instruments.

HABITAT-BASED ASSESSMENTS OF A LONG-LIVED SPECIES IN THE GULF OF ALASKA: IMPLICATIONS FOR COMMERCIAL FISHERIES MANAGEMENT

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The Alaska Department of Fish and Game has been using an occupied submersible to conduct line transects for estimating yelloweye rockfish density since 1989. Biomass of adult yelloweyee rockfish is derived as the product of estimated density, the estimate of rocky habitat within the 200 m contour, and average weight of fish. Current management is based on an estimate of density from all rock habitats combined and unit area is estimated from NOAA National Ocean Service (NOS) data. There are significant differences in density between different habitat types, with yelloweye more abundant in areas with refuge spaces, particularly in deep water boulder fields where the boulders are large and the void-to-clast ratio great. To increase the precision of our area estimate and to quantify the various types of rock habitat, we began a seafloor mapping program in 1996. This resulted in a sidescan and bathymetric mosaic of a 700 sq. NM area of commercial fishing grounds. The use of GIS allows us to overlay area specific commercial catch data with habitat and relative abundance data. In the mosaic area, NOS data details 218 sq. km of rocky habitat versus 287 sq. km from the sidescan interpretation. This difference results in a 24% increase in total allowable catch (TAC) in this area if applied directly to management. However, applying habitat-specific density estimates to each habitat category can yield very different results. In the example shown, the habitat-specific TAC would be 10% lower than that calculated using an overall density and area estimate from NOS data and 30% lower than that calculated using overall density and the area estimate from the sidescan data. This has significant implications for management and underscores the need to quantify both habitat-specific density and distribution of habitat.

IMPORTANCE OF HABITAT IN THE PRODUCTION OF THE HAWAIIAN DEEPWATER SNAPPER (PRISTIPOMOIDES FILAMENTOSUS)

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Eteline snappers are important to the demersal fisheries of the central and western Pacific, but little is known about their habitat needs, particularly concerning their juvenile stages. Through a variety of studies the nursery habitat of the Hawaiian pink snapper (*Pristipomoides filamentosus*) was identified at moderate depths (~65-100 m) and their movements and densities characterized. Juveniles were found to settle annually to spatially stable aggregations, occupying expanses of uniform sedimentary habitat. Habitat data assessed in a logistic regression model correctly predicted 68% of the juveniles' spatial variability. Premium habitat was identified as a sediment bottom, free of relief, and close to focused sources of drainage (reef platforms, embayments, and anthropogenic sources) in adjacent shallows. Estimates of recruit production, based on densities of juveniles from other than premium habitat, were a small fraction of the recruits needed (calculated from catch) to account for the fishery's current landings of adult snappers. The 68-fold higher juvenile abundance at premium habitat can reconcile this difference, indicating such infrequent high quality habitat is an important (perhaps critical) fishery resource.

EFFECTS OF HABITAT CHARACTERISTICS ON HAWAIIAN REEF FISH ASSEMBLAGES

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Habitat characteristics of a coral reef were examined as potential influences on fish assemblage structure, using repeated underwater visual census to estimate numbers and biomass of all fishes visible on 42 benthic transects, and making quantitative measurements of 13 variables of the corresponding physical habitat and sessile biota of the substrate. Fish assemblages in the diverse set of benthic habitats were grouped by detrended correspondence analysis, and associated with six major habitat types. Statistical differences were shown between a number of these habitat types for various ensemble variables of the fish assemblages. Overall, these variables tended to have higher values where reef substrate was more structurally or topographically complex, and closer to reef edges. When study sites were separately divided into five depth strata, the deeper strata tended to have statistically higher values of ensemble variables for the fish assemblages. Multiple linear regression models indicated that for the complete assemblages and for most of their component major trophic and mobility guilds, a large part of the variability for most ensemble variables was explained by measures of holes in the substrate, with important contributions from measured substrate rugosity and depth. A strong linear relationship found by regression of meean fish length on average volume of holes in .the reef surface emphasized the importance of shelter for fish assemblages. Results of this study may have practical application (e.g. in designing reserve areas) as well as theoretical value in helping to explain the organization of reef fish assemblages.

INTERACTIONS BETWEEN THE OCEAN, CORAL REEFS AND THE COASTAL ZONE

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Whether established on continental shelf margins or around oceanic islands, coral reefs represent a physical and ecological boundary between coastal zones and the open ocean. Despite the fact that in most instances their metabolic performances indicate a state of trophic balance, coral reefs do import carbon from the open ocean, both dissolved inorganic and dissolved and particulate organic, the latter mostly in the form of zooplankton. The zooplankton input may represent up to 30% of the reef gross productivity. Conversely, organic carbon produced by the reef system is exported to the ocean or to inshore waters (lagoon) mostly during storm events. The nature and the rate of exchange of carbon with the coastal zone is largely a function of the type of community developed inshore. Mangroves and seagrass beds, both very diverse and highly productive ccommunities, are a major source of organic carbon (both particulate and dissolved) input to coral reefs. The terrestrial environment is also a source of nutrients, in particular dissolved nitrogen, but total input rates have not been quantified, particularly when taking into account freshwater runoff from small coastal watercourses. Whereas data on the components of carbon flows and a carbon budget in the reef environment become more available, information on a total nitrogen and phosphorus budget is still scanty and requires further investigation.

THE APPLICATION OF GEOSCIENCE TO MARINE HABITAT RESEARCH IN CANADA

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The wide, shallow continental shelf of Atlantic Canada has supported a highly productive commercial fishery for more than 200 years. Today the three mainstays of this fishery (1) groundfish, (2) lobster and (3) scallops, are under considerable pressure. Conservation strategies are being developed to rebuild stocks and manage a sustainable fishery. One of the roles of science in this strategy is to identify and understand critical habitats. The GSC has been involved in collaborative projects with fisheries research scientists in each of the key fisheries:

- A multi-disciplinary study to assess the impacts of trawling on groundfish habitat is being undertaken utilizing sidescan sonar and high resolution seismics.
- Lobster habitat is being mapped using a neutrally buoyant sidescan sonar system, to produce base maps for lobster abundance surveys, to identify spawning grounds, and to explore sites for artificial reef formation for lobster farming.
- The banks off southern Nova Scotia support a rich scallop fishery. In a collaborative project between DFO and the fishing industry a suite of mapping tools (including high resolution seismics, sidescan sonar, multibeam mapping, and seafloor characterisation) is being used to map the seafloor and develop relationships between catch returns and substrate. Data will enhance fisheries management and cost effective harvesting techniques.
- Clan harvesting in the littoral zone impacts the benthic community. Geotechnical sediment properties are being used to assess the impact of clam harvesting techniques on juvenile clam recruitment.

THE EFFECTS OF TRAWL FISHERIES ON SHELF SEABED HABITATS

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Most of the management issues for GBR seabed habitats are related to the effects of prawn trawling and these effects have been documented most comprehensively by a 5 year CSIRO/QDPI study in, and adjacent to, the Cross-Shelf Closure in the Far Northern Section of the GBR. The seabed and associated communities in the study area were described, then sampling was conducted to compare areas open and closed to trawling. There were few significant differences between the benthic communities in open and closed areas — but this should not be interpreted as a direct comparison of trawled vs untrawled areas because the inshore area of the closure was trawled before the closure, and some trawling has continued in this area. Also, much of the area open to trawling has not been trawled and effort is highly aggregated. Next, a Before-After-Control-Impact experiment was conducted, in which twelve 2.7 x 1.2 km treatment plots were trawled entirely once-over and compared with control plots. Between 1–7 t of benthic material was removed from each treatment plot. Despite this obvious impact, there were few significant differences between the benthic communities in trawled plots and control plots. To determine the impact of intensive trawling on seabed benthos, a repeated-trawl depletion experiment was conducted. Preliminary analyses indicated that each trawl removed roughly 5-20% of the available biomass of sessile benthos and that 12-13 trawls removed roughly 70-90% of the apparent initial biomass. These results show that the impacts of trawling may not be detectable in areas that are trawled sparsely or infrequently; however, the cumulative effect of frequent trawls over the same grounds may be substantial.

METHODS FOR RAPID CHARACTERISATION, QUANTIFICATION AND MAPPING OF SHELF SEABED HABITATS

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The declaration of an EEZ carries an obligation to manage and conserve its resources and biodiversity. To underpin this planning, information on distribution of habitats is required. We have been providing such information for large areas of tropical continental shelf. Our philosophy is one of continual methodological improvement for greater efficiency, because of increasing costs. We map shelf seabed habitats using a suite of rapid deployment methods: video camera transects (sled or drop-weight mounted), with acoustics, side-scan sonar, benthic dredge and sediment grab. These are integrated by a computer logging system that acquires vessel data such as position, heading and writes relevant data to a database and onto the video. Qualitative physical and biological habitat codes are entered in real time, greatly facilitating post analysis. Typically, sites are located on a 5-10 km grid, depending on the complexity of habitat patterns. If very accurate positioning is required, the towed camera is tracked acoustically and differential GPS is used so that habitats can be located within a few metres. Where appropriate, other devices such as ROV, trawls, SSBA (where shallow), may be used. Data entered in the field can be rapidly presented as maps, using a GIS. Our research on seabed habitat distribution has provided a basic understanding of the physical factors driving tropical shelf seabed habitat patterns. These include bathymetry, substratum and current shear stress. Stratification on these factors, using variable grid sizes, greatly enhances the efficiency of representative sampling of habitat and biodiversity. Understanding these relationships also provides a basis for mapping-by-proxy for identification of representative areas for conservation planning and multiple-use management.

USE OF AN ROV TO RESEARCH THE LIFE HISTORY OF DOMINANT STRUCTURAL SHELF SEABED EPI-FAUNA, IMPORTANT FOR FISHERIES HABITAT AND BIODIVERSITY

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The dynamics (recruitment, growth, mortality, and reproduction) of structurally dominant seabed habitat organisms (sponges, gorgonians, and alcyonarians and corals etc), that may be found on the types of seabed that could be trawled for prawns or finfishes, is being documented at several sites in the Great Barrier Reef region. Sites have been chosen to contain several representative patches of benthos habitat. An ROV is being used to document megabenthos dynamics, including: mapping the large sessile epibenthic fauna in habitat patches at each site; tagging several dominant species of sponges, gorgonians, and alcyonarians; direct physical and video measurements of growth and mortality rates through time; observing the occurrence of new small individuals for measurements of recruitment; taking small biopsy samples from each individual to confirm taxonomy; and histological examination in the laboratory to determine reproductive strategies. By tagging a full size-range of individuals of each study species, we will be able to estimate life-time growth curves in three years. This study will estimate how fast seabed habitat will recover in areas set aside for refuges and benefit the design of refuge areas and new fishing strategies that impact less habitat. The adoption of these strategies into fishery management is expected to lead to increased productivity of commercial species by preserving critical habitat in refuge and will also help reduce conflict between commercial fishing activities and conservation. This study will also document the usage of living epibenthic habitat by key finfish species, in terms of species micro-distribution, shelter requirements, and food chain links.

CONSERVATION PLANNING TO SUPPORT INFORMED DECISION MAKING AND SUSTAINABLE DEVELOPMENT

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Torres Strait (TS) a ~30,000 km2 area between Australia and PNG is an area of rich geographical, ecological and cultural diversity. The marine environments have high productivity and outstanding conservation significance. Ecological research has provided an extensive range of data sets but there are data gaps since each project has had a particular focus and spatial scale. A central region of TS (12,347 km^2) with data on bathymetry, sediment, seagrass and epibenthos was identified as suitable for developing techniques to identify areas of high conservation significance to support decision making and sustainable development. Point-to-area transformations using a Geographic Information System converted the point data to maps; a unique conditions overlay of the maps identified 73 «habitats»; and, cluster analysis of the habitats grouped them into a manageable number of combinations of epibenthos, substrate, seagrass and depth. Nine main «habitat» groups were identified: H1 (739 km^2) — rocky areas with dense epibenthos and no seagrass; H2 (1,839 km^2) — rubble areas with little epibenthos and no seagrass; H3 (1,142 km^2) — rocky areas with dense epibenthos and seagrass; H 4 (2,558 km^2) —rubble areas with epibenthos and seagrass; H5 (3,683 km^2) — sandy areas with epibenthos and seagrass; H6 (248 km^2) — muddy areas with very little epibenthos and no seagrass; H7 (152 km^2) — bare mud at 20-30 m depth; H8 (179 km^2) —sandy areas with little epibenthos and no seagrass; and H9 (1,804 km^2) — bare sand. An index of habitat diversity, calculated as the variety of distinct habitats within a 10 x 10 km window passed over the study area indicated the areas with highest biological diversity were among the reefs and islands that formed two bands passing through central Torres Strait.

EVALUATING THE EFFECTS OF CONTAMINATED WATERS AND SEDIMENTS ON BENTHIC FAUNAS: DEVELOPMENT OF MONITORING PROTOCOLS AND POLLUTION MANAGEMENT STRATEGIES

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In many tropical regions, rapid urban and industrial expansion is closely linked to increasing environmental pollution, much of which, directly or indirectly, reaches the sea. In many urbanised estuarine and nearshore marine settings there is increasing evidence that such land-ocean contaminant fluxes are causing significant damage to sensitive ecosystems. The consequent reduction in biodiversity ultimately damages strategically important economies including fisheries and tourism. Recognising these problems, the UK Overseas Development Administration funded a coastal pollution monitoring programme, the Land-Ocean Contamination Study (LOCS) with the aim of facilitating a reduction in coastal-zone contamination through the provision of appropriate low-cost monitoring, amelioration and integrated coastal management strategies. Researchers from the British Geological Survey, the Institute of Terrestrial Ecology and the University of Newcastle Centre for Tropical Coastal Management Studies have worked closely with scientists from Kenya, Tanzania, Indonesia and Brazil to develop such strategies. Specific monitoring protocols are being developed for techniques such as: the collection of samples for analysis of heavy metals, alkanes, polycyclic aromatic hydrocarbons and organochlorines in waters, suspended particulate matter and in sea bed sediments; and ecotoxicological sampling for the use of cellular biomarkers in order to detect early-stage contaminant-induced stress, as well as for the uptake of heavy metals by coral tissues. Examples of these, and of their application towards coastal zone management are given from the near-shore waters of Jakarta Bay. The monitoring protocols and recommended, amelioration and integrated coastal management strategies will be published in a handbook next year.

First observations of a major coral bleaching in New Caledonia (Poster)

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The bleaching phenomenon, observed under conditions of physical stress was first reported in 1931. Until 1979 it was rarely observed. During the last fifteen years coral bleaching has been observed world-wide. New Caledonia, located between 18 and 21°S, possesses extensive coral reefs. Until present these reefs have been spared bleaching, probably due to the fact that the water temperature stays below 28°C during summer. In 1995 the observed mean temperature was superior to those of the previous 30 years. From December 1995 to March 1996 the sea temperature reaches 29°C in the SW lagoon. The first sighting of bleaching was observed in January on the fringing reefs of Nouméa Peninsula. At the end of February, a vast bleached zone was observed in shallow waters (1.5 - 3 m) and spread over more than 90 % of the surface of the fringing reefs. On the 6/7 of April during the low tide, a large part of fringing reef flats was exposed permitting an easy observation (Photo). Most of the coral was completely white, some displayed bright blue, green or pink. Others were dead and covered by green algae. The main genera affected were branched *Acropora*, encrusted *Montipora* and massive *Porites* and Faviidae. Alcyonarian from the genus *Sarcophyton* that are normally grey also turned white. The same location was revisited one year later (April 1997), the previously bleach area was completely dead and all branched corals were covered with red algae. The bleaching phenomenon was observed on all fringing reefs around the main island (Thio, Nepoui, Goro...), from the north to the south. Furthermore some isolated cases of coral bleaching (*Montipora*) were observed on the outer slope of the barrier reef at depths of 50 m.

THE VULNERABILITY OF THE BIODIVERSITY OF THE NORFOLK RIDGE SEAMOUNTS (POSTER)

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The Norfolk Ridge Seamounts located in the eastern part of the Economic Zone of New Caledonia were sampled by dredging and trawling during several deep sea surveys. Further to studies carried out by taxonomists on the zoological collections the results of which were published in the MUSORSTOM series, a deep sea data-base was built up. The analysis show that some well mapped and intensively sampled seamounts have a very high specific richness in invertebrates and dwell large concentrations of fish. About 60 % of the invertebrates species were described as new to science. Several species known from only one seamount are possibly endemic. This area is particularly rich in archaic organisms considered as living fossils: stalk crinoid *Gymnocrinus richeri*, mollusc gastropod *Perotrochus* sp., Sphinctozoid sponges, etc, ... The seamounts the top of which is ranging from 300 to 600 m deep are covered by communities dominated by sponges, stylasterid corals, large gorgonians (bamboo corals) and antipatharians (black corals). Although no data are available on the longevity of such organisms, their growth rate is probably slow in this cold water environment. The first information obtained about sphinctozoid calcified sponges shown a growth of one cm by century and life span of more than 600 years ! Preliminary study on the glass rod of a sponge has provided an estimated age between 200 and 400 years ! There is also no doubt that gorgonians with several cm trunk diameter could be as old as large trees ! Fish resources were discovered by trawling on the summit of these seamounts. Subsequently, a bottom longline fishery targeting alfonsino (*Beryx spendens*) and bluenose (*Hyperoglyphe antarctica*) operated in this area from 1988 to 1991. An ORSTOM scientific programme was devoted to the study of the biology and populations dynamic of alfonsino. The fishery collapsed after four years for economical reason but not from overexploitation. Unfortunately, no control was carried out on the effect of the fishery on the benthos.

SOFT-SEDIMENT BENTHIC COMMUNITY STRUCTURE IN A CORAL REEF LAGOON - THE PROMINENCE OF SPATIAL HETEROGENEITY AND «SPOT ENDEMISM»

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Biodiversity of coral reefs has clearly joined the main players on the centre stage of current marine research. An encompassing view of coral reef ecosystems needs to extend beyond the prominent and attractive hard substrata to also include soft-sediment habitats associated with the reefs, of which the Great Astrolabe Reef located in Southern Fiji is a representative example for the Pacific. Focusing on the soft-sediment benthic assemblages within the lagoon of this reef, patterns, clines and variability of community structure across space (scale ca. 2 km) were studied. Both plant diversity and biomass (as a proxy measure for habitat diversity) were poor predictors of zoobenthic diversity. Striking spatial heterogeneity in benthic community structure is a key-feature of this system. In contrast to the commonly held view that sediment characteristics are the prime factors in structuring benthic assemblages, spatial variability of the benthos was overriding the generally weak relationships between sedimentary features and the biota. Part of this pronounced spatial heterogeneity stems from the marked patchiness in individual species distributions, here operationally coined spot endemism. Out of a total of 211 recorded taxa, 42 % were rare, being restricted to a singular site. No species spanned the entire lagoon; in fact, the maximum species range was 16 out of 25 localities sampled. Furthermore, the number of taxa common to any two localities was not strongly linked to distance in space, with adjoining sites having no more taxa in common than distant localities (mean 6). The commoness of rarity, prevalence of extremely restricted species distributions, patchiness in benthic diversity all combine to have profound implications for the management and conservation strategies of these marine benthic habitats.

APPLICATIONS OF GIS FOR HABITAT ASSESSMENT AND MARINE RESOURCE MANAGEMENT

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Marine scientists often assess habitats to understand the distribution and relative abundance of marine resources. Due to the spatial nature of habitats and associated temporal changes, however, assimilating data using traditional analytical methods is often quite challenging. Geographic Information Systems (GIS) are proving to be a solution to the problems inherent in the analysis of spatial data, as they can be used to effectively collate, archive, display, analyze and model spatial and temporal data. Additionally, GIS provides an extremely valuable tool for coastal resource managers. Dissimilar data types, such as socio-political boundaries, bottom types, fish distribution, and traditional fishing grounds, for example, can be used to make informed management decisions. In this way, GIS provides resource managers with a way to integrate scientific data with prevailing cultural values and traditions. We have developed a working GIS for the Monterey Bay National Marine Sanctuary that allows the integration of many terrestrial and marine data sets, including inter-tidal monitoring data, permit locations, seabird strandings, fisheries catch data, habitat types, marine political boundaries, as well as land cover classification from satellite imagery, wathersheds, streams, roads, and political boundaries. We have linked terrestrial and marine data to create a broad spatial and temporal database that will be used in a variety of ways such as evaluating natural processes, permitting and monitoring coastal development and assessing environmental impacts (e.g. oil spills).

DIRECT AND INDIRECT ESTIMATES OF FISH DENSITY ON A ROCKY BANK

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Comparing estimates of fish density provided by direct observation and remote sensing is problematical primarily because of the differences in sampling methods and the way the sampling tools collect data. I compared submersible belt transects along a rocky bottom with acoustic surveys of the water column to estimate depth distribution and density of fishes at Stonewall Bank, Oregon, in the northeastern Pacific Ocean. The objectives of the study were to determine the proportion of fish in the water column that were not detected using submersible survey techniques, and to compare estimates of fish density near the bottom from submersible surveys with density estimates from hydroacoustic surveys. More than 75% of the fishes insonified on accoustic surveys resided in the bottom third of the water column. Rockfishes (family Scorpaenidae) were the predominate fish taxa observed in the study area. Submersible estimates of fish density were more than six times greater than acoustic estimates of fish density near the bottom. Submersible and acoustic surveys provided different, but complementary, information regarding fish use of rocky banks. Submersible surveys provided estimates of fish density near the bottom and provided valuable ground-truth for acoustic equipment. Hydroacoustic surveys provided estimates of fish density in the portions of the water column not observed on submersible transects, and provided additional information on the vertical and horizontal distribution of fishes. The combined use of submersible and acoustic sampling techniques provided a better understanding of fish usage of rocky banks than either technique alone.

REDUCING MARINE MAMMAL FISHERIES BYCATCH: EXPERIMENTS IN NEW ZEALAND WITH ACOUSTIC PINGERS

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Underwater acoustic pingers, emitting a 10kHz sound, were tested in New Zealand to evaluate their potential effectiveness in preventing entanglement and death of Hector's dolphins in coastal gillnets. Observations of dolphin movement and distribution relative to active and passive acoustic pingers in the water were made from land using a theodolite and logged directly into a computer. Two subsets were used in the analysis, one representing the distance between the sighted dolphins and the active pinger and one representing the distance between sighted dolphins and a passive pinger. The distribution of the distance data was significantly non-normal ($p < 0.001$), so the non-parametric Mann-Whitney rank sum test was used to compare porpoise distributions from the two subsets. In this analysis, all sightings data were included; the median distance value for the dummy pinger trials was 259m ($n = 1071$) and the median distance value for the ensonified or «active» trials was 390.5m ($n = 722$). The difference in the two sets of data was statistically significant. Results indicate that Hector's dolphin distributions were affected by the 10 kHz and that dolphins avoided the immediate area where the pingers were active. While this technique may help reduce dolphin bycatch in some New Zealand fisheries, this paper will also evaluate the potential usefulness of this technique in other South Pacific locations and fisheries served by the Marine Benthic Habitat meeting.

POLYNESIAN CORAL REEFS MONITORING NETWORK (RÉSEAU TERRITORIAL D'OBSERVATION DU LAGON EN POLYNÉSIE): METHODOLOGY AND EVALUATION OF DATA AFTER 8 YEARS

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In order to provide a sustainable social and economic development such as tourism, perliculture aquaculture and fishing in French Polynesia, particularly in islands under highly anthropic influence such as Tahiti and Moorea, a local coral reefs monitoring network was initiated in 1989 in Tahiti by the Minister of environment and the Delegation for environment. One of the goals of this study has been to select the parameters and to develop a simple, inexpensive methodological method in order to diagnose the lagoon ecosystems and evaluate the perturbations.

ORC: A CORAL REEF MONITORING NETWORK IN THE SOUTH PROVINCE OF NEW CALEDONIA (POSTER)

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Because the preservation of coral reef ecosystems is a major environmental concern, the South Province of New Caledonia created a Coral Reef Observatory (ORC) in 1997. The aim of the ORC is to develop a monitoring network in order to assess, at low cost, coral reefs health in the South Province of New Caledonia. Data collection is based on simplified underwater sampling for fish, invertebrates, corals and substrate by volunteers. Scientists are in charge of the training of volunteers, data checking and analysis. Five sites have been selected, from none to high anthropogenic impacts. Each site will be sampled by 3 stations on a shore to inner barrier reef transect. The stations will be sampled two times a year at the same dates. Expected results are: assessment of man-induced impacts, characterization of coral, invertebrate and fish communities, and assessment of coral reef health. Such information should be valuable for local authorities. A preliminary survey was undertaken in the vicinity of Nouméa during September 1997 to validate the sampling methods. Results were incorporated in *Reef Check 1997*, an IYOR event. The results indicate a high percentage of live coral coverage from shore (22%) to mid lagoon island and inner barrier reef stations (47%). These reefs near Nouméa (76,000 habitats) are in good health because of protective measures. Spatial distribution of invertebrate is determined by habitat characteristics rather than anthropogenic influence. Edible fish species were not recorded inshore, but small groupers in the mid lagoon island and large ones on the barrier reef. These findings are consistent with the overall decrease of fishing intensity from shore to barrier reef.

WESTERN NEW CALEDONIA ECONOMIC ZONE. NEW RESULTS OBTAINED DURING ZONÉCO 4 CRUISE (POSTER)

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The ZoNéCo 4 cruise (1996), was a seafloor mapping, geophysical and physical oceanography survey, carried out on board the R.V *L'Atalante* using the multibeam echosounders the EM 12 DUAL and the EM 950. The aim of this cruise was to identify potential sites of economical interest, for fisheries and mining industry, in the western area of New Caledonia's EZ over the Fairway Ridge and the Northern part of the Lord Howe guyots and the Lord Howe Rise. A compilaton of conventional and swath mapping bathymetric data shows: 1) the smooth topography of the Coriolis bank; 2) the terrace of the Nova Argo banks; 3) the 600 m deep seamounts located at the top of the Lord Howe rise; 4) a series of seamounts aligned in a general North-South direction located on the south Lansdowne banks culminating at 500 m-deep; 5) the Fairway basin deepening southward from 800 to 2500 m; 6) the N140°E trending Lansdowne bank and the Fairway ridge with a general depth of 800 m, also deepening southward. Imagery data allow to distinguish, including the slope effects, rocks outcrops from sedimentary cover. The superimposition of imagery and bathymetry data indicates possible trawling areas over the Coriolis bank, the summit of the Lord Howe Rise and the Northward end of the Fairway basin. The application of the ZoNéCo 4 cruise to deep-bottom fishing cruises and geological dredgings will start in 1998 with Halipro 3 and 4 cruises, planned in these selected areas.

BENEFITS OF SWATH MAPPING OF THE SOUTHERN PART OF THE EZ OF NEW CALEDONIA

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The ZoNéCo 1 cruise (1993), carried out onboard the IFREMER R.V *L'Atalante* equipped with the multibeam echosounder EM12 Dual, has surveyed the southern prolongation of New Caledonia and Loyalty Islands. The swath bathymetry and imagery data focuses primilarly on the mapping of areas with seamounts, the summits of wich are less than 1500 m-deep. This zone was selected because it was previously exploited by a bottom longline fishery with Alfonsino (*Beryx splendens*) as target species. In addition, geological dredgings have shown that this zone is likely to possess mineral resources. The swath mapping data show that: 1/ the Norfolk Ridge is composed of a 1000 m-depth plateau deepening to 2,000-m to the south, with seamounts culminating at 200 m-depth in the north and at 800 m in the south; 2/ the Loyalty Ridge is made of elongated and tabular structures or «guyots» culminating at 1,000 m-depth. Imagery data allow differenciation of hard substratum from muddy bottom. The superimposition of imagery and bathymetry data shows that seamounts observed in this zone are possible trawling areas. In 1996, the NIWA R.V *Tangaroa* has been chartered to carry out the Halipro 2 deep-sea trawling cruise between 800 and 1500 m-depth. A total of 94 trawlings were completed respectively over 21 seamounts located on the Norfolk Ridge and 6 on the southern prolongation of the Loyalty Ridge. The results of Halipro 2 cruise show that trawling is difficult on the slopes of the seamounts whilst it appears easier on the flat summits. Further exploratory fishing surveys are planned in areas where detailed maps of the seafloor are available to further swath mapping ZoNéCo cruises.

DEMERSAL FISHERY RESOURCES AND BATHYMETRIC RANGES WITHIN THE ECONOMIC ZONE OF NEW CALEDONIA (POSTER)

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In New Caledonia, four main depth ranges can be exploited : 0-100 m, 100-500 m, 500-800 m and 800-1500 m. The first one includes all the lagoons and covers an area of 37000 km2 (2.7 % of the EZ). Relevant catches attain 4000 tons a year (50 % of the total fishery production) half of which comes from subsistance and recreational fisheries. The main species caught by handline are Lethrinidae (Emperors), Serranidae (Groupers), Scaridae (Parrot fish) and Siganidae (Rabbit fish). Bottom fisheries within the other depth ranges were analysed as part of the ZoNéCo programme. The depth range 100-500 m which covers an area of 25500 km2 (1.8 % of the EZ) is exploited by the coastal fishery. Demersal species represent half of this coastal production, i.e. 0.6 % of the total fishery production. The main species are Etelinae, groupers and emperors caught on the outer reef slopes from 100 to 250 m with reels and from 250 to 500 m with bottom longlines. The depth range 500-800 m which covers an area of 24000 km2 (1.7 % of the EZ) was exploited by an industrial deep-sea fishery. The alfonsino (*Beryx splendens*) was the target species along with the bluenose (*Hyperoglyphe antarctica*) and the armorhead (*Pseudopentaceros richardsoni*). The catches were made by bottom longlines and trawls mainly over the seamounts located in the south-east part of the EZ. The depth range 800-1500 m which covers an area of 172500 km2 (12 % of the EZ) was explored by scientific surveys using bottom trawls and traps. This depth range is not yet exploited. The orange roughy (*Hoplosthetus atlanticus*) does not seem to occur over the seamounts of the New Caledonia EZ although it is abundant further south in New Zealand, on similar features. A few commercial species of deep bottom crustaceans which are exploited in other countries, were caught in the same bathymetric range.

THE RELATIONSHIP BETWEEN DEPTH, SUBSTRATE AND ECOLOGY: A DROP VIDEO STUDY FROM THE SOUTH EASTERN AUSTRALIAN COAST

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The South Eastern coast of Australia is separated from Tasmania by a shallow strait (Bass Strait) which was inundated during the last post-glacial marine transgression. The majority of Bass Strait is less than 75 metres deep, with a maximum depth of approximately 100 metres. The study involved the use of an Along Track Video (ATV) system to image the study sites, along with equipment to record depths and locations. All data were collected in 1996 by the Marine And Freshwater Research Institute (MAFRI), Queenscliff, Victoria. The video camera was mounted on a frame and dropped a number of times at each site. The relationship between substrate type, depth and ecology previously has not been widely investigated in this region. Therefore, a study has been implemented with 15 study sites chosen on the Victorian coastline. A better understanding of the correlation between substrate, depth and ecology will enable researchers to determine to what extent the benthic biological communities depend on physical factors. This understanding will allow better procedures to predict the seafloor ecology on the basis of geological and oceanographic data. If possible, this will represent the development of an important environmental management tool. The substrate compositions of these sites include granite, basalt, sand, calcarenite and Paleozoic materials. The depth range for the sites is from 2 metres to 78 metres. The seafloor characteristics, including dominant species assemblages and geomorphology, were observed and recorded for each transect, with analysis of the results including all three variables.

SWATH MAPPING NEAR-SHORE AND DEEP-SEA MARINE HABITATS: EXAMPLES FROM NEW ZEALAND (POSTER)

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The increasing need in New Zealand to (1) establish the sustainability of existing and new commercial fisheries, (2) document and protect marine habitats with unusual and/or high biodiversity, (3) identify and possibly exploit biomedicinal products from marine organisms, and (4) maintaining traditional, cultural seafood harvesting has produced a requirement for complete spatial «mapping» of marine habitats. Swath mapping, ranging from near-shore side-scan sonar surveys to swath multi-beam surveys of deep-sea seamounts and canyons, has proven to be an ideal first step in addressing such issues. Within near-shore environments, side-scan mapping with digital acquisition, geometric correction, and swath mosaicing has been used at various New Zealand localities to assess (1) shellfish distribution and density, and associated impacts of trawling, (2) substrate - habitat mapping of existing and proposed marine reserves, (3) surveying substrates and associated sponge dominated communities for the anti-tumor bearing *Lissodendoryx* sp., (4) surveying areas of traditional seafood gathering (taiapure), and (5) assessing the cost/benefit of habitat mapping for conservation/ environmental legislation. Such surveys are typically ground-truthed with representative and targeted SCUBA video/camera transects. Naturally, within deep-sea environments such investigations are fewer, but reconnaissance benthic studies of canyons and seamounts have commenced using integrated datasets of swath imagery and bathymetry, seafloor photography and sampling. Examples from both near-shore and deep-sea studies will be presented.

SENSING ESSENTIAL BENTHIC FISH HABITATS IN DEEPWATER

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Interest in assessment of marine benthic habitats is rapidly growing. As coastal resources are being increasingly modified by natural and human disturbance, the impacts on benthic fishes are of concern and need to be addressed. Studies of marine fishes and associated habitats are limited by available technology. Mapping habitats and landscape features has been conducted traditionally in either terrestrial or shallow aquatic settings, where sampling and surveying are much easier to perform than in deep ocean environments. There is relatively little information on fish assemblages associated with deepwater rocky habitat. Over the past three years, a team of marine fishery biologists, geologists, and ecologists from US federal and state resource management agencies and academic institutes has been pioneering the research on bottom-dwelling fishes associated with deepwater shelf and canyon habitats. We have combined the use of side-scan sonar, bottom profiling, and manned submersible operations to successfully identify and characterize large (i.e., 100's of meters to kilometers) and small-scale (i.e., 1 meter to 10's of meters) habitats that support fishes in deep water (i.e., 50-300 m water depth), and to compare fish assemblages and habitat specificity at both lightly- and heavily - fished sites. Our in situ techniques are especially critical when focusing on benthic habitats of extreme heterogeneity and biological assemblages of high diversity. We are now applying these techniques to an evaluation of harvest reserves as a supplementary management tool for marine fisheries. Characterizing and quantifying attributes of available habitat are crucial in evaluating the effectiveness of harvest reserves in maintaining regional fish resources.

MAPPING BENTHIC HABITATS AND OCEAN CURRENTS IN THE VICINITY OF A MARINE PROTECTED AREA (POSTER)

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Characterizations of benthic fish habitat and coastal ocean circulation patterns are critical steps in evaluating the effectiveness of marine protected areas (MPAs), or no-take reserves, at protecting and enhancing coastal resources. With the coordinated efforts of geologists, biologists, and physical oceanographers, side scan sonar was used to survey the seafloor in deep water (30-200 m) in and around one of California's newest MPAs. Maps of predicted seafloor habitat types were created from a mosaic of the side scan sonographs. A manned-submersible was used to validate or ground-truth our interpretations of the sonographs. Eight types of habitat have been identified and quantified, ranging from sand ripple fields to extensive rock outcrops to isolated pinnacles and boulders. About 10 percent of the survey area, both in and outside the MPA, was made up of complex habitats of relatively high relief. These habitat characterizations will help direct our next efforts to assess the fishes and their habitat associations within the MPA. Patterns of ocean circulation also were characterized over the continental shelf and upper slope (to 30 km offshore) in the vicinity of this MPA. Upwelling and substantial offshore transport off nearby headlands were evident in temperature, salinity, and acoustic doppler current profile data collected at sea and in satellite surface temperature (SST) imagery. Counter to the tradditional view of a southward flowing California current, we found coherent 10-25 cm/s northward flow from the coast to ~20 km from shore. This flow contributes to the convergence of water and offshore transport at an adjacent headland to the north. This information will help us define the physical processes that affect the distribution, transport, and survival of young fishes, and clarify our expectations for recruitment from an MPA to nearby unprotected areas.

ZEPOLYF: GEOPHYSICAL MAPPING OF THE FRENCH POLYNESIAN E.Z. (POSTER)

ZEPOLYF Program

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ZEPOLYF program aims mainly to contribute to the economic development of the French Polynesia in finding new fishing sites and inventoring potential mineral resources. A working group composed of French research institutions (IFREMER, ORSTOM and Université Française du Pacifique), and French Polynesian Institutions (Research and Sea Ministries) has been created to run this program. With its 5 millions of km2, the Exclusive Economic Zone (E.Z.) of French Polynesia is the largest of the South Pacific. It belongs entirely to the Pacific Plate and is composed of 5 archipelagos with at least 3 active hot spot tracks lying on an oceanic crust with ages comprised between 30 and 110 Ma. Although many scientific cruises have crossed the area in the past 30 years, several large zones remain unknown. For example, all the seamounts are not recognised and the location and depth of the already mapped ones are not accurate. The final goals of the program are thus: - to provide fishermen with detailed maps of the seafloor topography, with emphasis on seamounts which could be potential fishing grounds; - to make an inventory of the mineral resources on these seamounts (Fe-Mn incrustations). To achieve these goals, we have first made a compilation of all scientific data already collected in the E.Z. (geophysics, oceanography, biology). We then decided to attempt at least three geophysical surveys on selected zones using multibeam, seismic, magnetic and gravity instruments on board R/V *L'Atalante*. The first campaign was completed in December 1996. In a second step, we will conduct several experimental fishing cruises on the previously mapped seamounts. A complete synthesis of this work is scheduled to be achieved in 2002.

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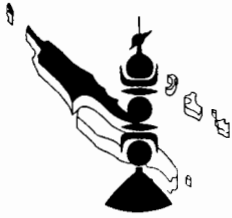

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