5 th Indo - Pacific Fish Conference

Noumea - New Caledonia

November 3 - 8 th, 1997

ABSTRACTS

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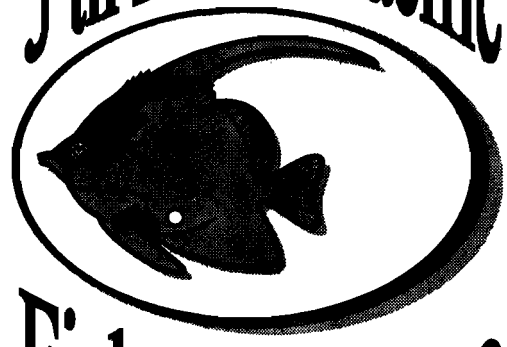

Nouméa - New Caledonia

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ABSTRACTS

LATE ARRIVAL

ZOOLOGICAL CATALOG OF AUSTRALIAN FISHES

HOESE D.F., PAXTON J. & G. ALLEN

Australian Museum, Sydney, Australia

Currently over 4000 species of fishes are known from Australia. An analysis of distribution patterns of 3800 species is presented. Over 20% of the species are endemic to Australia, with endemic species occuiring primarily in southern Australia. There is also a small component of the fauna which is found only in the southwestern Pacific (New Caledonia, Lord Howe Island, Norfolk Island and New Zealand). The majority of the other species are widely distributed in the western Pacific Ocean.

AGE AND GROWTH OF TROPICAL TUNAS FROM THE WESTERN CENTRAL PACIFIC OCEAN, AS INDICATED BY DAILY GROWTH INCREMENTS AND TAGGING DATA.

LEROY B.

South Pacific Commission, Nouméa, New Caledonia

The Oceanic Fisheries Programme of the South Pacific Commission is currently pursuing a research project on age and growth of two tropical tuna species, yellowfin tuna (*Thunnus albacares*) and bigeye tuna (*Thunnus obesus*). The daily periodicity of microincrements formed with the sagittal otoliths of these two spceies has been validated by oxytetracycline marking in previous studies. These validation studies have come from fishes within three regions of the Pacific (eastern, central and western tropical Pacific). Otolith microincrements are counted along transverse section with a light microscope. Observations with a scanning electron microscope allow checking of the interpretation of readings made with light microscope. Several growth models are tested according to the results of these daily increment counts. A large tagging database provides independent validation of the growth models. From 1989 to 1992, 33523 yellowfin and 6796 bigeye were tagged, from which 3482 (10.4%) yellowfin and 602 (8.9%) bigeye were recaptured (as of October 1997). Growth models deduced from otolith readings are consistent with growth rates observed during the periods of liberty at sea (several days to 5 years) of tagged tuna. Furthermore, the tagging data allow section of the model which describes the growth over a size range larger than the one provided with the otolith data.

REPRODUCTIVE BEHAVIOUR OF JAPANESE TUBESNOUT, *AULICHTHYS JAPONICUS.*

AKAGAWA I., IWAMOTO T. & M. OKIYAMA

Miyazaki University, Miyazaki, Japan

Aulichthys japonicus is known as the only one species that copulates and hides the eggs in the sea squirts in Gasterosteiformes. Courtship and spawning behaviour of *A. japonicus* was observed under natural environment in Otsuchi Bay, Japan and in the aquarium, respectively. The males showed remarkable nuptial colouration (metallic green or blue) on their snout during the spawning season and established the territory on the wall of the harbour. They courted the gravid female approaching to them and tried to lead her to their territories by tail flagging. The females were significantly larger than the males. In the aquarium, the gravid females repeatedly looked into the sea squirts, *Halocynthia roretzi*. The males were swimming around them or watching them still. The female spawned the egg mass above the sea squirt and put them through the exhalent opening by her mouth. The eggs were attached to the atrium. Only for a few minutes after the spawning, all the males tried to copulate the female lying on their back beneath the female. Spawning behaviour and sexual dimorphism in size and colouration is discussed in comparison with other related species; *Aulorhynchus flavidus*, which is the other Aulorhynchid species, *Hypoptychus dybowskii*, having been considered as the most primitive in Gasterosteiformes, and Gasterosteid fishes.

A NEW SEABREAM (SPARIDAE, DENTICINAE) FROM OFF NEW CALEDONIA.

AKAZAKI M. & B. SÉRET

Akazaki Ichthyological Institute, Miyazaki, Japan

The new species of yellow seabream caught from off New Caledonia differs its congeners from Japan, Okinawa, Europe and Africa, by its head length, eye diameter and suborbital width. The New Caledonian specimens have the typical dorsal fin count of the genus Dentex: XIII - 9. This new species of Dentex described from New Caledonia may have a larger distribution: indeed, the seabream figured on plate 97 in " Illustrations of edible aquatic fauna of the south seas " (Kumada, 1941) as Taius tumifrons may be identical. If so, the " New Caledonian " species should also occurs in Australian waters and possibly in those of Japan as reported by Kumada.

PRELIMINARY EXAMINATION OF GENETIC DIFFERENTIATION OF THE " KINUBARI " GOBY, *PTEROGOBIUS ELAPOIDES.*

AKIHITO, IKEDA Y. & Y. SUZAWA

Imperial Palace, Tokyo, Japan

P. elapoides is distributed from Hokkaido to Kyuushu in Japan and is also found in waters around the Korean Peninsula. There are two patterns of body coloration: one has 6 bands on the side of the body (Pacific Ocean), the other has 7 bands (Sea of Japan). This geographic variation has never been studied in detail. Therefore, our objective was to clarify possible genetic differentiation using electrophoresis. We compared two populations, one from Kanagawa Prefecture, Japan (Pacific Ocean), and the other from Ishikawa Prefecture, Japan (Sea of Japan). Genetic variations were determined for 23 allozymic loci relating to 12 enzymes and 1 non-enzymatic protein. Our results demonstrate that these two populations do show genetic variation (Nei's genetic distance, D=0.022).

MOLECULAR PHYLOGENY BETWEEN LOACH GOBY (RHYACICHTHYIDAE), FIVE SLEEPERS AND TWO GOBIES (GOBIIDAE) AND ONE WORM FISH (GUNNELICHTHYDAE).

AKIHITO, KOBAYASHI T., IWATA A. & T. GOJOBORI

Imperial Palace, Tokyo, Japan

Based on character states of their cephalic sensory canals and certain bones, *Bostrychus sinensis* and *Oxyeleotris marmorata* (Gobioidei: Eleotrididae) were considered to represent an ancestral gobioid morphotype (Akihito, Prince 1986). Using other morphological characters, Gill and Hoese (1993) hypotheesized that *Odontobutis, Micropercops*, and *Perccottus* represented the most primitive group of gobioid fishes (except for the Rhyacichthyidae); they erected the family Odontobutidae for these three genera. The purpose of our study is to hypothesize gobioid phylogeny using molecular data. About 800 bp of cytochrome b sequences from the following gobioid species will be analyzed using the percoid *Lateolabrax japonicus* as outgroup: *Rhyacichthys aspro, Bostrychus sinensis, Eleotris fusca, Gunnellichthys monostigma, Micropercops swinhonis, Odontobutis obscura, Oxyeleotris marmorata, Tridentiger bifasciata* and *Tridentiger obscurus*. The results will be compared with those of Akihito, Prince (1986) and Gill and Hoese (1993).

EFFECTS OF THE 1991 GULF WAR OIL SPILL ON REEF FISH ASSEMBLAGES.

ALMARRI M. & F. KRUPP

National Commission for Wildlife Conservation and Development (NCWCD), Jubail, Saudi Arabia

Following the 1991 Gulf War oil spill, benthic and demersal fish assemblages were studied in nearshore areas between Ras az-Zor and Abu Ali and at five offshore locations north of Jubail, Saudi Arabia. This area has the highest fish species diversity anywhere in the Arabian Gulf. It was severely affected by the Gulf War oil spill, but coral reefs and reef associated biota escaped direct oil contamination. Upon first inspection in 1991, reef fish assemblages seemed to be in a reasonably healthy condition. However, a conclusive assessment of their status was hampered by a lack of comparative pre-war data. Additionally, in these high latitude reefs where many tropical fish species live close to their physical limits, there are considerable natural fluctuations of population densities. Between 1992 and 1997 reef fishes were counted annually along 50 m transect lines. All specimens of 20 mm total length and longer occurring one metre to each side and two metres above the transect were recorded. Counts taken in 1992 and 1993 gave similar results with an average of 34.0 species and 254.1 individuals per 100 m^2 transect (1993 data). In summer 1994, the average number of species increased by 11 % and the number of specimens per transect almost doubled, indicating that fish assemblages had recovered from the effects of the oil spill. Similarly high or higher counts were obtained in subsequent years. A possible explanation is that the oil had no direct effect on fishes inhabiting these reef areas. However, as shown in other studies, planktonic eggs and larvae were affected by the oil slick on the water surface, resulting in lower levels of recruitment onto the reef in 1991 and 1992 and thus lower fish counts in the two subsequent years.

A REVISION OF *ARNOGLOSSUS* FROM THE WATERS AROUND NEW CALEDONIA.

AMAOKA K., MIHARA E. & J. RIVATON

Laboratory of Marine Zoology, Faculty of Fisheries, Hokkaido University, Hakodate, Japan

Species of the bothid genus *Arnoglossus* collected from the waters around New Caledonia are reviewed. Seven species were identified including two new species: *A. macrolophus, A. japonicus, A. elongatus, A. tenuis, A. polyspilus*, *A* sp. 1 and *A*. sp. 2. *A*. sp. 1 is described from ten specimens collected from depth of 230-315m off southern New Caledonia. This species is unique in having the pelvic fins with seven rays. *A*. sp. 2 is described from two specimens collected from depths of 300-315m of the Chesterfield Plateau and the northwest region of New Caledonia. This species is characterized by having the third and fourth rays of dorsal fin elongated in the male and in having head region darkened. *A. tenuis*, formerly known from South China Sea and southern Japan and *A. elongatus*, previously from Madura Sea and northwest coast of Australia are new records for this geographic region.

CLINICAL RECOGNITION OF CIGUATERA FISH POISONING IN NEW CALEDONIA.

ANGIBAUD G.

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This study is based on a retrospective analysis of cases admitted to the Gaston Bourret Hospital (Noumea, New Caledonia) for serious manifestations of ciguatera poisoning between 1991 and 1995. A total of 56 patients were analysed, 37 men and 19 women. The average age was 36 years with a range from 2 to 62 y. The signs most frequently encountered were paresthesia (84%), diarrhea (82%), bradycardia (66%), nausea and vomiting (57%), itching sensations when touching water (55%). Ten patients suffered serious neurological signs of ciguatera poisoning. These signs were polyneuritis (5 cases), ataxia (5 cases), confusion (3 cases) and visual blurring (1 case). Delay between the consumption of fish and the onset of clinical symptoms seems to be longer in serious neurological cases of ciguatera. Diagnosis of fish poisoning, including ciguatera, is made on clinical grounds (i.e; history of fish eating and suggestive clinical signs). However, this diagnosis may be at times rather difficult as illustrated by the analysis of a recent case.

SEASONAL AND LOCAL DIFFERENCES OF EGG SIZE AND NUMBER IN THE ANEMONE FISH, *AMPHIPRION CLARKII.*

ARATAKE H. & A. NAKAZONO

Department of Fisheries, Faculty of Agriculture, Kyushu University, Fukuoka, Japan

The size and total number of eggs produced by a single female during one spawning season can vary according to local environmental factors. In species with distribution patterns that are subject to latitudinal variation in water temperature, the total amount of reproductive material (RM) produced by a female in one season should be less in colder water. There is scarce information, however, on the relationship between the total amount of RM and patterns of its allocation by a single batch spawning female. The monogamous anemone fish provides a good example for understanding the seasonal pattern of RM allocation. This paper compares the pattern of RM allocation of female anemone fish at two different sites in southern Japan, Bohnotsu (B) and Ushibuka (U). At both sites, the anemone fish spawned during summer but the season was longer at Site B. This site is about 100 km south of Site U and water temperatures are higher seasonally. The number of eggs in each batch was fewer at both sites at the beginning of the season but increased suddenly with a rise in water temperature. At Site U, fish spawned a fewer number of times compared to fish at Site B (U=5.5è}1.03SD; B=8.8è}1.32). Egg-size (mm3) of a batch was inversely correlated with average water temperature after previous spawning events at both sites, with lower values at Site U (pèê0.05). At warmer Site B, RM output for a unit of body weight (L3) was larger than that at Site U (pèê0.05). When calculated for RM produced per body weight per day however, there was no significant difference between the two sites. This result suggests that female anemone fish living at lower water temperature increase egg number but decreasing egg size. This result also suggests that the number of eggs produced within a unit of time and the number produced by a unit of body size are both larger in colder water.

GENETIC STRUCTURE AND BIOGEOGRAPHY OF SOUTH-EAST ASIAN SCAD MACKEREL *DECAPTERUS MACROSOMA.*

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Restriction fragment analysis of the mitochondrial DNA control region in *Decapterus macrosoma* samples from the Indonesian archipelago revealed a high degree of polymorphism. Three groups of haplotypes were found, distributed in a contrasted geographical pattern: the westernmost samples (Java sea, southern South-China sea, Sunda strait, Makassar strait) harboured one group of related haplotypes, whereas the easternmost samples (Molucca sea and Banda sea) shared haplotypes unique to this region and genetically highly distant from the above western haplotypes. A sample from a geographically intermediate location (Sulawesi sea) showed both a third group of haplotypes unique to this sample, and a proportion of haplotypes of the western group. The haplotype diversity of the South China sea, Java sea and Makassar strait samples was very low compared to the level of polymorphism found elsewhere. Altogether, these results suggest a high degree of population genetic structure on a relatively small geographical scale and allow to propose some hypotheses on the recent biogeography of the Indonesian seas.

BIOLOGICAL DATABASES DESIGNING AND BIOLOGICAL CONCEPTS DEFINITIONS: A NEED FOR CONVERGENCE.

BAILLY N.

Muséum national d'histoire naturelle, Laboratoire d'Ichtyologie, Paris, France

The use of computerised databases in Biology has increased during the last 20 years, but beyond the interest of many biologists, the daily use for biological researches is not as current as we might expect. Many tools were presented in the Disseminating Biology Information workshop in 1996, but too few conferences took up the conceptual designing. It is stated and discussed here that the lack of explicite strong equivalence between the biological concepts definitions used by the systematists and the data structure designed to store information on living organisms, explains in part why the database use spreads with so much difficulty in the systematists community. Computer Sciences and Systematics have to make a step one towards the other to fill such a need. The former has to provide information systems that can manage biological information peculiarities. For the latter, the systematists must give unambiguous definitions of their concepts assuming that the natural language is not operative for such a purpose. Only mathematical definitions may be precise. Examples are given for the phylogenetic reconstructions and the concepts of semaphoront, individual, holomorph, population, species. In fact most of the times, the existing databases store information at the species level, when the systematists need more basic information, especially at the level of semaphoronts which are the objects of the world we do describe. For future database projects, we must distinguish two kinds of database. The "input"databases provide basic information to specialists, information that may result from observations or data analysis. They must be designed mainly on the biological concepts. The "output" databases summarise the previous ones for a targetted public, widespread from other scientists, to politics and to general public. They can be designed mainly on their utilisation.

RELATIONS BETWEEN MAN AND FISH IN SOUTH-PACIFIC CULTURES: TRADITION AND FUTURE.

BATAILLE, M.C.

Musée de l'Homme, Paris, France

Within the framework of the study of the relationships between man and animals, the fish have been forgotten; one of the reason being that they move in an environment that is not ours and is considered as "wild", "not domesticated", or more exactly which escapes from man's control. Now, in the whole world and at all times, from antic Greece to the Pacific, from Africa to Charlotte island in the north-west coast of America, we have examples of privileged relationships between men and specific ichthyological species, provided that we are of course set in a non industrial context. Many examples are provided by myths, oral and written tradition, daily life, materialistic representations and those of the social and religious imagination, and this in soft water as well as in salted water. For the societies of the Indo-Pacific area, and more precisely the societies of Oceania, land and sea form a continuity, a reticular woven in which men, islands, fishs and gods intercross, have something to do which each other. The shore does not constitute a rupture but rather a link within which, people of the land and people of the sea make exchanges, complete each other and realize themselves. In this societies, fish is often perceived as a social partner, which make adopt specific behaviours concerning the appropriation of the sea resources, including rituals totally associated with techniques. This privileged relationship with ichthyological species associated with a strict sea tenure, which means controlling the access to the fishing areas - a part often filled by the local traditional hierarchy - create a balance between man and its surroundings, lead to the respect of ichthyological species, environment and nature on the whole. Putting together crossing looks, different perceptions and feelings in the perspective of departionning subject matters deserves a meeting between hard sciences and human sciences.

EUROPEAN EXPLORATION OF THE INDO-PACIFIC OCEAN.

BAUCHOT M.L.

Muséum national d'Histoire naturelle, Paris, France

After a brief historical review of the great maritime voyages of explorers as Vasco da Gama who reached the East Indies at the end of the XV th century and the first circumnavigation around the globe via the southern ocean by Fernando de Magalhaes (1519-1522), the author mentions the numerous Iberian, Dutch and English sea voyages and explorations to discover the mythic "Terra Australia incognita". A new era then begins in the middle of the XVIII th century - that of scientific expeditions led by the English, the French and the Russian. The accent is put on the scientists and naturalists who took part to those travels and brought back a prodigious amount of collection specimens, drawings, observations, maps and notes of a remarkable precision and richness. They were the object of many scientific publications and atlas that reveal not only the discovery of lands and islands yet unknown but also the human populations encountered, and the flora and fauna of the Indo-Pacific area, especially the ichthyological fauna of these oceans.

ONIC BASIS OF THE NEUROCELLULAR ACTIONS OF CIGUATOXINS IMPLICATED IN FISH POISONING.

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Laboratoire de Neurobiologie Cellulaire et Moléculaire, CNRS, Gif sur Yvette, France

Ciguatoxins are a family of complex lipid-soluble, highly oxygenated cyclic polyether compounds which bind with high affinity to a specific receptor site on the neuronal voltage-dependent Na^+ channel. These toxins are responsible for a common form of human seafood poisoning, known as ciguatera fish poisoning, characterized mainly by severe gastrointestinal and neurological disturbances which develop after consumption of certain contaminated species of tropical and subtropical coral reef fishes. The major source of these toxic compounds is produced by the benthic dinoflagellate *Gambierdiscus toxicus*, believed to elaborate the toxins which are transmitted to fish through the marine food chain and ultimately to man. Electrophysiological studies reveal that ciguatoxins, with high-affinity, affect voltage-dependent Na^+ channels in various tissues, leading to an increase in Na^+ permeability. As a consequence, the toxins evoke membrane depolarization as well as spontaneous and/or repetitive activity in myelinated axons, motor nerve terminals and innervated muscle fibers. This action of ciguatoxins is attributed to the modification of Na^+ channels which permanently stay open at the resting membrane potential instead of being maintained in a closed state. Such altered Na^+ channel behaviour causes a continuous Na^+ entry, leading to an increase in internal Na^+ concentration that directly or indirectly disturbs the osmotic equilibrium between the internal and the external medium. Therefore, an influx of water occurs to restore both the osmotic equilibrium and the internal Na^+ concentration to initial levels. Indeed, ciguatoxins produce swelling of both nodes of Ranvier and motor nerve terminals. This swelling is prevented by tetrodotoxin, which blocks voltage-dependent Na^+ channels, and is reversed by an external solution made hyperosmotic with D-mannitol. In addition, as a consequence of their selective action on Na^+ channels, ciguatoxins affect Na^+-dependent mechanisms, such as Na^+/Ca^{++} exchange. It is concluded that the ionic basis of the neurocellular actions of ciguatoxins involve an alteration in Na^+ homeostasis. This alteration is correlated with an activation of voltage-dependent Na^+ channels. Finally, ciguatoxins also affect although with less affinity voltage-dependent K^+ channels of nerve membranes.

PRELIMINARY RESULTS OF ACOUSTIC TARGET STRENGTH MEASUREMENT OF BIGEYE (*THUNNUS OBESUS*) AND YELLOWFIN TUNA (*THUNNUS ALBACARES*).

BERTRAND A., JOSSE E. & J. MASSÉ

ORSTOM, Brest, France

For the first time, in situ acoustic target strength of 4 yellowfin tuna (*Thunnus albacares*) and 2 bigeye tuna (*Thunnus obesus*) of 4 to 50 kg have been estimated. These fish were individually caught, identified and measured, then equipped with ultrasonic tags for telemetry experiments. During the tracking operation, simultaneous underwater acoustic data were recorded with a split beam echo-sounder. When the fish is under the transducer of the research vessel, a corresponding acoustic signal is reflected to the echo-sounder. Then, acoustic echoes can be compared with depths of the tagged fish to identify target strength of the fish, taking into account vertical movements of fish and possible effects on target strength measurements. Applications of those results in tuna studies are numerous. Acoustic is an excellent method to observe individuals or schools in their environment for tuna behavior studies. For abundance estimation of subsurface tuna stocks, acoustic has the advantage to be independent of catchability thus of CPUE. Knowledge of individual target strength of tuna is the previous condition of those kinds of studies.

BIODIVERSITY AND FISH FARMING.

BILLARD R.

Muséum National d'Histoire Naturelle, Paris France

In aquaculture man has taken advantage of the large number of fish species and their biological diversity. Over about 25.000 species more than 100 are cultivated, and, for few of them, the production is high, about 7 and 0.7 millions tonnes/year for cyprinids and salmonids respectively. There are now many attempts to rear new species either to compensate for overexploitation of stocks (cod, tuna...) or for conservation purpose (endangered species such as sturgeons, ornamental fish). Finally the large number of cultivated fish reflects the diversity of fish caught by fisheries and offered to the market; the consumer is then expecting some diversity of species and products from aquaculture. Man is also taking advantage of the fish biological diversity in the case of polyculture as practiced in China. In intensively manured ponds, in inland waters, several fish species, especially cyprinids, exhibiting complementary feeding habits, are stocked and consume food at the different levels of the trophic web. The most commonly used species are the silver carp *Hypophthalmichthys molitrix* feeding on microalgae and microzooplancton, the grass carp *Ctenopharyngodon idela* on macrophytes, the bighead *Aristichthys nobilis* and the common carp *Cyprinus carpio* on zoobenthos and macrozooplancton. Other species are also introduced, taking advantage of other niches such as the black carp *Mylopharyngodon piceus* which eats molluscs. Similar systems are operating in India with the indian major carps. These system are deeply integrated with agriculture and represent an efficient way of recycling wastes (integrated fish farming). The productivity is high, in average more than 3t of fish/ha/year in China, which is much higher than in any other system of animal production consuming only primary production (grass). Presently polyculture yields 5 millions t/fish/year *i.e.* 50 % of the total production of fish culture in the world.

FISHBASE: A CALL FOR COLLABORATION.

BINOHLAN C. & R. FROESE

International Center for Living Aquatic Resources Management (ICLARM), Makati City, Philippines

FishBase is a database on fish biology, now covering about 17,500 species, with the ultimate goal of including all 25,000 species by the year 2000. The breadth and depth of the present coverage of FishBase have been enormously enhanced through collaborative work with institutions and indivduals who were willing to share their expertise and disseminate their data through the FishBase interface. However, augmenting, bringing up-to-date, and ensuring the accuracy of taxomomic information remains a constant challenge. We therefore invite taxonomists to become FishBase coordinators of their respective groups, similar to authoring a chapter in a major checklist such as CLOFFA or CLOFETA. Similarly, we are looking for country experts to coordinate national checklists and complete nationally available information on, e.g., distribution, abundance, regulations, human uses, and local names. Every contribution will be properly referenced. Collaborators will receive free copies of FishBase and a number of other benefits. Please contact us (r.froese@cgnet.com) if you are interested in this collaboration.

LAKE BOMBON, LUZON, PHILIPPINES, HAS A VERY UNUSUAL HISTORY AND A PARTLY ENDEMIC FRESHWATER FISH FAUNA, ALTHOUGH LESS THAN 250 YEARS AGO IT WAS A SALTWATER LAKE.

BLEHER H.

Via Miradolo 33, 20074 Graffignana, Italy

Lake Bombon can be found on today's map of the Philippines, but only under the name Taal. Its topography is unique: at its centre lies an island on which is another lake encircling a volcano, the whole being situated on Luzon, itself an island in the sea. Moreover the Taal volcano has erupted no less than 42 rimes durring the last 400 years, repeatedly changing the shape, size and the depth of the lake. Consequently the fish fauna (and a marine sea snake) have had to adapt to the constant changes in the aquatic environment and the water parameters. According to old records, less than 250 years ago the lake water was salt. But, at least since the gigantic eruption of the Taal volcano in 1911 (the following eruptions have not caused such dramatic environment changes), both completely freshwater and primarily marine fish species have been living together in the lake for generations. The majority of species are of marine origin (eg the sea snake), a few primary freshwater. I will demonstrate the biodiversity and biogeography of these species today, as well as their adaptations to this "new" freshwater environment. Some species have adopted to "never before seen protection" against the volcanoes constant eruptions and the molten lava flowing into the lake.

GLOSSOLEPIS WANAMENSIS (MELANOTAENIIDAE: ATHERINIFORMES) A SPECIES THREATENED BY EXTINCTION IN LAKE WANAM, PAPUA NEW GUINEA, AS A CONSEQUENCE OF EXOTIC SPECIES INTRODUCTION.

BLEHER H.

Via Miradolo 33, 20074 Graffignana, Italy

During my three visits to Lake Wanam in 1992, 1994 and 1995, I became aware of the incredibly fast disappearance of a beautiful rainbowfish species: *Glossolepis wanamensis* Allen & Kailola 1979. This eye-catching beauty , a fish of small size (9-10 cm TL), with a shiny green overall colour, orange on the lower side and frequently a jet black broad anal fin, was only recently discovered (1978) and described (1979). Some time during the eighties a tilapia (*Oreochromis mossambicus:* Cichlidae) was introduced. Tilapias were originally introduced by the Dutch in the forties and fifties and are now found throughout New Guinea. Almost all introductions into the wild have prove unsuccessful. But in Lake Wanam the tilapiine population has exploded, almost completely eliminating the native fish fauna, including the endemic rainbowfish. The tilapiine species have created turbid conditions in the once crystal-clear water and have overcrowded the lake by there prolific breeding. Today they occupy virtually every available space/niche in the lake. On each research trip to the lake I found fewer rainbowfishes (and more tilapia), and during the 1995 survey I was able to find only a few large old specimens (age 2-3 years) in the entire lake. Not a single juvenile or eggs. It is clear that the now almost exclusively tilapiine fauna in Lake Wanam has had to find new sources of food, and have found the native fish fauna, including eggs and fry, to their taste. We should not let this species be exterminated. We know little about it, its behaviour and biology . There is just one, small, sign of hope for this unique species: its aquarium population is increasing, all around the world.

EXOTIC SPECIES INTRODUCTION IN SULAWESI, INDONESIA AND DESTRUCTION OF NATURAL HABITATS BY EXPLOITATION COMPANIES: ITS CONSEQUENCE ON THE NATIVE FAUNA.

BLEHER H.

Via Miradolo 33, 20074 Graffignana, Italy

Sulawesi, formerly Celebes, is a remarkable island, well known for its rare endemic fauna and flora. Many naturalists and scientists have reported on its uniqueness. The Wallace line, named after the great naturalist Alfred Wallace, was drawn here and is still recognised as the zoogeographical boundary for many animals and plants. The freshwater fish fauna is also unique and most species found on Sulawesi are endemic, with some species restricted to a tiny habitat, or found in only in a single lake. On several journeys, from 1985 through 1994, I was able to do research and collect in freshwater environments throughout the island. This gave me the opportunity to study the aquatic fauna quite extensively and the results are "breathtaking": several endemic species could not be found anymore, chiefly after the introduction of mainly tilapiine (Cichlidae), cyprinid (Cyprinidae) and siluriform (Claridae) fishes. In addition to these introduction, nickel mining must accept a major share in the responsibility for the disappearing fauna (at least in one lake). This report will reveal my findings on the destruction of the aquatic fauna of Lake Towuti, the continuing elimination of the endemic Lake Poso and Lake Lindu species due to introductions, the consequences of the introduction of exotic species in northern Sulawesi, as well as riverine introductions and their consequences

BATANTA ISLAND, IRIAN JAYA, INDONESIA, IS PREVIOUSLY COMPLETELY UNEXPLORED ISLAND, WHOSE FRESH AND BRACKISH WATER FISHES ARE ALSO UNKNOWN.

BLEHER H.

Via Miradolo 33, 20074 Graffignana, Italy

It was quite an adventure to "enter" the island of Batanta which lies in the north-western part off New Guinea. In spite of several centuries of exploration to most of the islands of the area (the Moluccas, Waigeo, New Guinea, etc.), this island seems to have never ever been visited by naturalists or scientists. Its fauna is of great interest as regards not only to the geographical distribution and the biodiversity of the animals, including fishes, but also the species found here. Batanta extends for more than 60 km, is about 30 km wide, and is covered with dense primary (rain) forest. Thick, impenetrable, mangrove jungle grows along the entire shoreline. A single larger river, approximately 40 km long, crosses the island and contains crystal clear freshwater. It is home to an incredible number of fish species, several new to science. But the most interesting fact is probably that the majority of the species lives in this fresh water river, above a cataract, are of marine origin and have adapted completely to the freshwater environment. Here one can find mugilids, gobiids, atherinids, and many more marine groups, living their entire live, for generations, in freshwater. During this presentation I will also show the extended distribution of several freshwater species which have never before been recorded from any area east of Sulawesi, and thereby add a new aspect to our knowledge of the geographical distribution of freshwater fishes.

MARINE PROTECTED AREAS AS A SHARK FISHERIES MANAGEMENT TOOL.

BONFIL R.

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Marine reserves can be classified into three broad categories according to their main objectives: ecological (conservation of biodiversity and habitats), economic (fisheries enhancement and protection) and social (tourism, education). In practice, many MPA's fulfill several or all of these objectives at the same time. The utilisation of no-take marine reserves as a fisheries management tool has been applied to a variety of resources, most commonly teleosts from tropical and temperate waters. However, there is very limited experience in the usage of MPA's for the protection or enhancement of shark stocks. This paper presents a review of worldwide information on the protection status of sharks. The results indicate the existence of only one no-take marine reserve used as a fisheries management tool for sharks. However, there are several *de facto* MPA's for sharks that have different objectives and which offer various degrees of protection. General criteria commonly utilised for the design of MPA's are reviewed while attempting to evaluate their application and feasibility for the implementation of MPA's for different kinds of sharks.

BIOLOGICAL CHARACTERISTICS OF THE SPOTTED HANDFISH *(BRACHIONICHTHYS HIRSUTUS)*, AUSTRALIA'S FIRST ENDANGERED MARINE FISH.

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The Brachionicthyidae (handfishes) are a little known Lophiiform family endemic to SE Australia. Some of the species have amongst the most restricted ranges of any known marine fish. This feature alone makes their populations highly vulnerable to perturbation. The spotted handfish (*Brachionichthys hirsutus*) is endemic to a small area of SE Tasmania and was common throughout the lower Derwent estuary and adjoining bays prior to the mid 1980's. It has since suffered a dramatic decline in distribution and abundance. In 1996, *B. hirsutus* became the first marine fish to be listed as endangered under the Australian Endangered Species Act. We recently commenced a project to determine population status, establish basic life history details, investigate possible captive breeding and investigate the recovery potential of *B. hirsutus*. This paper reports on progress to date. *B. hirsutus* is a small, slow moving, benthic and remarkably cooperative species. Individual fish are easily approached and measured underwater to the nearest millimetre. Individuals are also identifiable by their unique pattern of spots, thus enabling individual growth trajectories and movement patterns to be mapped. Growth rates of *B. hirsutus* suggest that maturity is reached after two years. Longevity is unknown but is expected to exceed 5 years. Fecundity is low - it lays 80-100 large eggs that are generally attached to the base of a stalked ascidian. The female guards the eggs which take 6-8 weeks to hatch. Handfish lack a dispersive larval stage and hatch as essentially fully formed juveniles (5-6 mm in length) that settle immediately to the bottom and «walk» away from the egg mass. Consequently, once removed from broad areas of their previous range, the ability for handfish to repopulate such areas is expected to be low. The cause of the reduction in spotted handfish numbers has yet to be determined. Suggested reasons include predation or habitat disturbance by a recently introduced asteroid and/or habitat modification through rural, industrial and urban development.

MOLECULAR PHYLOGENY OF *NEMADACTYLUS* AND *ACANTHOLATRIS* (PERCIFORMES: CHEILODACTYLIDAE).

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The Cheilodactylidae is a predominantly Southern Hemisphere family of cool tropical to cold temperate coastal fishes, comprising five genera and 30+ species. Members of the genus *Nemadactylus* are almost entirely restricted to the waters of New Zealand and southern Australia, except for one representative from the east coast of South America. In contrast, the species of *Acantholatris* inhabit only isolated islands and seamounts, consisting of Juan Fernandez in the eastern Pacific, and those which form a loose chain from Tristan da Cunha and Gough Island in the South Atlantic, to Saint Paul and Amsterdam Islands in the Indian Ocean. Homologous DNA sequences have been obtained from all five species of *Nemadactylus*, two of the three species of *Acantholatris*, and several other cheilodactylids and cirrhitoids. Analysis of these sequences suggests that the two species of *Acantholatris* are very closely related to three of the *Nemadactylus* species, and that these genera are synonymous. The suggestion of synonymy is supported by a recently identified species, included in this genetic analysis, which falsifies the present morphological distinction of *Nemadactylus* and *Acantholatris*. It is proposed that these closely related species have radiated and dispersed widely throughout the Southern Hemisphere in recent times, most likely mediated by the 9-12 month pelagic larval period commonly observed for these and other cirrhitoid species. The possible directions of this dispersal are under current investigation using additional DNA sequence data, while several questions of specific status and population genetics are being addressed with microsatellites.

DIET, GASTRIC EVACUATION, AND DAILY RATION OF JUVENILE SCALLOPED HAMMERHEAD SHARKS, *SPHYRNA LEWINI.*

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Gastric evacuation, diet, and daily ration of juvenile scalloped hammerhead sharks, *Sphyrna lewini*, were studied in Kane'ohe Bay, O'ahu, Hawai'i. Stomach contents were collected from 251 sharks that were caught in gill nets, and gastric evacuation data was obtained from 63 sharks held in field enclosures. Stomach contents were recovered by gastric eversion in all cases. For the 194 (87.3%) sharks whose stomachs contained food, crustaceans made up 53.7% of the diet (IRI), teleosts accounted for 13.5% of the diet, and unidentifiable material 32.6%. An Alphied shrimp, *Alpheus mackayi*, was the most important prey item, accounting for 38.4% of the total diet. The average amount of food in the stomachs was .35g(+/- .3g) dry weight. Gastric evacuation of teleost prey proceeded in a curvilinear manner, and was 90% complete in 19.7 hours at 27.1oC, and in 28.6 hours at 24.0oC. Daily ration estimates based on stomach contents of wild sharks and digestion rates of captive individuals were ca. .3% bodyweight/day. This value is quite low compared to other sharks. This low consumption estimate, along with available growth data, suggest that food may be a limiting factor for juvenile scalloped hammerheads in Kane'ohe Bay.

RECOLONIZATION BY FISHES ON STORM-DAMAGED CORAL REEFS IN THE TUNKU ABDUL RAHMAN PARK, KOTA KINABALU, SABAH.

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In December 1996, Storm Greg passed from eastern to western coasts of Sabah Malaysia. Storm Greg has caused damaged on the fringing coral reefs of Tunku Abdul Rahman Park (TARP), off the coast of Kota Kinabalu. The impact of the storm has been pronounced in some parts of the 5 islands in the TARP area. Massive corals were overturned and branching corals were broken. It was also observed that filamentous algae grew immediately on the damaged reefs. The recolonization of the fishes in these storm-damaged reefs is currently being studied by visual census. The results of this study will be analyzed and presented in line with succession in a coral reef fish community.

SPATIAL DISTRIBUTION OF CHAETODONTIDAE IN CORAL REEFS OF THE RYUKYU ARCHIPELAGO, SOUTHERN JAPAN.

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This paper examines and compares the spatial patterns of butterflyfish communities (Chaetodontidae) among five islands of the Ryukyus Archipelago, Southern Japan. A total of 30 species were identified, and species richness per island ranged from 20 to 25 species. On each of the 45 stations prospected, between 4 and 17 species were observed, and between 0.75 and 21.75 individuals/250 m2 were counted. Variation in species composition, diversity and abundance among islands was less pronounced than the variation within island, where communities of the reef flat, the reef edge and the reef slope were distinguished. The highest diversity and abundance were found on the reef slope and the reef edge. Canonical correspondence analysis revealed that depth, coral cover, and substrate complexity were influencing the distribution of Chaetodontidae. Despite being the northernmost ones in the world and despite the severe natural and human perturbations that affected them from the 70's, the coral reefs of the Ryukyu Islands have one of the most diversified communities of Chaetodontidae in the world.

PRELIMINARY DEMOGRAPHIC ANALYSIS OF THE SHORTFIN MAKO SHARK, *ISURUS OXYRINCHUS.*

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We have evaluated existing and added new life history information on the shortfin mako shark, *Isurus oxyrinchus*, including size frequencies, marginal increment analysis, tag-recapture growth rates, reproduction (Mollet, personal communication) and catch curves for use in a demographic analysis. We assume that the mako shark lives ~ 20 years, has an instantaneous natural mortality coefficient (M) between 0.175 and 0.265, matures at 4-6 years old, and has a two year reproductive cycle, a gestation period of ~ 12 months, and a fecundity which increases with female size. From female catch curves (n = 2210) off southeastern Australia and using two different mass-length methods, total instantaneous mortality coefficients (Z=F+M) were estimated to be 0.30 (s.e. 0.02) and 0.34 (s.e. 0.02). Our preliminary demographic analysis provided estimates of net reproductive rate (R{-0}) between 1.08-1.61, mean generation times (G) of 9.7-9.9 years, and instantaneous rates of population increase (r) of 0.048-0.0084. These suggest that the mako shark could be vulnerable to both directed fishing and by-catch from other fisheries despite its relative fast growth.

STATUS OF THE FRESHWATER FISHES OF THE PHILIPPINES.

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There are 229 fish species recorded to occur in the fresh waters of the Philippines. Ninety-seven of these are primary freshwater species, 102 are secondary, and 30 are introduced species. Thirty-two species are contained in the 1996 IUCN Red List with status ranging from critically endangered to data deficient, included are 20 endemics, most of which are cyprinids found only in Lake Lanao, Mindanao. Based on preliminary data, there are 29 species which are not reported from other countries and are in need of additional assessment, especially those which are used in the fishery and aquarium trade. At present, only *Sardinella tawilis* and *Mistichthys luzonensis* are protected under national laws. Factors affecting decline of populations and the need for conservation and management measures are discussed.

THE FUTURE OF ICHTHYOLOGICAL RESEARCH IN THE INDO-PACIFIC.

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Many areas of systematic ichthyological research remain wide open for investigation in the Indo-Pacific. Undescribed species and other valuable specimens are expected from relatively unexplored marine and freshwater habitats and regions. For example, from the marine realm deep reef, outer shelf, and deep sea habitats have been sparsely collected with mostly inadequate gear. A large area of the central Indian Ocean remains virtually unsampled except for a few epipelagic collections. Many lakes and rivers in the region have never been visited by an ichthyologist. Certain areas such as Sumatra, where rich freshwater fish faunas are expected, require extensive additional collections. The freshwater fish fauna of Myanmar needs serious critical review. In addition to habitats and regions, certain groups of fishes from the region remain highly problematic taxonomically. For example, most marine anguilliform and many cypriniform groups require extensive revisionary work. The complex and often unresolved geological history of the region, particularly around Southeast Asia, continues to confound both marine and freshwater biogeographic hypotheses. Only a handful of phylogenetic hypotheses down to species level are available among the numerous fish families, leaving biogeographic models largely untested and supraspecific classification less defensible. New collecting and analytical methods, infusions of scientific support, and plenty of dedicated research time are required to make significant research achievements. Many of these research gains are urgent, in view of the increasing rates of degradation of both marine and freshwater habitats of the Indo- Pacific.

A SYNOPSIS OF THE GENUS *BENTHOBATIS* ALCOCK, WITH A REDESCRIPTION OF *BENTHOBATIS MORESBYI* ALCOCK, 1898 (CHONDRICHTHYES, TORPEDINIFORMES).

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Benthobatis Alcock, 1898 is a poorly known deep-sea genus of eletric ray. Presently, there are three nominal species, of which two are valid. *Benthobatis moresbyi* Alcock, 1898, the type-species, is rare and known with certainty from only two specimens (excluding collections in India), both captured in the Arabian Sea (the holotype, off the Travancore coast of western India, and another specimen known from the western Arabian Sea). *Benthobatis marcida* Bean and Weed, 1909, of which *Benthobatis cervina* Bean and Weed, 1909 is a junior synonym, is known from abundant material from the western North Atlantic, eastern Gulf of Mexico and adjacencies. Along with a redescription of *Benthobatis moresbyi* based on the holotype, an overview of the genus is presented on the basis of new material (from southern Brazil, Taiwan and the Indian Ocean), some of which represents undescribed species. *Benthobatis* is further compared with other electric ray genera, and an emended generic diagnosis is presented.

DOCUMENTING POTENTIAL ECOLOGICAL IMPACTS OF FRESHWATER FISH INTRODUCTIONS .

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There are 250 recorded introductions in the central Pacific area, more than half of which have established feral populations. The major reasons for introducing exotic species in the region include: aquaculture (18%), ornamental (11%) and biological control of mosquitos (10%). A major bulk (35%) of the records did not specify the reasons for these transfers (category «unknown»). There are 127 freshwater species introduced, the most commonly used of which are: *Oreochromis mossambicus* (18%), *Gambusia affinis affinis* (12%) and *Poecilia reticulata* (9%). Available data indicate that there are more introduced than native freshwater species in some Pacific islands. Implications of the changes in the freshwater ecosystems as caused by these introductions are discussed.

ILYOPHINE EELS (SYNAPHOBRANCHIDAE) AND OVIGEROUS LEPTOCEPHALI OF THREE SPECIES IN THE INDO-WEST PACIFIC.

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Eels of the subfamily Ilyophinae are the least known of the synaphobranchs. Most species are distinct from the Synaphobranchinae in having just a few, but prominent vomerine teeth, anus far forward and body naked. In the Indo-west Pacific they are currently known from four genera and 13 species, through very scattered records from Tahiti to South Africa. Several species are known from just a few or even single specimens. The adults live on the bottom variously down to 2000 m; their distinctive leptocephali live in about 200 m, i.e., near the deeper limit of the so-called «lepto layer». Ilyophine and synaphobranchine leptocephali uniquely share a «tubular» (or «telescopic») eye, though they are otherwise quite different. Ilyophines variously have distinctive patterns of lateral and gut pigment and a depressed snout that may carry a prominent appendage. In contrast, synaphobranchines have only caudal pigment, a normal snout and a distinct band of darker vertebral tissue. Our study assemblage of about 200 larvae, mostly from Dana collections in the Banda, Celebes, Sulu and South China Seas and ORSTOM collections in the central Pacific, contain what we preliminarily recognise as about nine genera and 25 species, i.e., many more than are known as adults. Thirty four of these leptocephali, of three species, possess ovaries with minute ova (each ca. 0.045 mm), but male larvae have not been identified. Sex, if only for females, is therefore identifiable early in these species. The occurrence of ovigerous leptocephali could be viewed as a unique example of paedogenesis amongst fish larvae, though the minute size of the ova suggests that full maturity is unlikely to be reached at the larval stage.

EPICRANIAL MORPHOLOGY OF THE DORSAL FIN IN THE SOLES (PLEURONECTIFORMES: SOLEIDAE): PHYLOGENETIC, TAXONOMIC AND BIOGEOGRAPHIC IMPLICATIONS.

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The soles (Pleuronectiformes: Soleidae) are in great need of taxonomic revision and phylogenetic reassessment. A striking feature within this clade is the structural variability of the epicranial portion of the dorsal fin. Examination of radiographs of 1200+ specimens belonging to 100+ nominal species has allowed the definition of large monophyletic groups within the family based on the following epicranial features: (i) shape and position of the first proximal pterygiophore of the dorsal fin (or erisma), (ii) relationships between the erisma, dorsal surface of the cranium and neural spine of the second abdominal vertebrae, (iii) shape, length and curvature of this neural spine and (iv) number of proximal pterygiophores of the dorsal fin associated with these structures. Also, the study of the epicranial complex was instrumental in clarifying the taxonomic status of nominal species within the genus *Bathysolea*. Finally, we observed a correlation between epicranial morphological patterns and the biogeographic distribution of the various groups of soles. For example, most soleids inhabiting the Eastern Atlantic Ocean have the following combination of traits: a short, straight or slightly curved neural spine with several dorsal-fin pterygiophores articulating on the dorsal surface of the cranium and on the dorsal edge of the erisma.

THE ABORE MARINE RESERVE (NEW CALEDONIA) - I: GENERAL PRESENTATION OF THE STUDY.

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In order to improve the management of the SW lagoon of New Caledonia, a local marine reserve complex was studied. Aboré reef is one of the three major barrier reefs in front of Nouméa. This reef was part of a marine reserve system which had 3 barrier reefs. Each reef used to be alternatively opened to fishing every three years. This study assessed the fish and benthos population levels in 1993 when this reef had been a reserve for three years, i.e. just one month before its change in status. The same reef was revisited two years later to assess the effects of fishing.

RESULT OF BLACK-BASS, *MICROPTERUS SALMOIDES*, TAGGING EXPERIMENT. LAKE OF YATÉ - NEW CALEDONIA.

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In order to improve our knowledge of the Black-bass (*Micropterus salmoides*) population of the Yaté lake (New Caledonia) 300 individuals were tagged and released in 1992. Between 1992 and 1997 more than 16 % were recaptured. This paper gives some data on the growth and population estimates of this introduced species.

DEMOGRAPHIC ANALYSIS OF THE SCALLOPED HAMMERHEAD, *SPHYRNA LEWINI,* IN THE WATERS OF TAIWAN.

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The scalloped hammerhead, *Sphyrna lewini*, is the most common and commercially important large shark in Taiwan. Population growth and exploitation was estimated by demographic analyses using known life history parameters. Life history tables were constructed by using best estimates of natural mortality (M) of 0.3 for maximum ages of 25. Natality was from N=-26.105+0.179L and age at maturity was at age 5. At M=0.3 for all ages, the population increase rate was 37.9%/yr, and the generation time was about 9 years without exploitation. Sensitivity analysis indicated that net reproductive rate was the most sensitive one of life history parameters and the mortality of juvenile stage was more sensitive than that of larval stage. Fishing mortality (F=0.1, 0.2, 0.3, 0.4, 0.5) was simulated to begin from age 3 to 8. The generation time decreased with the increase of fishing mortality for all cases, but annual population growth rate increased with the increase of fishing mortality for the cases begin at ages 7 and 8. At F=0.1 begin at age 5, the population increase rate was 37.9%/yr, and the generation time was about 8 years. The scalloped hammerhead population will decline under any substantial fishing mortality on immature ages and that mature fish can be exploited only at very low levels.

SYSTEMATICS AND MOLECULAR PHYLOGENY OF FRESHWATER GOBIID, *RHINOGOBIUS* SPECIES WITH HIGHER VERTEBRAL NUMBER FROM TAIWAN, SOUTHERN CHINA TO THAILAND.

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The common freshwater gobiid genus *Rhinogobius* Gill, 1859 is widely distributed from the Amur Basin of Russia to the Mei-nan Basin of Thailand. Landlocked, hill-stream species usually have evolved with the common character of higher vertebral (HV) number (27-29) than the anadromous species with lower number of vertebrae (LV) (26, rarely 25). An intensive survey from Taiwan and southern continental Asia has yielded 1 and 12 morphological species respectively belonging to HV species. The endemic Taiwanese species has evolved more reduced head canal system than the southern continental HV species. The *R. duospilus* species group has colonized into more basins than any others. The Pearl river of southern China is the most species-rich drainage in having 5 sympatric species. The mitochondrial D-loop region in most of the HV species has been amplified and sequenced by PCR. Its complete length is ranging from 836~842 bp. Molecular phylogenetic analysis by both distance and parsimony methods suggests that the *R. duospilus* and *R. chiengmaiensis* species group are closely sister group and then radiated into different allopatric units in isolated river basins. Their detailed phylogenetic relationship will also be discussed.

COMPARATIVE GROWTH STUDIES IN CORAL REEF FISHES: PHYLOGENETIC AND BIOGEOGRAPHICAL COMPARISONS.

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Systematic check marks observed in sectioned sagittal otoliths of a number of reef fish species have been validated as annuli. The resulting size-at-age data have provided a means for estimating age-specific growth and reproductive rates. This has proved especially valuable in analysing the demography of protogynous reef fishes. Analysis of Indo-Pacific representatives of two major groups of reef fishes, Acanthurids and Scarids have revealed different demographic patterns. Acanthurids display rapid initial growth, achieving asymptotic size early in life with an extended life span once sexual maturity is obtained. Size and age are largely de-coupled. Life spans in the order of 50 yr may be achieved. Scarids have shorter life spans and a gradual approach to an asymptotic size. Most life spans are substantially less than 20 yr. Once sexual maturity is achieved growth is highly flexible and sex-specific; growth in terminal phase males is significantly greater than in females and shows a marked increase following sexual transition. For Indo-Pacific populations age-based data are of critical importance in determining demographic properties of acanthurid and scarid populations and in evaluating responses to fishing. Analysis of sagittal otoliths in Caribbean acanthurid and scarid fishes has revealed readable systematic check-marks in sagittal otoliths. Under the assumption of annual periodicity these generate size-at-age curves which produce similar growth patterns to Indo-Pacific taxa. However an examination of species from the genera *Acanthurus*, *Scarus* and *Sparisoma* indicated that maximum and modal life spans were substantially lower in Caribbean species when compared to equivalent Indo-Pacific taxa. This contrasts with published mortality estimates which project 25 yr life-spans for some Caribbean scarids. The question of differences in life-histories between Caribbean and Indo-Pacific reef fishes must take into account different levels of fishing pressure and analytical approaches in each case. This paper will review the current status of these comparisons.

MOLECULAR SYSTEMATICS OF SURGEONFISH GENERA: DO MOLECULES AND MORPHOLOGY CLASH?

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Phylogenetic relationships among fishes from the family Acanthuridae (surgeonfishes) were examined using partial mitochondrial DNA sequences from the control region and the small (12S) and large (16S) subunit ribosomal DNA genes. A total of 21 species of acanthurids from each of the 6 extant genera were examined: 4 *Naso*, 3 *Prionurus*, 3 *Zebrasoma*, 3 *Ctenochaetus*, 7 *Acanthurus*, and the monotypic *Paracanthurus*. Four species from the 3 other extant acanthuroid families were examined for outgroup material: 2 species of *Siganus*, and the monotypic *Zanclus* and *Luvarus*. Parsimony and maximum likelihood trees were constructed for the sequence data. Although these trees were significantly congruent with Winterbottom's (1993) morphological tree there were some points of incongruence in the basal nodes. In the sequence trees these nodes had low bootstrap values and short branch lengths. A partition heterogeneity test was used to assess the validity of combining the molecular and morphological data sets. As this test found no significant heterogeneity between the two data sets an analysis was performed on the combined data sets. The implications of the resulting well-resolved phylogeny for the monophyly of *Acanthurus* and for combined data systematics will be discussed.

INTERIOR LANDSCAPES: USING COMPARATIVE HISTOLOGY TO INVESTIGATE THE EVOLUTION OF SEXUAL PATTERNS IN FISH.

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Among fishes with labile sexual patterns, sexual state and progression of sexual function frequently can be assessed by conspicuous changes in behavior and/or external morphology. This information can be used, in turn, to address behavioral ecological and evolutionary questions related to hermaphroditism. However, among those species which have cryptic lifestyles and/or minimal sexual dimorphism, documenting and tracking changes in sexual function is much more difficult. In such cases, detailed studies of gonad histostructure can provide crucial insights into the sexual dynamics of hermaphroditic species. In addition, histological studies can provide information on the sexual demography of populations and, through studies of gonad ontogeny, reveal variations in sexual trajectories within and among populations. Finally, gonad morphology and histostructure can be used, in concert with existing phylogenies, to examine the origins of hermaphroditism within and among fish taxa. Some examples of the application of histology to the study of hermaphroditism will be presented and serve as a focus for a more general discussion regarding the evolution of labile sexual patterns in fishes.

PATERNAL BEHAVIOR ASSOCIATED WITH LARVAL HATCHING IN THE BICOLOR DAMSELFISH, *STEGASTES PARTITUS*.

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Like many coral reef fishes, larval hatching of the bicolor damselfish, *Stegastes partitus*, occurs at night. We carried out a series of night dives in order to determine the time of hatching in situ for the larvae of this species and the role, if any, of the guarding male in the hatching process. Hatching occurs 15-30 min after sunset. Males with no eggs tended to move to their nocturnal retreat shortly after sunset while males with eggs stayed longer in the vicinity of the nest site. During this time, parental males exhibited both contacting and fanning behavior directed towards the spawning substrate and associated eggs. When the spawning substrate of males with no eggs, and those of ready-to-hatch embryos, were switched, the male adopted the behavior appropriate for the post-switching treatment, indicating that increases in male behavior are stimulated by the presence of eggs. When nest sites with ready-to hatch embryos were screened shortly before sunset to prevent male access, 65% of 11 trials resulted in successful hatching. Consequently, male behavior directed towards eggs is not always necessary for successful hatching.

MACKERELS, MOLECULES, AND MORPHOLOGY.

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Current classification of the Scombridae is based largely on morphology. Recent molecular studies examine some aspects of this classification. 1. Monophyly of the genus *Thunnus* and both subgenera (*Thunnus* and *Neothunnus*) is confirmed with the bigeye tuna intermediate. 2. North Atlantic and North Pacific sub- species of the bluefin tuna might better be considered full species. 3. The yellowfin tuna is a single worldwide panmictic species. 4. North Atlantic *S. scombrus* show sharp divergence from Pacific *S. australasicus* and the wide-spread anti-tropical chub mackerel *S. japonicus* raising the question of whether to once again recognize two genera or subgenera, Scomber for *S. scombrus* and *Pneumatophorus* for *S. australasicus* and *S. japonicus*. Morphological characters such as presence/absence of a swimbladder and otolith morphology should be re-evaluated. 5. This study also raised questions about the identity of mackerel in the Red Sea and northern Indian Ocean. Re- examination of mackerels from the Red Sea and northern Indian Ocean shows that this population is actually *S. australasicus*. 6. A nuclear DNA study confirms monophyly of the *Scomberomorus regalis* group of Spanish mackerels but produces a slightly different picture of species relationships.

ITIS, THE INTEGRATED TAXONOMIC INFORMATION SYSTEM.

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ITIS is a relational database of scientific and common names for plants and animals. The use of consistent names of species is fundamental to successful management of biological systems. ITIS provides a standardized vocabulary for this purpose, and integrates the scientific results of the world taxonomic community into a coherent list of biological names. ITIS has been designed to replace the flat file of scientific names maintained by the US. National Oceanographic Data Center (NODC). ITIS currently contains about 500,000 names of plants and animals and is accessible on the Internet at the URL: http://www.itis.usda.gov/itis. ITIS is up to date for North American vertebrates and crustaceans. ITIS staff are reviewing and editing names transferred from NODC and adding high priority names such as fish species covered in FAO world catalogues. Through the continued cooperation of its partners, ITIS will make a significant contribution to the scientific infrastructure that is fundamental to the conservation and management of the world's biodiversity.

THE EFFECT OF LOW WINTER TEMPERATURES ON CORAL-ASSOCIATED FISH IN HONG KONG.

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Hong Kong's coral communities are some of the most northernmost on the coast of mainland China and are at a geographical extreme for the region. Percentage coral cover may be high but rich coral areas are limited to a few sheltered, shallow bays. Although average sea temperatures rise to 30°C in the warmer summer months, they drop to 15°C in the winter, representing a major constraint to the distribution of corals and coral-associated fishes. Permanent belt transects were established at two depths at three sites and coral-associated fish were censused over three month summer and winter periods during 1997. Optimal transect size was determined by examining the precision of data collected for the most common species for three different transect sizes. Analysis of abundance data showed significant differences between sites, depths and seasons. Differences between seasons were primarily due to reduced numbers of many species in the winter. The largest seasonal differences were noted for siganids, a pomacentrid, *Neopomacentrus bankieri* and a labrid, *Halichoeres dussumieri*. *Halichoeres dussumieri* also showed great variation within season. It was still one of the most abundant species recorded at the beginning and end of winter when temperatures were above 19°C but none were recorded below 17°C. Although some other species showed small within season variation, the largest changes occurred between seasons and seasonal distinctions are therefore valid.

DIVERSITY OF TREMATODES OF FISHES OF THE GREAT BARRIER REEF: POINTERS TO PATTERNS IN THE TROPICAL INDO-PACIFIC.

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Coral reef fishes of the tropical Indo-Pacific number some 3,000 species and comprise the single richest component of the world's fauna of fishes. This enormous fauna is host to an even larger fauna of parasites, including protists, arthropods and helminths. Of the many groups of parasites, digeneans are the dominant internal metazoan parasites. Most digeneans of fishes are transmitted by way of metacercariae in food items but they may also attach directly to their hosts, penetrate directly, or be eaten from the plankton. As a consequence, practically all groups of fishes are subject to infection with adult and juvenile trematodes. The digenean fauna of Indo-Pacific fishes is still very poorly known, despite their prominence. The trematodes of three families of fishes (Pomacentridae, Siganidae and Haemulidae) of the Great Barrier Reef in Australia are reviewed to explore patterns of diversity of trematodes. These families differ markedly in their size, species-richness, diet and in their communities of digeneans. Trematode species-richness in individual fish species within these families range from as low as 1 to as high as 21 species. Determinants of the species-richness of the communities of trematodes are difficult to disentangle, but appear to relate principally to the diet of the fishes, the size and complexity of the gut, and the species-richness of the families of fishes themselves. Patterns and explanations of diversity of digeneans of fishes on the Great Barrier Reef may be a pointer to patterns for the Indo-Pacific as a whole.

ULTRAVIOLET VISION IN MARINE INVERTEBRATES.

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The existence of ultraviolet (UV) and near-ultraviolet vision in marine invertebrates is well documented, and awareness of its presence long predates our more recent knowledge of UV vision in fishes. In particular, many species of marine crustaceans, found in habitats from the deep sea to semiterrestrial beaches, have UV photoreceptors. The greatest known diversity of UV receptors in any living animal occurs in mantis shrimps, crustaceans that occupy shallow to moderately deep water. Single species of mantis shrimps have as many as 6 UV photoreceptor classes, ranging in peak sensitivity from 310 to 390 nm, and some UV receptors are polarization-sensitive as well. The ultraviolet photoreceptive systems of marine invertebrates may be involved in a number of vIsual tasks: (1) recognition of species-specific bioluminescence, (2) recognition of species-specific ultraviolet reflectance patterns, (3) navigation and orientation, using patterns of polarization, (4) analysis and imaging of polarized reflectance patterns, (5) UV spectral discrimination for signalling or breaking of camouflage, and (6) imaging midwater objects against the bright UV spacelight background. Visual requirements of fishes frequently resemble those of midwater and benthic crustaceans, so it is likely that they employ ultraviolet vision for tasks similar to these. Supported by the National Science Foundation.

FISH COLOUR PATTERNS AND INTERSPECIFIC INTERACTIONS WITHIN CORAL REEFS.

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This study quantifies interspecific behavioural encounters amongst an assemblage of coral reef fishes. The focus of the study was the parrotfish *Chlorurus sordidus*, a mobile grazing species which forages either singly or in schools while displaying a variety of short-term physiological colour patterns (PCPs) in the juvenile phase, some of which are common to other juvenile parrotfish species. The aim was to determine the relationship between colour patterns and schooling behaviour in juvenile *C.sordidus* and the role of interspecific encounters in influencing this relationship. The study quantified encounters between juvenile *C.sordidus* and a variety of potentially competing species. Interactor species were partitioned into either territorial or non-territorial and as trophic competitors and non-trophic competitors. Data were collected through systematic observation of focal individuals of *C.sordidus* and recording their behaviours as a response to interspecific encounters. The sampling design included size of focal juveniles, their schooling and PCP status, location on the reef and the ecological classification of the interactor species. Log-linear modelling of the data was used to examine the relationships between all possible combinations of the variables measured. The major findings of the study were as follows: there was an even distribution of schooling and non-schooling juveniles, only 50% of schooling juveniles displayed a common PCP, most interspecific encounters occurred between juveniles and herbivorous territorial pomacentrids, schools were frequently fragmented as a result of encounters, and juveniles showing common colour patterns were less likely to leave a school following an interspecific encounter than those displaying an odd colour pattern.

STAGING AND EARLY DEVELOPMENT OF *CALLORHINCHUS MILII* (HOLOCEPHALI, CALLORHYNCHIDAE).

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The early development of *Callorhinchus milii*, a primitive chondrichthyan fish (Subclass Holocephali), is described in detail based on a complete series of embryos from the blastoderm to the hatching stage. The external features of these specimens, in comparison with other chondrichthyan embryos, are used to establish the first staging table for any chimaeroid species. Each stage of *C. milii* is defined by a suite of morphological characters in addition to total length, including the number of somites, the extent of external pigmentation, eye size and shape, head flexure, heart morphology, and size and shape of paired and unpaired fins. Particular attention is given to features of the gill arches and associated structures including external gill filaments and the opercular flap. Embryos of this species also possess a transient rostral bulb, apparently unique among vertebrate embryos. Embryological development of *C. milii* is similar to that described previously for elasmobranch taxa. These include shark such as the spiny dogfish, *Squalus acanthias*, the Japanese bullshark, *Heterodontus japonicus*, and the frill shark, *Chlamydoselachus anguineus*; as well as batoids including the guitarfish, *Rhinobatus halavi*, and skate, *Raja brachyura*. *C. milii* is also similar in overall developmennt to another holocephalan, *Hydrolagus colliei*. A comparative review of previous staging schemes confirms that progressive morphological development in all three major chondrichthyan lineages (sharks, batoids, and chimaeras) can be correlated using a common set of stages. By standardizing the comparative description of characters early in development, this uniform system should prove useful in continuing ontogenetic and phylogenetic studies of this entire clade of fishes.

DESCRIPTION OF TWO NEW SPECIES OF CHIMAEROID FISHES FROM AUSTRALIA AND NEW ZEALAND (HOLOCEPHALI, CHIMAERIDAE) WITH COMMENTS ON TAXONOMY CHIMAERIDS.

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Increased fishing effort and exploration in deep water, at or below 1,000 meters, has resulted in the capture of many new species previously unknown to science. In particular, several new species of chimaeroids have been collected from the Central and South Pacific around New Zealand and Australia. Of the 35 known species of chimaeroid fishes, 23 belong to the Family Chimaeridae, making it the most speciose of the three families of chimaeroid fishes. Almost all of the newly discovered species belong to this family. For each specimen a total of 35 measurements were taken. Two new species are described on the basis of body proportions as well as external features such as coloration, clasper morphology, lateral line canal pattern, and fin morphology. Over 700 additional specimens were examined for comparative purposes. A revision of the Family Chimaeridae is in progress and the taxonomy of the family is reviewed with an overview of the status of types and currrently recognized species.

REVISION OF THE GENUS *RHODEUS* (CYPRINIDAE) DISTRIBUTED IN THE INDOCHINESE PENINSULA.

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Two species of the genus *Rhodeus* have been described from the Indochinese Peninsula, i.e., *R. rheinardti* (Tirant, 1883) and *R. ocellatus vietnamensis* Mai, 1978. Recently, *R. ocellatus vietnamensis* and *R. spinalis* Oshima, 1926 (distributed in Hainan Island) were considered to be junior synonyms of *R. rheinardti*. In this study, based on specimens collected from Viet Nam and Laos, as well as type specimens of the above species, three species, two of them new, are recognized from the Indochinese Peninsula. *Rhodeus rheinardti* (Tirant, 1883) (junior synonym *R. ocellatus vietnamensis* Mai, 1978): 10-13 branched dorsal fin rays, 12-16 branched anal fin rays, male with broad lateral stripe on caudal peduncle. Distributed in Viet Nam (Red River basin in the north to Song Tranh River basin, near Da Nang, in the south). *Rhodeus* sp. 1: 12-13 branched dorsal fin rays, 14-15 branched anal fin rays, body depth (BD) 43.6-48.2 of SL, caudal peduncle length (CpL) 13.4-14.4% of SL, male with narrow lateral stripe on caudal peduncle. Distributed in Viet Nam (Song Tranh River basin, near Da Nang). *Rhodeus* sp. 2: 10-12 branched dorsal fin rays, 12-14 branched anal fin rays, BD 39.7-44.8 of SL, CpL 9.9-13.9% of SL, male with narrow lateral stripe on caudal peduncle. Distributed in Laos (Nam Theun River, Mekong River basin). *R.* sp. 2 is the first species of the genus recorded from the Mekong River basin. *Rhodeus spinalis* Oshima, 1926 (distributed in Hainan Island), formerly treated as a junior synonym of *Rhodeus rheinardti*, is a distinct species.

ASSESSING PHYLOGENY, HISTORICAL ECOLOGY, AND REPRODUCTIVE BEHAVIOR OF HAWKFISHES (PISCES: CIRRHITIDAE).

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Phylogenetic analyses of behavioral characters have utility in testing hypotheses generated from systematic studies of morphological and molecular characters. Behavioral characters may also be examined phylogenetically to determine which are historically constrained and which likely arise from environmental conditions. The evolution of behavioral strategies, and the adaptive advantages therein, can be related to changes in morphology and ecological factors. In example these analyses are applied to hawkfishes, protogynous reef-dwelling fishes with haremic and facultatively monogamous mating systems. Phylogenetic relationships and the evolution of reproductive behavior in relation to microhabitat utilization are discussed.

SYSTEMATICS OF THE HALFBEAK GENERA *DERMOGENYS* AND *NOMORHAMPHUS* (HEMIRAMPHIDAE) WITH A PRELIMINARY PHYLOGENETIC ANALYSIS.

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The family Hemiramphidae, the halfbeaks, comprises 13 genera and more than 100 species of atherinomorph fishes. Three brackish and freshwater genera are known to be internally fertilized and viviparous, *Hemirhamphodon, Nomorhamphus*, and *Dermogenys*. Much confusion exists concerning the number of valid species and relationships within *Dermogenys* and *Nomorhamphus*. The sister group relationship between *Dermogenys* and *Nomorhamphus* is supported by modifications of the anal fin in males. Histological study of the gonads of many species has led to new characters of sperm bundle morphology and modifications associated with viviparity which suggest that these generic limits may be artificial. Osteological and reproductive characters were combined in a phylogenetic analysis. Preliminary results indicate overwhelming support for a sister group relationship between *Hemirhamphodon* and (*Dermogenys Nomorhamphus*). Monophyly of *Dermogenys Nomorhamphus* is also well supported. Additionally, these results suggest that *Dermogenys*, as currently constituted, is paraphyletic. Within the group comprised of (*Dermogenys Nomorhamphus*), two monophyletic groups are supported. One clade comprised of nine species of *Dermogenys*, including the generic type, and the other clade comprised of seven species of *Dermogenys* and four species of *Nomorhamphus*, including the generic type.

DEEP-SEA DEMERSAL ICHTHYOFAUNA OFF THE ST-PAUL AND AMSTERDAM ISLANDS (SOUTHERN CENTRAL INDIAN OCEAN).

DUHAMEL G.

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Oceanographic cruise (R.V. " Marion-Dufresne ", July 1986) and experimental fishing cruise (F.V. " Austral ", July 1996) allow to investigate the deep-sea zone (respectively 410 - 3075 m and 400 - 980 m) off the St-Paul and Amsterdam islands, a poorly known area in the Central Indian Ocean. 50 species are recorded belonging to 17 families. Macrouridae is the most speciose family but, in term of biomass, Berycidae and Oreosomatidae seem to be dominant. The ichthyofauna is compared to those from other areas of the subtropical belt of the Southern Hemisphere.

BY-CATCH IN THE DEEP-SEA LONGLINE FISHERY OF *DISSOSTICHUS ELEGINOIDES* FROM THE INDIAN SECTOR OF THE SOUTHERN OCEAN.

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The bottom longline fishery of *Dissostichus eleginoides* is presently expanding everywhere in the Indian and Pacific sectors of the subantarctic part of the Southern Ocean. Up to 30/ 50 000 tonnes are expected to be landed in 1996/97! However the targeted species is not the only species of fish caugth. Joint Japanese-French exploratory fishing (1996 and 1997) shows that by-catch reach 35% of the total catch (in number) off the Kerguelen and Crozet islands. Macrouridae (*Macrourus* spp.) are dominant and Rajidae (*Bathyraja* spp. and *Raja taaf*) and Moridae (*Antimora rostrata*) are secondary by-catch. Reports of commercial by-catch species are rare because fish are often discarded. Such situation inflicts loss on the stocks assessment and reduces the opportunity to evaluate the impact of the fishing method on the deep-sea environment.

MONOPHYLY AND PHYLOGENY OF THE SUBFAMILIES MACROUROIDINAE AND TRACHYRINCINAE (GADIFORMES, MACROURIDAE).

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The Macrouroidinae and Trachyrincinae are the highly specialized subfamilies of the Macrouridae. Nolf and Steurbaut (1989), and Iwamoto (1989) hypothesized that the two subfamilies are sisterly related based upon the otolith feature and branchiostegal rays-epihyal relation, respectively. The monophyly is further supported by the 14 additional synapomorphies (five are homoplasies). They include the presence of two anterolateral processes of the lachrymal, presence of a cartilaginous window of the post-temporal region of the cranium, and four features derived from the suspensorium and opercular bones. Many reductive and reversal characters observed in the two subfamilies suggest that their evolution is paedomorphic, possibly related to the specialization of the acoustic apparatus and cephalic sensory system.

TAXONOMIC DATABASES FOR FISHES.

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Managing information about animals depends on accurate names of organisms. Having accurate taxonomic information is important for all aspects of biological informatioon management. Very large databases for fishes (genera, species, references) have been built at the California Academy of Sciences with support from the National Science Foundation. The species database contains about 54,000 records. Most original descriptions of fishes have been examined, and information on location of type specimens gathered. Using recent literature, most taxa have one or more status references that are a guide to further literature. Careful attention has been paid to dates, spellings, and proper taxonomy. The preparaton of the databases and the value and utilization of these databases will be discussed and demonstrated. A portion of the database is on the internet in a gopher search format at http://www.calacademy.org/research/ichthyology.

WHAT DO WE KNOW ABOUT PARASITES OF INDO-PACIFIC FISHES ?

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Parasites, and specially the ones with oioxenous specificity, have proved to be extremely useful in taxonomy, systematics and biology of fish hosts. Nevertheless, the use of parasites as indicator requires an extensive preliminary work in order to identify parasite species and life cycle. Litterature on Indo-Pacific fish parasites is very poor in all groups of parasites from Protozoa to Crustacea. However, parasitism is better known in certain areas such as Japan, Australia, India and Hawai. This fact can be viewed only as a consequence of the work of some researchers. For all other areas of the Indo-Pacific, data are fragmentary or totally lacking. For example, there is no information available on parasites of marine fishes from the whole african east coast and very little on the south american pacific coast. Even in regions where litterature on fish parasites does exist, a group by group examination reveals the sparseness of data. For Whittington «Australia boats the richest marine fish fauna on earth with approximately 3400 species. By applying the estimate of 1 monogenean species per fish species, potentially there could be 3400 monogenean species from marine fish in Australia. About 260 species of monogenean are only named from Australia». This review tries to show the distribution of the knowledge on Indo-Pacific fish parasites using specific examples.

WHAT CAN PARASITE STUDIES PROVIDE TO ICHTHYOLOGY ?

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The aim of this review is to emphasize the value of parasitological studies as a tool for better understanding various aspects of fish biology. Numerous analyses of fish parasites have proved to be extremely useful in providing informations on, for example, fish diet and feeding behavior, spawning behavior, recruitment pattern of juveniles, adult migration, stok separation, phylogeny, systematics, and center of origin and ancestral dispersal routes. The use of parasites as indicators is generally seen as a method complementary to conventional analyses. However, in some particular cases such as the study of deep water species, the parasitological approach may be the most appropriate. The usefulness of parasitology in studying fish biology is presented in this review using specific examples from the litterature.

APPLICATION OF FISH BEHAVIOR TO STREAM MONITORING ON TROPICAL PACIFIC ISLANDS.

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In Hawai'i, the social behavior of indigenous stream fishes (Gobiidae and Eleotridae) occurs as sequences of discrete movements and postures that can be readily observed in the islands' clear mountain streams. These units of behavior are uniform within a species, and the sequence in which they appear in a given social context is consistent througout the chain of high islands. Stereotypy in behavior enables investigators to use ethological studies for island fishes as a valuable adjunct to stream surveys because the information addresses directly whether or not the animals are engaging in activities essential for maintenance and reproduction. Behavioral data also are sometimes bettter indicators of stream degradation and more useful in judging whether stream restoration has been successful than are simple lists of species and numbers of animals. We suggest that procedures for applying behavioral information to stream monitoring in Hawai'i can be extended to the other areas of the tropical Pacific where close relatives of Hawaiian freshwater fishes and other members of the same two families form the major faunal component of island streams.

GROWTH, DIET AND REPRODUCTION INFORMATION OF FISHES FROM TAIWAN: A COMPILATION OF DATA FROM NATIONAL SOURCES.

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This paper presents most of the local information available on growth, diet, and reproduction of Taiwanese fishes. The major sources included: five major journals dealing at least partly with domestic fishery biology; theses which dealt particularly with these subjects in Taiwan; and Symposium abstracts of the Taiwan Fishery Society for as long as traceable by the authors. For age and growth, a total of 50 reports were located as information source, given rise to a data base of 67 species of fishes. In about one-third of the species studied, significant differences between male and female fishes were found. Their age and/or growths were thus listed separately. Some species were repeatedly studied with different methods and in different areas. As a whole, a total of 134 records of fish «populations» are reported. For diet composition, a total number of 45 journal articles were located. Most papers belong to marine economical migratory species including large pelagic swordfish, dolphinfish, scomber, bonito, yellowtail, scad, mullet, thornfish, eel or small anchovies as well as demersal cutlassfish. Most of them provide quantitative data but some were incomplete with only a few items of gut contents. In addition, seven theses with feeding data were furnished. Three of them contained food items of more than 150 species of coral reef fish species. For spawning seasons, 53 articles were collected from the local journals. Only 29 among them provided further information on reproductive ecology, such as seasonal variation of gonad index and sex ratio.

ELASMOBRANCH BIODIVERSITY, CONSERVATION AND MANAGEMENT IN SABAH.

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A collaborative project between the Department of Fisheries-Sabah and the IUCN Shark Specialist Group, funded by the UK Darwin Initiative for the Survival of Species, is described. Prior to the initiation of the project, there had been no recent detailed studies of elasmobranchs in local fisheries and markets. There were no records of freshwater sharks or rays in scientific literature, although local fishermen, when asked, reported occasionally catching elasmobranchs in Sabah rivers. However, the likely biodiversity and importance of elasmobranchs in Sabah waters, and their potential vulnerability to growing fishing pressure and habitat problems was recognised. A programme of market visits and freshwater surveys and a pilot study of the socio-economic importance of these fish were therefore carried out between January 1996 and July 1997, and a reference collection made. The study methodology is briefly described and results reported. Thirty-two species of sharks and 41 species of rays were recorded during the 18 month project; of which 14 sharks and 12 rays were new records for Sabah, and one shark an undescribed species. Several other records could only be determined to genus, and probably include additional undescribed species. New species records were still being made during the last months of the study. The project ended with an international seminar and workshop to disseminate the results. The workshop reviewed the status of sharks, rays and chimaeras in the region, trends in fisheries and market, and the needs and options for the management and conservation of elasmobranchs. Further research, conservation and survey needs in the region were identified. The paper outlines the lessons learnt by the Darwin project and makes suggestions made for extending the study to neighbouring states and countries.

EMBRYONIC DEVELOPMENT IN PORBEAGLE SHARKS (*LAMNA NASUS*).

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Large numbers of porbeagle sharks, mainly juveniles, are caught by tuna longliners around New Zealand and southern Australia during autumn-winter. Porbeagles are viviparous and nourish their embryos *in utero* with ova produced by the mother. Litter size is nearly always four embryos, and birth occurs at 65-75 cm fork length (FL). Forty-five embryos (21 to 67 cm FL) from 13 litters were examined. The stomachs of most embryos contained copious yellow yolk, causing gross abdominal distension at lengths less than 50 cm. Yolk quantity increased from 0.1-0.2 kg (42-56% of total body weight) at 21-23 cm FL to a maximum of 0.8-1.6 kg (57-76%) at 30-35 cm FL. Larger embryos contained variable quantities of yolk (0-1.1 kg) but it comprised only 0-26% of total weight in embryos longer than 50 cm. Liver weight and intestinal contents increased with FL. Porbeagle embryos ingest huge quantities of ova during early and mid gestation. Ova production by the mother may decline thereafter, and embryos continue growing by digesting their stomach contents. Excess food energy is stored in the liver. The period of maximum ova production may coincide with the season of greatest availability of maternal food sources, such as squid.

SHARK BYCATCH IN NEW ZEALAND'S TUNA LONGLINE FISHERIES.

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Longline fishing for tunas began in New Zealand waters after World War II. Estimates of fishing effort and catches of the target species have been available since 1980. The fishery was developed by foreign (mainly Japanese) vessels, and fishing effort peaked in 1981 at 27 million hooks per year. With the progressive exclusion of foreign vessels from New Zealand's 200 mile EEZ, and a decline in the catch rates of tunas, fishing effort declined steadily. New Zealand fishing companies expanded into the fishery by chartering foreign vessels from 1989, and deploying domestic vessels from 1991. Domestic vessels have now replaced foreign and chartered vessels. By 1996, fishing effort had declined to 1.7 million hooks. Scientific observers have been recording bycatch since 1987, although significant coverage only began in 1989. In the period October 1988 to September 1996, 1,818 out of 23,382 longline sets were observed (8%). However, observer coverage increased as effort declined, and has averaged 28% for the last three years. The main species caught by longlines is blue shark (*Prionace glauca*), which is more than twice as abundant as the next commonest species, albacore tuna (*Thunnus alalunga*). Large numbers of porbeagle shark (*Lamna nasus*) are also taken, and there is a significant bycatch of shortfin mako shark (*Isurus oxyrinchus*) and school shark (*Galeorhinus galeus*). Small quantities of about 25 other species of sharks and rays are also caught. Estimates of the total numbers of blue, porbeagle, mako and school sharks caught were obtained by scaling up the observed hooks to the total number of hooks set, following stratification of the data by year, latitude, fleet nationality and season.

SYSTEMATICS AND ZOOGEOGRAPHY OF TROPICAL SOUTHWEST PACIFIC TRIPTERYGIIDAE.

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Tripterygiid fishes are a group of small, benthic blennioids living on hard substrates, mostly in the upper 30 m of rocky and coralline coastal substrates, some occurring down to 500 m. In the Southwest Pacific, here defined as stretching from Lord Howe Island and the Great Barrier Reef to Vanuatu and Tonga, a total of 39 tripterygiid fish species is found. 15 of these are endemic in the area, 5 are Pacific Plate endemics with a marginal distribution, 4 are only occurring on the Pacific Plate margins, and 15 are widespread. Of the endemics, 4 species are exclusive to Eastern Australia, 4 to New Caledonia, and 1 species each to Vanuatu, Lord Howe Island, and Kermadec Islands. Tripterygiid fishes have two diversity centers. The center for cold temperate forms is around New Zealand, while another center for tropical and warm temperate forms is around northern Australia and in the South-west Pacific A vicariance study of tripterygiid fish distributions shows that the southern center contains more primitive species, which originally dispersed around the southern temperate zone. At some stage, tripterygiids penetrated into the tropics along the coasts of Australia (with 3 independent tracks), and then disperseed worlddwide in the tropics. The Southwest Pacific is one of the first ancient tropical oceans colonized by tripterygiids. Plate tectonic events in the area of the past 50 million years are reflected by tripterygiid fish distributions.

VISION IN BILLFISH (XIPHIIDAE).

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Billfish are large pelagic predators with a well developed visual system. Their eye muscles have been transformed into heater organs to keep retina, optic tract and brain above ambient temperature emphasising the importance of vision for these fish. As a first step in a thorough investigation of the billfish visual system retinae were investigated as wholemount preparations to generate maps of ganglion cell density and to plot photoreceptor distribution. The preliminary data suggests that there are two areas of high ganglion cell density in the nasal and temporal part of the retina in the blue marlin (*Makaira nigricans*). A third area centrales was found in the ventro-temporal retina in the black marlin (*Makaira indica*) This means that in the marlin the area of acute vision is concentrated horizontally and frontal with an additional specialisation in the forward-upward direction in the black marlin. The peak visual acuity was calculated to be 10 cycles/degree. We found at least two types of photoreceptors, single and double cones. The two cone types are arranged in square mosaics in the ventral retina whereas in the dorsal retina rows of double cones with few single cones are predominant. This coincides with a higher ganglion cell density in the ventral retina compared to the dorsal half. These anatomical data suggest that marlin have colour vision contradicting previous physiological studies (1,2).

WHY TAXONOMISTS WILL WANT A COPY OF FISHBASE 97.

FROESE R. & M.D.L. PALOMARES

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FishBase 97 is a large biological database covering 17,500 species of finfish. FishBase contains a wealth of information (trophic ecology, population dynamics, reproduction, human uses, common names) that is of interest to taxonomists. It contains the current Internet versions of Eschmeyer's PISCES, GENERA, and REFERENCES databases. It contains a procedure that will check long lists of scientific names and highlight synonyms, spelling mistakes and missing parentheses. Another procedure produces errata lists with updated names for major taxonomic works. Annual updates of FishBase allow for continuous correction of possible errors. These and other features of FishBase will be shown in a live demonstration.

A NEW PROCEDURE TO CLEAN UP FISH COLLECTION DATABASES.

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A procedure is presented that compares some of the information typically contained in a fish collection database (scientific name, classification, size of specimen(s), locality) with similar information compiled in FishBase, a large database on finfish available on CD-ROM. The procedure detects possible errors in spelling, classification, locality, and identification. It can be used to assign a preliminary quality indicator to collection records, pending the reexamination of specimens by experts. In addition, various maps can be produced to visually detect possible errors in locality or identification. Preliminary experiences in applying the procedure to a large collection database are presented.

OSTEOLOGICAL DEVELOPMENT IN THE SURFPERCH, *DITREMA VIRIDIS* (PISCES, EMBIOTOCIDAE).

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A total of 102 embryos taken from 12 gravid females was cleared and stained for observing skeletal development. Length of embryos examined were: Yolk sac larvae 4.5-4.7 mm NL; Preflexion larvae 6.8-8.7 mm NL; Flexion larvae 8.8-13.7 mm NL; Postflexion larvae 14.8-26.3 mm SL; Juveniles 29.5-41.2 mm SL. Hyoid and branchial arches: all elements were present at 6.8 mm NL, and remained cartilaginous at 11.2 mm NL. Ossification occurred at 14.8 mm SL. Initial branchiostegal ray was first observed at 8.7 mm NL, the full complement of 6 rays being attained by 18.0 mm SL. Jaws: at 6.8 mm NL, maxilla, Meckel's cartilage and dentary were observed. All elements were formed by 12.3 mm NL. Suspensorium: hyomandibular-symplectic and quadrate cartilages had formed at 6.8 mm NL, palatine and metapterygoid at 9.5 mm NL. All elements had formed by 15.5 mm SL. Opercular bones: opercle first appeared at 9.0 mm NL, followed by preopercle at 12.3 mm NL, interopercule at 12.8 mm NL, and subopercle at 14.8 mm SL. Vertebral column: vertebrae 35-37 (usually 36). Precaudal vertebrae 15. Several cartilaginous neural and hemal arches had appeared at 7.5 mm and 9.0 mm NL, respectively, the full complement of both being attained by 14.7 mm NL. Anteriormost 10 centra were first seen at 10.7 mm NL, all centra including urostyle being completed by 14.8 mm SL. Fin and fin supports: dorsal and anal proximal pterygiophores were first seen at 8.7 mm NL, the full complement of the former being completed by 12.7 mm NL, the latter by 14.8 mm SL. At 12.3 mm NL, dorsal and anal rays were first observed, the full complement of the former being attained by 15.8 mm SL, the latter by 18.0 mm SL. Yolk sac larvae possessed cleithrum. Coraco-scapular cartilage and fin plate were seen at 6.8 mm NL. Pectoral rays were first seen at 14.8 mm SL and completed by 29.5 mm SL. Pelvic girdle first appeared at 9.3 mm NL. Pelvic rays first appeared at 18.0 mm SL and completed by 21.7 mm SL. At 7.5 mm NL, hypurals 1 and 2 were present as cartilage. Caudal complex was formed by 14.8 mm SL. Caudal rays were first seen at 9.0 mm NL and completed by 25.5 mm SL.

ADULT REEF-FISH COMMUNITIES IN THE CLOSED LAGOON OF TAIARO ATOLL, FRENCH POLYNESIA.

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Species composition and abundance of the reef fish communities were investigated in the closed lagoon of Taiaro, Tuamotu archipelago. Surveys were made in 1972, 1992, 1994 and 1996. A total of 134 species of fishes were identified. Twenty-one fish species were common to all four surveys; 34 species were common to the last three surveys; 9 were found only in 1972; 2 only in 1992; 17 only in 1994 and 13 only in 1996. Five species represented 70% of the total number of individuals inside the lagoon during the 1994 and 1996 surveys. The small size of Taiaro and the isolation of its lagoonal waters, which generate harsh environmental conditions, are likely to be the major causes of the very low diversity observed. These data on adult reef-fish community suggest that some species may complete their entire life-cycle inside the lagoon, but in the absence of additional data on recruitment and genetic evidence, such an hypothesis is still speculative.

WIDESPREAD INDO-PACIFIC CORAL-REEF FISH SPECIES: A NEED FOR TAXONOMIC PRACTICE.

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Indo-Pacific coral-reef fish species vary considerably in the size of their geographic distributions; some species have very restricted distributions while others range widely across the region. Although the wide distributions of some species may be real, many are clearly artificial and reflect the inconsistent application of criteria for spe-cies diagnosis. In particular, discrete geographic entities have been diagnosed within many widespread species, but these have been viewed as intraspecific forms such as subspecies or geographic variants. Since intraspecific forms are rarely distinguished in popular or scientific literature, data pertaining to the geographic distribution and biology of such forms do not accumulate. Clearly there is a nedd for review of how taxonomists deal with «widespread species».

THE FRESHWATER FISHES OF SOUTH-WESTERN AUSTRALIA.

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Approximately 500 sites in the south-western corner of Australia were sampled for freshwater fish. Sites were described, fish identified and the number of each species recorded. These data were then collated with those from other studies and used to describe the distributions and habitat associations of the eight endemic species (*Tandanus bostocki, Lepidogalaxias salamandroides, Galaxias occidentalis, Galaxiella nigrostriata, Galaxiella munda, Bostockia porosa, Edelia vittata* and *Nannatherina balstoni*), the two native, but widespread species (*Galaxias truttaceus* and *Galaxias maculatus*), the anadromous pouched-lamprey (*Geotria australis*), the native species which are commonly found in the freshwaters of the region, but have a recent marine origin (*Leptatherina wallacei, Pseudogobius olorum* and *Afurcagobius suppositus*) and those species introduced into the region (*Oncorhynchus mykiss, Salmo trutta, Gambusia holbrooki* and *Perca fluviatilis*). The most common and widespread native freshwater species are *G. occidentalis, B. porosa* and *E. vittata*. Our sampling regime precluded capture of the freshwater catfish, *Tandanus bostocki*. The remaining four endemic species, *L. salamandroides, G. nigrostriata, G. munda* and *N. balstoni*, are effectively restricted to a small area of peat flats on the south coast. The two species found in both south-western and south-eastern Australia, *G. truttaceus* and *G. maculatus*, were found only in a small nature reserve on the south coast. Adult lampreys were recorded migrating up several rivers of the south coast, ammocoetes were collected from the silty banks of these rivers. Although *L. wallacei, P. olorum* and *A. suppositus*, are generally associated with coastal water bodies, they were often found considerable distances inland. The most common and widespread feral species was *G. holbrooki*, but *P. fluviatilis* was also often locally abundant. A brief account of the biology of the endemic species will be discussed.

GAMBUSIA HOLBROOKI A MAJOR THREAT TO THE ENDEMIC FRESHWATER FISHES OF SOUTH-WESTERN AUSTRALIA?

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In less than 100 years agricultural practices and urbanisation have resulted in the loss of approximately 80% of freshwater habitats on the Swan Coastal plain, while continuing deforestation and draining of wetlands for agriculture are causing alterations to inflow, salinisation, siltation and eutrophication of freshwaters in the lower south-west. Four of the eight endemic freshwater species of this region are represented by small populations in specific habitats and have very restricted ranges. These species are therefore vulnerable to the continuing loss or alteration of habitat and to the introduction of non-native species. Perca fluviatilis, a large piscivore, and *Gambusia holbrooki* have become well established in the region. Although, there is much anecdotal evidence that *G. holbrooki* is agonistic towards similar sized fishes, the effect of this behaviour, i.e. fin nipping, on Australian species has never been quantified. As the pygmy perch *Edelia vittata* is of a similar size and utilises similar resources to *G. holbrooki* and is one of the most widespread and abundant endemics, the interaction of this species and *G. holbrooki* was explored in more detail. Fin damage to *E. vittata* was highest in those waterbodies in which *G. holbrooki* occurred in high numbers and had little complex cover. Laboratory experiments measured the survivorship and fin damage in *E. vittata* when stocked with three densities of *G. holbrooki*. Mortality of *E. vittata* was higher in those tanks in which *G. holbrooki* was present, while fin damage was directly related to the density of *G. holbrooki*. The implications of continuing habitat alteration and the further introductions of established exotic species will be discussed.

MEASURING AND UNDERSTANDING VISUAL SENSITIVITY OF VERTEBRATES TO UV.

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Two methods are available to measure the wavelength sensitivity of individual vertebrate photoreceptors: absorption spectroscopy (microspectrophotometry or MSP) of the outer segments, and spectral sensitivity of the membrane voltage or photocurrents generated by individual cones. Most of the available data on UV receptors comes from the first source, but the second offers a couple of advantages. First, measurements can be extended to long wavelengths where sensitivity has fallen several log units and MSP is not possible. Second, sensitivity of UV receptors is maximal in a part of the spectrum where photoproducts and light scatter are the most troublesome for measurements of weak absorption. We will show spectral sensitivity measurements of the photocurrents of UV cones of Danio aequipinnatus and Carassius auratus containing retinal and dehydroretinal respectively. The absorbance spectra of A1-based UV pigments are narrower than visual pigments with lmax in the visible, and there is evidence that UV cones of some species may express small amounts of other opsins. Measurements of photoreceptors do not address the question of how UV cones are used in vision: whether they participate in color vision, drive wavelength-specific behaviors, or both. Appropriate behavioral evidence is available for only a few species. In the budgerigar (*Melopsittacus undulatus*), color mixing and color matching experiments show clearly that UV cones are used in color discrimination.

BIOGEOGRAPHICAL RELATIONSHIPS OF THE AUSTRALIAN SPECIES OF FRINGED STARGAZER (*ICHTHYSCOPUS*: URANOSCOPIDAE).

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The discovery of an undescribed species of the uranoscopid stargazer genus *Ichthyscopus* in coastal waters of eastern Australia provided and opportunity to examine the detailed morphology and distributions of the six Australian representatives of the genus. These taxa variously possess a number of ancestral and specialized characters, including differential developments of a fleshy flap enveloping the cleithral spine, fimbriae associated with this flap as well as the lips, jaw dentition, squamation, and the anterior dorsal fin elements, which enable the testing of hypotheses about their interrelationships. A comparison of 14 variable characters present in the six species, using the computer software PAUP, yielded two trees having an equal shortest length of 22 steps with a consistency index of .909. A comparison of the preferred tree with distributions of the six taxa, all of which are confined to waters adjacent the Australia and southern Papua New Guinea land mass, have enabled the formulation of a likely evolutionary scenario which is compatible with our current understanding of climatological fluctuations in the region. The scenario is presented and discussed.

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 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.

THE *APOGON ERYTHRINUS* COMPLEX A PACIFIC SPECIES GROUP.

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In Hawaii, a small red semitranslucent speecies of cardinalfish was described as *Apogon erythrinus*. Similar cardinalfishes from other arcas of the Indo-Pacific have been identified as this species, or *E. erythrinus* has been synonomyzed with *A. crassiceps* or *A. coccineus*. These fishes form two phenetic groups defined by a number of characters; one group contains *A. coccineus* described from the Red Sea, and the other group contains *A. erythrinus* from Hawaii. The *A. erythrinus* complex appears to be restricted to the Pacific Ocean and is composed of several species, with *A. erythrinus* being endemic to Hawaii.

STRUCTURE OF FRINGING REEF FISH COMMUNITIES IN THE SOUTH WEST LAGOON OF NEW CALEDONIA.

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This work deals with the structure of fringing reef fish communities, with the relationships between these structures and the environment and with the influence of spatial scale on the relationships shown. Five structures have been defined. They are based on biological characteristics of fish species such as feeding ethology, life history strategies, size, mobility and schooling behaviour. The environmental variables are expressed at three spatial scales, which are: (1) the fish census station (100m), (2) the couple of stations (200 to 400 m) and (3) the group of stations located in front of the same river drainage basin (5km maximum). Two different ways were used to study the relationships between the community structures and the environment. The first one shows links between habitat and structures, using linear correlation. with respect to the type of the environmental variables chosen, a second approach is used to tackle the effect of spatial scale. This procedure is carried out at the three above-mentionned spatial scales, for each structure, in terms of species richness, density and biomass respectively. The aim is to define for the faunistic data as well as for the environmental data what is the most appropriate spatial scale to the fish-environment relationships. The structure study enabled us to modelise some aspects of the community functionning. This conceptual model shows three major ways which account for 75% of the total biomass, with two strategies: Microherbivorous and macrocarnivorous fish represent important and very mobile biomasses, with a slow turnover, whereas plankton feeders which are not very mobile, have a very high turn. The community structures are mostly significant correlated to depth, benthos composition, in particular coral, and the chemical composition of rocks on the shore. Finally, although environmental parameters expressed at the larger spatial scale are the most appropriate to describe fish-environment relationships, it appears that fish community studied at the station scale are the most representative.

DIURNAL VARIATION IN THE ABUNDANCE OF PARASITIC GNATHIIDS ISOPODS: ITS SIGNIFICANCE IN CLEANING INTERACTIONS.

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Parasitic gnathiid isopods may form up to 90% of the diet of cleaner fish. This study found abundance on host fish shows strong diurnal change. Variation in the abundance and feeding patterns of parasitic gnathiid isopod larvae was examined on fish (*Hemigymnus melapterus*, Labridae) collected from dawn to sunset. Gnathiids were counted and their guts categorized as empty, partially full, or full. Fish collections were replicated in two habitats, the shallow reef flat (0.5-2m) and the reef slope (3-15 m). The number of gnathiids per fish decreased significantly from dawn to sunset in both habitats. Most gnathiids had full guts (70-82%) suggesting that they had not recently infected fish. There were, however, slightly more gnathiids with empty guts in the afternoon. This was probably because more gnathiids with full guts left the host than gnathiids which have not completed feeding. A pilot study in the laboratory found more gnathiids fed and developed a full gut on fish exposed to no light (80%) than fish exposed to light (33%). The results support the hypothesis that gnathiids infect fish at night and that cleaner fish 'farm' parasites, i.e. they harvest only a small proportion of the gnathiid population each day. This has important implications for understanding the ecological significance of cleaning.

FROM FIELD TO LABORATORY: ELASMOBRANCHS AS MODELS IN CONTEMPORARY BIOLOGY.

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Traditionally, studies on elasmobranchs have focused on aspects of field biology including abundance, distribution, systematics, age and growth, behavior and potential attacks on humans. These studies continue to be useful, particularly in light of the increased awareness of the deleterious effects on shark populations by overzealous commercial and recreational fishing and bycatch mortalities. Increasingly, laboratory based scientists are appreciating elasmobranchs as attractive models in which to investigate and elucidate many fundamental vertebrate processes. This workshop will present an overview of the present themes of research being pursued on elasmobranchs with an emphasis on the considerable diversity of these areas. Since the late 1980's several published volumes have added to the contemporary literature on elasmobranchs. In 1989 a symposium was held that focused on contemporary biology and evolution. In 1990 three symposia dealt with reproduction, vision and elasmobranchs as living resources including biology, ecology, systematics and fisheries. elasmobranchs. In 1988 Physiology of Elasmobranch Fishes and Sharks of the Order Carcharhiniformes appeared which served as reference works of great value. A compilation of current reviews of elasmobranch anatomy, ultrastructure, biochemistry and physiology using a systems approach will appear as Biology of Elasmobranch Fishes in 1998. These volumes serve as an introduction to the biology of elasmobranchs as well as a reference resource to the primary literature based on contemporary laboratory studies.

MICROANATOMY OF THE MALE GENITAL DUCTS IN THE CLEARNOSE SKATE, *RAJA EGLANTERIA.*

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The principal extratesticular genital ducts of male *R. eglanteria* consist of the paired: 1) epididymes, 2) ductus deferens and seminal vesicles, associated with the adjacent Leydig glands. In concert, they function to: 1) transport spermatozoa, 2) contribute to the seminal fluid and 3) effect sperm aggregation. The epididymes and ductus deferens receive secretions from the Leydig gland (Leydig gland bodies) which are considered the primary source of seminal fluid. The epididymis is composed of ciliated columnar cells. Cranially, luminal contents include sperm laterally aligned head-to-head in groups of 2-8. They are scattered in the heterogeneous seminal fluid composed of: 1) membrane limited vesicles derived from Sertoli cells (Sertoli cell bodies), 2) Sertoli cell cytoplasts which are remnants of Sertoli cells exclusive of Sertoli cell bodies, 3) Large Leydig gland bodies and 4) secretions and/or cell fragments of epithelial cells of the genital ducts. In the caudal epididymis, large aggregations of laterally aligned sperm are embedded head-first in a homogeneous extracellular mass forming spermatozeugmata. Large folds project into the lumen of the tubule. These folds decrease in size in the ductus deferens. Epithelium of the ductus deferens is simple columnar. Leydig secretions here consist of small secretory vesicles. The lumen of the seminal vesicle is massive when compared with the epididymis and ductus deferens. Epithelial shelves of simple columnar ciliated cells project into the lumen. Smooth muscle is a component of the vesicle walls. Sperm are organized into definitive simple spermatozeugmata which are smaller than those in the epididymis.

FUNDAMENTAL ORGANIZATION OF OVIDUCAL GLANDS IN ELASMOBRANCHS.

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Oviducal glands in elasmobranchs, variously termed shell or nidamental glands, are specialized regions of the anterior oviduct modified to perform the following functions: 1) lubrication of the oviduct for transmission of the egg, 2) production of a jelly coat around the egg, 3) production of the various egg investments in species that have coverings and 4) serve as a sperm receptacle. All oviducal glands have similar zonation, i.e., 1) anterior mucous zone, 2) jelly coat zone, 3) investment zone and 4) posterior mucous zone. In oviparous species such as *Raja eglanteria*, a hard, permanent egg case is produced that is deposited externally. In aplacental yolk sac species such as *Squalus acanthias*, a transient, flexible «candle» case is produced and retained in utero. In placental species such as *Rhizoprionodon terraenovae*, a pliable egg envelope is formed that is maintained throughout gestation and is incorporated into the placenta. The stingray, *Urolophus jamaicensis*, is aplacental with trophonemata and is unusual in that it does not form any type of egg covering except for mucous and jelly. Species that produce an egg case, candle case and egg envelope all share similar design features of the egg investment zone, e.g. a blown extrusion die complex that manipulates liquid crystal secretions in a spinerette zone to form complex lamellated structures. Secretory glands elaborate their products into secretory ducts that conveys the liquid crystal material through a spinerette region where baffle plates manipulate the secretory stream to produce the various lamellae. Secretory units ejects their products into transverse grooves that extend across the width of the gland. Adjacent secretory units thus form a part of each subsequent layer of the covering.

TRADE IN SHARKS AND SHARK PRODUCTS IN INDIA.

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With shark meat gaining popularity in both domestic and international market, sharks are being increasingly harvested all along the Indian coast. In many regions, growing trade in shark products like fins, liver oil, cartilage and skin has played a significant role in increased shark harvests. Such has been the rush in catching sharks, specially during the last five years, that over-exploitation is now begining to threaten the very survival of the species. Since much of the trade in shark meat and products is unregulated, intensive hunting for sharks is becoming environmentally and economically unsustainable. With hardly alittle known about the biological status of more than 50 species found in the Indian Ocean, vulnerability of the sharks to intensive harvesting can upset the marine ecology. The steady decrease in the size (length) of the sharks over the years is a clear indication that over-exploiation is beginning to leave a telling effect. Shark catches were earlier incidental. Sharks were in fact a by-product of fishing. In the absence of any demand for shark meat, all that the fishermen would do was to extract the fins and throw the maimed sharks back into the sea. But with the advent of sophisticated fishing trawlers and with increasing demand for export of shark products, sharks have emerged as a valuable catch. India is now emerging as a major destination for shark harvests. Trade in shark fins is fast multiplying. Thailand, Malaysia and Singapore are re-exporting unprocessed and processed fins in various forms to the western countries Hongkong, Japan, Europe and the United States have emerged as the major buyer of shark products. This paper will talk about the shark trade aspects in India. All out efforts to be made to ensure sustainable harvests of sharks. In the absence of any elaborate study on sharks this has been a pioneering effort.

REEF FISH COMMUNITY STRUCTURE WITHIN ATOLL LAGOONS IN FRENCH POLYNESIA (TUAMOTU ARCHIPELAGO).

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In order to relate the morphological characteristics of atolls to the functioning of their lagoons, ten atolls of contrasting morphology have been studied in the Tuamotu Archipelago, French Polynesia. Despite a great difference in total fish species richness between lagoons (41 to 224 spp), mainly related to atoll size, a general pattern of fish community structure was observed within lagoons. In all atoll lagoons, the species composition of the fish community was dominated by labrids, acanthurids, pomacentrids and scarids. Their global trophic structure consisted mainly of macrocarnivores (30% in weight), herbivores (30%) and piscivores (20%), whereas zooplanktivores represented only 8% of the fish biomass due to their small individual size. Fish distribution was highly heterogeneous in space, but consistent patterns have been evidenced in all lagoons, related to reef biotopes, wind exposure and depth. Species richness, density and biomass of fish were always the highest near passes and around pinnacles, medium near motu (vegetated parts of the atoll rim) and hoa (reef rim channels), and the lowest near the reef rim (unvegetated temporally immersed parts of the atoll rim). The trophic structure of the fish community differed in this last biotope with higher percentages of piscivores and macrocarnivores, and lower percentages of herbivores and corallivores. Fish distribution was also influenced by wind exposure, as fish assemblages were more diversified and numerous in the windward side of the lagoon (western part) than in the leeward side (eastern part). No difference in trophic structure was associated with difference in wind exposure. In the depth range studied (0-20 m), zooplanktivores and piscivores increased in density and biomass with depth, while the density and biomass of herbivores, corallivores and macrocarnivores were higher in shallow waters. A general model of within-lagoon fish distribution is proposed for the Tuamotu atolls.

COMPARATIVE OSTEOLOGY AND PHYLOGENY OF THE AMPHILIIDAE (TELEOSTEI: SILURIFORMES).

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A freshwater catfish family Amphiliidae (Amphiliinae + Doumeinae), had been reviewed based on the 99 osteological characters with out-groups composed of Sisoridae, Amblycipitidae and Diplomystidae. Results indicate that: 1) The Amphiliidae is not a monophyletic group, its two subfamilies are separated by *Euchiloglanis* (with most of the glyptosternoid fishes), *Glyptothorax* (with most of the non-glyptosternoid fishes of Sisoridae) and *Leptoglanis* (sister-group of *Zaireichthys*) of Bagridae; 2) no synapomorphies were found for subfamily Amphiliinae. In the group studied, *Paramphilius* is the most primitive genus except *Liobagrus* and Diplomystidae. 3) The five geenera of subfamily Doumeinae, constitute a monophyletic group. It forms the sister-group of a clade represented by *Glyptothorax* and *Liptoglanis*. The most primitive Doumeinae is *Doumea*.

A NEW SPECIES OF *ACANTHISTIUS* (PISCES: PERCIFORMES, SERRANIDAE) FROM SOUTH AFRICA, WITH COMMENTS ON THE CLASSIFICATION OF THE GENUS.

HEEMSTRA P.C.

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The serranid fish genus *Acanthistius* comprises about eight species occurring in the temperate waters of South Africa, Australia, New Zealand and South America. Two species are known from South Africa. *Acanthistius sebastoides* (Castelnau, 1861) occurs from False Bay (Cape of Good Hope) to Durban. A new species of *Acanthistius* from Kwazulu-Natal and the Eastern Cape Province of South Africa is described and differentiated from congeners in South Africa, Australia, New Zealand and South America. The new species differs from *Acanthistius sebastodes* by having distinct scales on the maxilla, fewer pectoral fin rays and in its colour pattern, which includees a black oval spot on the operculum.

IN SITU NOCTURNAL OBSERVATIONS OF REEF FISHES USING INFRARED VIDEO.

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In situ video using infrared illumination enabled observation and recording of behavior of reef-associated fishes during the night as well as the day. The imaging system consisted of a monochrome ultra-high resolution CCD chip compact camera in a waterproof housing. The camera was positioned on a reef and power was supplied from shore over a coaxial cable, which also returned the video signal to the laboratory where images were recorded on videotape. Illumination at night was provided by arrays of waterproof infrared illuminators. The remotely operated video system permitted observation of two crucial nocturnal behaviors of *Dascyllus trimaculatus*, the three-spot damselfish. First, it documented the arrival of new settlers from the plankton to the reef. Video images revealed that competent larvae appeared to use olfactory cues in their location of and settlement onto nursery habitat (sea anemones). Second, video observations enabled post-settlement interactions with conspecifics and predators to be documented. Nocturnal aggressive interactions with conspecifics were common and the frequency was positively related to the density of fish on an anemone. Several types of predators were active at night. However, while they frequently visited anemones, attacks on young damselfish were rare. Daytime recording under ambient light conditions revealed behavior of predatory fish that normally would be deterred by the presence of observers. Diurnal predators made successful attacks on young *D. trimaculatus* as they rose off the anemone into the water column to feed. The remote video system with night-time capabilities can shed light on activity of various predators throughout the 24 hour period. This information can help ascertain whether fish that disappear from a microhabitat patch have been consumed by a predator or have simply moved.

ACOUSTIC TELEMETRY OF TIGER SHARKS IN HAWAI'I.

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A series of shark attacks in Hawai'i prompted the funding of shark research and control programs. One of the primary goals of the research was to study the short and long term movements of large tiger sharks (*Galeocerdo cuvier*) in Hawaiian waters. Sharks were caught on longlines set overnight off the heavily populated south shore of O'ahu. All sharks were tagged with ID tags to study long term movements, and 9 individuals were tagged with acoustic transmitters and tracked for up to 50 hours. Initially small external dart tags were attached to the dorsal musculature. Later larger transmitters were successfully implanted into the body cavity. Eight out of 15 tiger sharks with internal transmitters have been detected by data loggers on the sea floor. The success of this research has led to an effort to develop archival acoustic tags, which will store information such as depth, water temperature, light intensity, etc. These data can then be sonically down loaded directly to the data loggers, doing away with the need to recapture the animal.

THE ENDANGERED JAPANESE FRESHWATER FISHES: AN OVERVIEW.

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The Japanese ichthyofauna in freshwaters is composed about 200 species, including 90 true freshwater fishes (primary and secondary) such as Cypriniformes and Siluriformes, and 110 peripheral freshwater fishes as Salmonoidei, Gobiidae and Cottoides. Geophyletically, the Japanese freshwater fishes are presumed to have originated from the orth Pacific, Siberia, China, Indochina, and the Japanese Archipelago itself; 80% of true freshwater fishes are smaller species belonging to China or Indochina lineages. Three Japanese formes, i.e. *Oncorynchus nerka kawamurai, Gnathopogon elongatus suwae*, and *Pungitius kaibarae* have already been extinct. Twenty rare species/forms on their way to extinction are classified into four categories based on gravity, viz. " endangereed ", " vulnerable ", " rare " and " local populations to be protected " in the so-called Japanese Red-list by the National Environmental Agency, 1991. Four " endangered " cyprinoids, *Tanakia tanago, Acheiolognathus longipinnis, Leptobotia curta*, and *Pseudobagrus ichikawai* were also designated as national natural treasure by the Culture Agency. Besides, the two former bitterlings get to be strictly protected under " the Law for the Conservation of Endangered Species of Wild Fauna and Flora and Administration for Nature Conservation. Causes to bring about the mass reduction of Japanese freshwater fishes in the present century, are also inferred in terms of biodiversity.

IDENTIFICATION OF ANGUILLID EELS BY GONADOTROPIN BETA-SUBUNIT GENE.

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To discriminate the species of anguillid eels, GNA fragments amplified from the genome of eight species of anguillid eels with polymerase chain reaction (PCR) were examined by restriction fragment length polymorphism (RFLP). Comparative RFLP analysis of the type II gonadotropin beta-subunit (GTH-b) genes revealed specific patterns of *Anguilla japonica* (HpaII) and *A. anguilla* (SphI and Nsi I), which could be used to distinguish them from the other 6 species of eels, *A. australis, A. bicolor bicolor, A. celebesensis, A. marmorata, A. reinhardtil* and *A. rostrata*. These findings suggest that the PCR/RFLP analysis of the GTH-b gene was a fast and sensitive method for the identification of *A. japonica* and *A. anguilla* from the other six speecies of anguillid eels.

"CARIDE" RE-VISITED.

HULLEY P.A.

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Between 1965 - 1971 and as part of a comprehensive study of tuna stocks, the Centre ORSTOM de Nouméa carried out a sampling programme in the equatorial and tropical Central South Pacific to investigate the distributions and trophic relationships of pelagic marine organisms. Sampling was undertaken mainly with a 10' Isaacs-Kidd midwater trawl, which was deployed during periods of daylight and darkness to a maximum of 1 700 m. The fishes taken during the cruises are now housed in the collections of the Muséum National d'Histoire Naturelle (Paris). The lanternfishes (family Myctophidae) from the CARIDE-1, CARIDE-2, CARIDE-3 and CARIDE-5 cruises have been re-examined in order to elucidate spatio-temporal variations in species richness, species and community structure, and distribution patterning within the region. The analyses presented are based on more than 34 000 myctophid specimens, taken between 00∞28'N - 14∞53'S, 135∞01'W - 155∞43'W and re-identified to 71 species in 17 genera. The results suggest that species diversity in equatorial waters is different to that in tropical waters, and that there is both seasonal and inter-annual variation in community structure.

COORDINATION AND STANDARDIZATION OF THE MANAGEMENT RULES FOR FISH COLLECTIONS.

HUREAU J.-C.

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For several centuries, the large Museums of natural history in the world, have had to face a huge increase of their collections in all fields of natural history: marine organisms, terrestrial arthropods and vertebrates, plants, geological and paleontological samples or ethnographical objects. Fishes do not except from this general rule, because of the frequent collecting expeditions and oceanographical cruises. Curators of Fish collections have to cooperate and coordinate their efforts in order to try to standardize their management rules. With the development of computerization of the data linked to the collections, an absolute precision in the collection of data must be approached. Even if non-written rules or tacit agreements already exist for fish collection management, it seems necessary to clarify some aspects of the relationships between the Museums. The aim of the present paper is to propose some simple rules that every curator should follow. A debate should take place within the present workshop in order to come to some general agreement.

BIOGEOGRAPHY OF THE NEARSHORE FISH FAUNA OF THE KIMBERLEY, WESTERN AUSTRALIA.

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The Kimberley region of Western Australia is inhabited by a distinctive though depauperate marine fish fauna. It consists mostly of species able to tolerate waters of high turbidity and strong tidal flow. Many of its species range across the coastline of Australia's northern half, reaching as far south as Shark Bay on the west coast and south-eastern Queensland on the east coast. However, a number of species are endemic to north-western Australia, while other typical Queensland species occur no where else in Western Australia other than the Kimberley. Analysis of these distributions supports the division of the Kimberley into three biogeographic zones: northeast Kimberley, northern Kimberley, and southwest Kimberley. The relationships between the Kimberley fauna and other parts of northern Australia are also explored.

CLONING AND MOLECULAR CHARACTERIZATION OF THE ZEBRAFISH UV OPSIN.

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To fully appreciate the development and functioning of any visual system, a combination of morphological, electrophysiological, and molecular approaches need to be applied. My lab is currently investigating the development of the zebrafish retina and the various consequences of genetic and environmentally-induced retinal degeneration. The zebrafish retina contains rods and three different cone photoreceptor cell types, with each cell type likely expressing a single, unique opsin molecule. Electroretinograms of zebrafish reveal that they possess the capability to detect ultraviolet wavelengths of light. Several lines of experimentation have suggested that the short cones express an UV-sensitive opsin, the long cones express a blue-sensitive opsin, and the double cones express a red-sensitive and green-sensitive opsin in adjacent outer segments. We used a PCR-based strategy to clone the UV opsin gene from zebrafish to address the temporal and spatial distribution of this pigment. The zebrafish UV opsin possesses 85% amino acid identity to the goldfish UV opsin. We generated a rabbit polyclonal antisera generated against an amino terminus peptide of the UV opsin to examine the expression of the UV opsin in the zebrafish retina. We determined the specificity of the UV opsin antisera on immunoblots and by immunohistochemical localization. The antisera stains only the short single cone outer segments. We used the antisera to examine the temporal expression of the UV opsin in the developing retina relative to the rod and other cone opsins. We also used the antisera to determine the status of the UV-sensitive cones in response to intense light treatment, which results in retinal degeneration.

GENETIC STATUS AND CONSERVATION STRATEGY FOR ENDANGERED ISLAND POPULATIONS OF AN OSMEROID FISH (*PLECOGLOSSUS*).

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The ayu *Plecoglossus altivelis* inhabiting in the Ryukyu Islands is known to differ from those of the Japan Islands in some behavioral, morphological and genetic characteristics, and was described as subspecies, Ryukyu-ayu *P. a. riykyuensis* in 1988. The Ryukyu-ayu has already extincted from Okinawa Island and currently occurs only on Amami-oshima Island with rapid reduction in the number in recent years. Ryukyu-ayu on Amami-oshima Islands includes geographically separated populations in the western and eastern parts of the island. We examined their genetic status by using mtDNA sequence analysis. The nucleotide diversity in the first half of the control region was considerably low in both populations, in which only 6 haplotypes were found. Complete nucleotide substitutions between the two populations were found in the control region as well as in the NADH dehydrogenase subunit 4 gene region, indicating that the two popultions are substantially independent from each other. The genetic heterogeneity in Ryukyu-ayu on Amami-oshima Island should be taken into account in conservation precedures for this endangered subspecies.

REVISION OF THE DEEP-WATER FISHES OF THE GENUS *OWSTONIA* (CEPOLIDAE, PERCIFORMES).

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Fishes of the genus *Owstonia* Tanaka (1908), belonging to the Cepolidae, are characterized by having a deep body, large head, large eyes, oblique mouth, and an elongate, pointed caudal fin. They occur in deep water (200-400 m) in the Indo-Pacific. Some workers regard genus *Sphenanthias* as a synonym of *Owstonia*, but others recognize the 2 genera as distinct. This study reveals that *Owstonia* may be distinguished from *Sphenanthias* by the following characters: *Owstonia* has a deeper body (27.9-38.7% SL vs. 13.0-24.9% SL) and longer head (25.1-35.5% SL vs. 14.9-23.9% SL) than *Sphenanthias*. *Owstonia* is represented by 11 species being divided into 3 groups. Group 1 has serrations on the preopercle and the lateral lines on both sides are joined together just in front of the dorsal fin. Group 1 includes 4 species: *O. totomiensis* Tanaka, 1908 from Japan, *O. weberi* (Gilchrist, 1922) from Kenya to Mozambique, *O. maccullochi* Whitley, 1934 from Australia, and *O. dorypterus* (Fowler, 1934) from the Philippines and Indonesia. Group 2 has serrations on the preopercle and unconnected lateral lines, and includes 4 species: *O. japonica* Kamohara, 1935 from Japan, *O. tosaensis* Kamohara, 1934 from Japan, *O. macrophthalmus* (Fourmanoir, 1985) from the Philippines and *O. nigromarginatus* (Fourmanoir, 1985) from the Philippines. Group 3 has no serrations on the preopercle and unconnected lateral lines. It includes *O. grammodon* (Fowler, 1934) from Indonesia, *O. simoterus* (Smith, 1968) from Africa, and *Owstonia* sp., an undescribed *Owstonia* collected from Japan and Australia. This latter species differs from other *Owstonia* species by the following character combination: unbranched dorsal fin rays 1-3, gill rakers 34-39, and lateral line scales 25-39.

BIOLOGY OF THE MANTA RAY *MANTA BIROSTRIS* WALBAUM IN THE INDO-PACIFIC.

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Manta ray, *Manta birostris* is a circumtropical big mobulid ray and monospecific in the genus in contrast to ten species in the genus *Mobula*. Using an identification method based on a combination of patterns of ventral markings and other marks, we could clarify some biological features of the species occurring along the Japanese Archipelago, i.e., migration, schooling, mating behavior including copulation, reproduction, age and feeding. The feeding habit was also surveyed based on the manta rays in captivity in the Okinawa Expo Aquarium. The manta rays, whose ventral surface is dark are called "black mantas" and are observed in the whole Pacific Ocean. Based on the information concerning the black mantas, we have compiled the range of the black mantas in the Pacific. Fisheries targeting the manta rays are found on both sides of the Pacific i.e., coastal waters of Mexico and channels of some Philippine islands. It should be clarified how far those fisheries may threat the population of the manta rays.

REDESCRIPTION OF *GERRES BACONENSIS* (EVERMANN AND SEALE, 1907) AND *G. EQUULA* SCHLEGEL, 1844 IN THE *G. OYENA* COMPLEX (TELEOSTEI: PERCIFORMES: GERREIDAE).

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Gerres baconensis (Evermann and Seale, 1907) and *G. equula* Schlegel, 1844 are redescribed as valid gerreid species from the Indo-West Pacific. The former is currently known only from the Ogasawara (=Bonin) Islands, Japan and Bacon, Panay Island, Philippines and the latter is only from southern Japan (except in the Ryukyu Islands) and southern Korea. Although these species are very similar to *G. oyena* (Forsskal, 1775), having been widely known from the Indo-West Pacific, *G. baconensis* differs from *G. oyena* in having a groove between intermaxillary processes fully scaled in specimens over ca. 160 mm in standard length (SL), being partially so in specimens from ca. 100 mm SL, and then, squamated area expanding around the groove by 160 mm SL (vs. scaleless), and 7-9 (usually 8 or 9), lower gill rakers (vs. 7). *G. equula* differs from *G. oyena* in shorter second dorsal and anal fin spines, smaller eyelid inside diameter, lower caudal peduncle depth and lower body depth at first anal fin spine. These differences between *G. equula* and *G. oyena* become outstanding, especially in specimens over ca. 150 mm SL. The three species comprise the *G. oyena* complex of the genus *Gerres*.

JUVENILE OREOSOMATIDS - BIZARRE AND STILL LARGELY UNKNOWN.

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The family Oreosomatidae (or deepwater oreos) occurs predominantly in temperate waters of the southern oceans, although occasional specimens of several species are known from tropical and northern hemisphere oceans. While the adults of several species are an important catch in deepwater trawl fisheries, particularly around New Zealand and Australia, the juveniles are rarely encountered. After more than 20 years of regular fisheries research cruises in Australasian waters, only a few juveniles of some species have been collected. This poster describes what is currently known of the distribution and life history of these bizarre pelagic juvenile oreosomatids in the Australasian region.

THE ESTUARINE FISHES OF THE THA-CHIN RIVER, SAMUT SAKORN THAILAND.

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The investigation of estuarine fishes was carried out between May and August of 1997 by using 33 HP engine-pushing net (6.5 m. wide, 16.0 long and cod end = 1.5 cm.) in the mouth of Tha-chin River, in the gulf of Thailand. Abiotic factor, however, such as depth, temperature, salinity , pH and distance from shoreline were also recorded. Fishes were ttained from 7 stations (both day and night collections) belong to 24 families 35 genera and 42 species. Most of fishes were relatively small in size and at immature stage. Fishes of family Ambassidae, *Ambassis gymnocephala* was the most abundant in term of number and the family Polynemidae, *Eleutheronema tetradactylum* was the most abundant in term of biomass. There were slight differences between fish diversity at night and day collection. Several species are economically important. Although the studied site is situated in a polluted area, fish are rather abundant in both biomass and species composition. However, this study should be continued in order to gain more information for monitoring the environment.

SOCIAL RELATIONSHIPS BETWEEN *PLECOGLOSSUS ALTIVELIS* (OSMERIDAE) AND *TRIBOLODON HAKONENSIS* (CYPRINIDAE) UNDER ENVIRONMENTAL STRESS.

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Plecoglossus altivelis and *Tribolodon hakonensis* are dominant species in Japanese rivers although their social relationships have not been investigated. We divided 28.0 m length of a stream into 8 blocks with an equal area (3.5x1.7 m), and released 10 *P. altivelis* in 2 blocks, 10 *T. hakonensis* in 2 blocks, and 10 *P. altivelis* and *10 T. hakonensis* in 2 blocks. The other 2 blocks contained no fish. Experiments lasted from 29 June to 11 September in 1993 during which a total of 1125 minutes of observations were made. The two species exhibited aggression against conspecifics in every block. When the two species were encountered in the same block, *P. altivelis* occasionally attacked *T. hakonensis*. *P. altivelis* principally grazed algae, whereas *T. hakonensis* were omnivorous, feeding upon both algae and invertebrates. The feeding menu of P. altivelis was not affected by the presence of *T. hakonensis*, but *T. hakonensis* exhibited few algal feedings when they coexisted with *P. altivelis*. The growth rate of *P. altivelis* in blocks with *T. hakonensis* was significantly greater than that in blocks without *T. hakonensis*. The number of aquatic insects was significantly decreased by *T. hakonensis* foraging. Because most aquatic insects feed upon algae, the decrease of aquatic insects by *T. hakonensis* might benefit *P. altivelis* by increasing algal production.

OLFACTORY EPITHELIIUM OF LARVAL SCOMBRIFORM FISHES.

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Although it is known that each species in teleost fishes has different cell structures of olfactory epithelium, developmental process have poorly been investigated. There are no report about transition of the cell structure in marine fishes. We observed olfactory epithelium of scombriform fishes with SEM, including 3 families: Scombridae, Gempylidae and Trichiuridae during larval stage, as a part of our study on early life development of these fishes. Most of larval scombriform fishes shared common characteristics, the continuous sensory epithelium with 3 kinds of olfactory cells: Type1 ciliated cell, Type2 ciliated cell and microvillous cell. Rod cell known to be possessed by adults was not observed during this stage. These characters may reflect a common system in these fishes. It is known that Type1 ciliated cell, also called "ciliated non-receptor cell" is not sensory cell, produces a water current in nasal cavity. The conspicuous development of Type1 ciliated cell in these scombriform larvae may suggest the adaptation for the pelagic stage. On the other hand, it is known that the open sea adult Scombridae fishes, for example tunas, have no Type1 ciliated cell. In these fishes, the adults with high-speed swimming ability may not need Type1 ciliated cell to produce nasal cavity current.

CLONE FORMATION IN THE WILD POPULATION OF THE JAPANESE ROSY BITTERLING, *RHODEUS OCELLATUS KURUMEUS.*

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Rhodeus ocellatus kurumeus, an endemic subspecies of *R. ocellatus* to Japan, is on the verge of extinction, because it easily hybridizes with its type subspecies, *R. o. ocellatus* accidentally introduced from China before World War II, in the natural environment. So, it is currently found only in some very restricted waters. In Yao City, Osaka, there remains a single population of *R. o. kurumeus*. Compared with other populations of *R. o. kurumeus* and *R. o. ocellatus*, Yao population is characterized and evidently discriminated in the following characters; small body size, luminescent body coloration, low survival and small clutch size. This population is being kept in a few small ponds, located on mountain slope at the high altitude and completely isolated from neighboring drainages. These observations suggest that morphological deterioration in Yao population was caused by over-inbreeding. Little genetic variation was recognized in the scale graft experiment and the DNA fingerprinting. Hence the wild population of *R. o. kurumeus* in Yao proved nearly to be a clone population. This would be the first report of clone formation in fishes, owing to over-inbreeding, in the natural environment.

THE LARVAL FISH COMMUNITY STRUCTURE IN THE SOUTHERN PART OF THE EAST KOREAN SEA, IN SUMMER.

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A study of the community structure of larval fish was conducted in the southern part of the East Sea, Korea during August 1993. A total of 125 species were found from 47 sampling stations. Among them *Engraulis japonicus* was the most dominant species (3,078 indivi./10m2) comprising 84.3% of the total fish larvae collected and followed by *Maurolicus muelleri* (280 indivi./10m2) accounting for 7.7%. Sampling stations were classified into three groups using a cluster analysis based on the abundance of fish family except for Gonostomatidae. The larval fish were more abundant in the stations within the site Group I, located in the center of the Tsushima Current, than those in the site Group II and III which cover the marginal areas of the Tsushima Current and Korean coastal waters. *Engraulis japonicus* was more abundant in the stations Group III. The site grouping of the sampling stations by a discriminant analysis using the environmental factors (temperature, salinity, chlorophyll *a* and dissolved oxygen) revealed 14.5% difference which appears not to be very significant from that by the cluster analysis using the family composition. This may imply that distribution of the larval fish in the study area is mainly influenced by environmental conditions.

FISHES OF A SHALLOW TROPICAL MANGROVE CREEK AND BAY, GAZI, KENYA.

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Fish sampled in an estuarine mangrove fringed soft silt bottom site, mangrove fringed sandy bottom interspersed with seagrass site and muddy sand seagrass covered site in Gazi creek and bay using a beachseine net are described and compared with similar communities. A total of 128 teleost fish species belonging to 50 families were identified in samples collected in twelve months. Gerridae, Atherinidae and Clupeidae dominated the catches making 78.5 % of the total fish number caught. Juveniles were found for 63% of the species. Reef associated fish species represented 44% of the total species number. Mean species were similar in the 3 sites sampled. Mean relative fish density and biomass were higher in the seagrass sites than in the mangrove fringed soft silt bottom site. Ecological diversity indices were higher in the mangrove fringed soft silt bottom site than in the seagrass sites. Mean Species were higher in June and February. However, there was no statistical difference in site and monthly data because of the high variation of catches. Majority of the commercial fish families sought by fishers were represented in the samples.

REVISION OF THE GENUS *GAZZA* (PERCIFORMES: LEIOGNATHIDAE).

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The leiognathid fish genus *Gazza* is restricted to Indo-West Pacific, inhabiting sandy or muddy bottom areas including estuaries. The genus characterized by having anteriorly protractible mouth and large canine-like teeth on upper jaw comprises five species: *G. minuta* (Bloch), *G. dentex* (Valenciennes), *G. achlamys* Jordan & Starks and two undescribed species. Their diagnostic characters and distributional areas in parentheses are as follows. *G. minuta*: breast naked; continuous squamated area on the anterior dorsolateral surface of body extending anteriorly beyond vertical through the posterior tip of sensory canal on the temporal; the slivery area between upper jaw and orbit narrow; supraorbital ridge serrated (east coast of Africa to Micronesia and Okinawa, Japan). *G. dentex*: breast naked; continuous squamation area on anterior dorsolateral surface of body reaching or close to vertical through the posterior tip of the sensory canal on the temporal; the silvery area wide, its distal part adjoining orbit; supraorbital ridge slightly serrated (Seychelles, Mauritius, Indonesia and northern Australia). *G. achlamys*: breast and dorsolateral surface of body anterior to base of the sixth or seventh dorsal-fin spine naked; supraorbital ridge slightly serrated; neural and hemal spines of the fifth preural centrum slender oar-like shaped (Sri Lanka to Papua New Guinea). *G.* sp. 1: breast naked; continuous squamated area on the anterior dorsolateral surface of body not reaching to vertical through the posterior tip of sensory canal on the temporal; the slivery area narrow; supraorbital ridge serrated (Sri Lanka to Micronesia; Iriomote I., Japan). *G.* sp. 2: breast partly scaled, scaled area on anterior ventrolateral surface of body extending anteriorly beyond the line from pectoral fin base to pelvic-fin origin; the silvery area narrow; supraorbital ridge smooth (Kenya and Mozambique).

INTERRELATION OF ICHTHYOFAUNA FROM A SEAGRASS MEADOW AND CORAL REEF IN THE PHILIPPINES.

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Tropical seagrass meadows associated with coral reefs are utilised both daily and seasonally as feeding ground and nursery area by reef fishes. The interrelation of seagrass meadow and coral reef ichthy- ofauna was studied in Malatapay, Negros Oriental, Philippines. Sampling was conducted with a beach seine in a seagrass bed at two distances (50 m and 250 m) from a coral reef at day and night. 109 species from 66 genera and 39 families were identified. Hierarchical clustering by Bray-Curtis similarity of the four sampling sites shows a day and a night group with sub-groups depending on distance to the coral reef. Ordination of samples by multi-dimensional scaling (MDS) confirm the pattern. Hierarchical clustering by Bray-Curtis similarity of species separates the ichthyofauna in a day and night active group. Diurnally active species belong to the families Labridae, Scaridae, Siganidae, Mullidae, Pomacentridae and Gobiidae. Nocturnally active species belong to the families Bothidae, Soleidae, Callionymidae, Scorpaenidae, Lethrinidae, Plotosidae and migrating Apogonidae, Holocentridae, Diodontidae, Congridae, Muraenidae, Ophichtidae and Tetraodontidae. Length frequencies indicate that Mullidae, Scorpaenidae, Lethrinidae and Plotosidae utilise the seagrass bed as a nursery area. Additional observations by the visual census technique support this results. Margalef index for species richness is significantly higher at night (2,97) than at day (2,81) and higher in a distance of 50 m (2,93) than in a distance of 250 m (2,86) to the coral reef. This demonstrates the high influence of coral reef fishes on the seagrass meadow ichthyofauna in the immediate vicinity of the coral reef.

FISHING OR COUNTING? A COMPARISON OF BEACH SEINING AND VISUAL CENSUS IN A SEAGRASS MEADOW.

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The visual census technique is a non destructive method for the estimate of fish populations, specially in coral reefs and protected areas. The quality of population estimates depends on visibility, structure of the habitat, behaviour of fishes and experience of the diver. Adequate fishing methods for a habitat are less problematic, but entail more logistical organisation for fishing gear, boat and personnel. In this study sampling of seagrass meadow ichthyofauna was conducted with a beach seine and the visual census technique. The different methods of sampling lead to divergent pictures of the seagrass fish community. Beach seining recorded 109 species, visual census only 48 species of fishes. There were also differences in the abundance of the main families. Most abundant families in beach seine catches were Labridae (50,2 %), Apogonidae (15,7 %), Lethrinidae (7,9 %), Scaridae (7,3 %) and Bothidae (5,3 %). Records by the visual census technique showed the following ranking in abundance: Pomacentridae (33,0 %), Siganidae (17,8 %), Plotosidae (16,3 %), Labridae (15,2 %) and Apogonidae (12,8 %). Fast swimming species like *Siganus canaliculatus* (Siganidae) and *Cheilio inermis* (Labridae) were able to escape out of the slowly pulled beach seine and were underestimated with this method. The visual census technique underestimated the well camouflaged species of the families Labridae and Scaridae and was not able to detect cryptic families like Bothidae. In this study beach seining provided the best data about the structure of the seagrass meadow ichthyofauna and the visual census technique supported additional data. Both techniques together are recommended to investigate the structure of the seagrass meadow ichthyofauna.

ONTOGENETIC DEVELOPMENT OF THE WEBERIAN OSSICLES IN THE BLACK-TETRA, *GYMNOCORYMBUS TERNETZI* (CHARACIFORMES: CHARACIDAE).

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Development of the Weberian apparatus and associated bones on the first to fifth vertebrae (vertebrae 1-5) is described for laboratory-reared larvae and juveniles of black-tetra, *Gymnocorymbus ternetzi*. The origin and homology of the Weberian ossicles are discussed and compared with those of cypriniform and siluriform fishes. The smallest specimen having Weberian-related elements was 4.81 mm BL, two cartilaginous basidorsals being observed in the positions of vertebrae 4 and 5. A small bony claustrum, the last-appearing Weberian element, was first seen at 9.96 mm BL. Dorsal elements of the scaphium, intercalarium and neural arches 3-5 were derived from cartilaginous basidorsals 1-5, respectively. Bony parapophyses appeared on the lateral aspects of vertebrae 2-4. No basiventrals were observed on vertebrae 1 and 2, and no ribs on vertebrae 1-4. The tripus and os suspensorium originated from parapophyses and basiventrals on vertebrae 3 and 4, respectively. Based on the developmental modes and shapes of the Weberian ossicles, the black-tetra was determined as possessing a mosaic of characters pecculiar to both cypriniforms and siluriforms, indicating a phyletic position intermediate between the latter two taxonomic groups.

LARVAE OF THE PACIFIC TILEFISH GENUS *HOPLOLATILUS* (PERCOIDEI: MALACANTHIDAE) WITH A COMMENT ON THE GENERIC MONOPHYLY.

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Larval developments of three species of tilefishes (genus *Hoplolatilus*) mostly from the western North Pacific are studied. They are referred to *H. chlupatyi*, *H.* sp. (possibly *H. fronticinctus* or *H. pohle*) and *H. cuniculus*. Larval specimens of *Hoplolatilus* are characterized by having a robust body, elaborate head spination and spinous scales. Both *H. chlupatyi* and *H.* sp. possessing the same fin ray counts have a remarkably elongate, serrate spine on the posttemporal, preopercle at angle and rostral portion. On the both sides of the frontals, there is a series of serrate ridges arranged in the concentrically rhombic shape. The rostral spine initially appears as a pair of small spines at the anterior tips of the nasal bones, but they become fused by a bony ridge later. *Hoplolatilus* sp. is distinguishable from *H. chlupatyi* in having a higher body and feature of the slower fusion of the rostral spines. Head spination of *H. cuniculus* is nearly similar in configuration and arrangement to that of malacanthid *Branchiostegus*: the posttemporal, preopercle and nasal spines are not considerably prolonged, and a series of serrate ridges on the frontal is radiate fanshape. The differences of larval head spination between *H. chlupatyi* and *H.* sp., and *H. cuniculus* pose a question concerning the monophyly of the genus.

THE ICHTHYOFAUNA OF THE ARABIAN GULF - TROPICAL MARINE FISHES IN AN EXTREME ENVIRONMENT.

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The fish species composition in the Arabian Gulf is reviewed and factors limiting biological diversity are discussed. Systematic research on the fishes of the area started in the first half of this century along the Iranian shores, while most of the more recent studies have been conducted on the Arabian side, with a significant increase in research activities following the 1991 Gulf War. To date about 540 fish species belonging to 118 families are known from the Gulf. This number is low compared to other branches of the tropical Indo-Pacific, such as the Red Sea which harbours more than twice this number of species. The shallowness of the Gulf, the comparatively low structural complexity of its habitats, extreme seasonal fluctuations in temperature and high salinity are limiting the species richness. The fish fauna is young in geological terms, with limited time for speciation processes. About 20 fish species are known exclusively from the Gulf. In many cases their distribution pattern is insufficiently clear and endemism is probably less than 2 %. In addition to unstable, naturally stressful conditions, where many species are living close to the limit of their ecological tolerance, human pressure is increasing rapidly. Fish populations have recovered from the effects of the 1991 oil spill, but they still are exposed to chronic oil pollution, development and fishing pressure.

STOCK ASSESSMENT OF COMMERCIAL FISHES IN THE NORTHERN NEW CALEDONIAN LAGOONS. 2 - LAGOON BOTTOM AND NEAR REEF FISHES.

KULBICKI M., LABROSSE P. & Y. LETOURNEUR

ORSTOM, Nouméa, Nouvelle-Calédonie

The northern part of New Caledonia was sampled using bottom longlines and handlines. A total of 90 longlines stations (2 lines with 100 hooks each) were sampled, and 399 handlines stations were performed using a standard protocol. Longline stations were set 3 miles apart on lagoon bottoms and handline stations 2 miles apart near reefs. Underwater visual censuses (UVC) were performed on 18 longline stations and in the vicinity of 100 handline stations. Handlines captured more Lutjanidae and less Carangidae than longlines. Handlines tended also to catch smaller fishes. Handlines and longlines indicated strong differences in catch composition and fish size between regions and between biotopes, the northern part of the lagoon yielding higher CPUE for most species. Correlations between longline or handline CPUE and biomass estimates from UVC were significant. This allowed to make biomass estimates from CPUE data. Biomass of line-fish ranged from 4 to 15 g/m2. From these biomass estimates it was then possible to calculate stock estimates for total line-fish stock and separately for the major species. Near reefs, the stock was estimated at 13 500 tons, and on lagoon bottoms the stock was 61 000 tons. Biomass estimates are compared with values from other areas in New Caledonia and the Indo-Pacific.

STRUCTURE OF THE REEF FISH COMMUNITIES IN TONGA TAPU.

KULBICKI M. & G. MOU-THAM

ORSTOM, Nouméa, Nouvelle-Calédonie

A survey using underwater visual transects (UVC) was conducted on the reefs north of Tonga Tapu. A total of 46 transects were performed. Species richness averaged 49 species/transect (range 22 - 76), average density was 3.3 fish /m2 (range 0.7 - 9.7) and average biomass was 128 g/m2 (range 21 - 828). Winward stations had higher values than leeward stations. These differences were higher than differences between reef types (fringing, middle lagoon or barrier reefs). Species richness was dominated by microherbivorous and carnivorous species. Species with a size between 8 and 15cm were the most diverse. There was approximatively the same number of sedentary and mobile species. Schooling species did not make a large number of the species. Density was dominated by zooplanktivores and microherbivores. Fish density was essentially composed of sedentary fish and of small size (less than 15 cm). Biomass was dominated by microherbivores, the second important group being macrocarnivores. The biomass was mainly composed of mobile species and fish of average (8-15cm) to large size (15-30cm). There were only minor differences in the structure of the assemblages according to exposition or type of reef. Fish parameters were essentially correlated to depth and coral cover. Piscivores and macrocarnivores were correlated to soft substrates and deeper waters. Microcarnivores and microherbivores were found mainly over hard bottoms in shallow waters. Zooplanctivores increased with depth, whilst microcarnivores displayed the opposite pattern. Fish size, gregarity and mobility were little correlated to environmental parameters. These data are compared to similar data sets from New Caledonia and French Polynesia.

STOCK ASSESSMENT OF COMMERCIAL FISHES IN THE NORTHERN NEW CALEDONIAN LAGOONS. 3: LINKS BETWEEN FIELD DATA AND SOCIO-ECONOMIC ASPECTS OF THE FISHERY.

LABROSSE P., LETOURNEUR Y., KULBICKI M. & J. R. PADDON

ORSTOM, Nouméa, Nouvelle-Calédonie

At the request of the Northern Province of New Caledonia, ORSTOM undertook an assessment of the commercial demersal fish stocks of the northern lagoons of New Caledonia. The area studied covers approximatively 10 000 km2 and can be divided into three lagoons, North, East and West. Fishing effort was estimated by two methods. Directly by analyzing fishermen's log books, indirectly by a study of the human fish consumption in this area. This consumption was obtained from data from a large survey conducted by the ITSEE (Territorial Institute of Statistical and Economical Surveys). Fishing effort and catch data could thus be estimated for each lagoon and could to some extent be further detailled down to the major fish groups. These informations were correlated with data from experimental surveys of the reef and lagoon commercial fishes. In particular, estimates of fishing effort and catch were linked to total stock estimates and helped to calculate MSY values per lagoon and for the major fish groups. In 1996, The total MSY was about 14 000 tons which was 10% of the estimated total stock (138 000 tons). This estimated MSY was ten times greater than the current yields (1 330 tons). The stocks of commercial fishes were general not endangered, but on some reef biotopes and some line-species MSYs were probably reached or exceeded. An analysis of the social-economical aspects of this fishery (potential market and consumption, economical structure of the fishery) showed also that the available methods for estimating catch and fishing effort in this area were not adequate and that new ways of estimating these parameters were needed for management actions.

A NEW DATABASE ON THE BIOLOGY AND ECOLOGY OF LAGOONAL AND REEFAL FISHES OF THE SOUTH PACIFIC.

LABROSSE P., LETOURNEUR Y., KULBICKI M .& F. MAGRON

ORSTOM, Nouméa, Nouvelle-Calédonie

FISHEYE is a database currently developed at the ORSTOM Center of Nouméa. The main objectives of this database are to provide information on several aspects of the biology of numerous fish species (such as reproduction, diet, length-weight relationships, etc) and the ecology of fish communities and/or populations (species richness, densities, biomasses, different types of structures, etc). FISHEYE includes data issued from various types of sampling (visual censuses, trawling, rotenone poisoning, gill netting, handline fishing, lagoonal bottom long-line fishing) monitored by ORSTOM since 1985 in various locations, mainly New Caledonia, but also Chesterfield Islands, French Polynesia, Indonesia and Tonga. Different from a CD-Rom which has a fixed content, FISHEYE is a dynamic database, because new records are constantly added and new types of presentation of the results may be developed. Summary information is derived on demand directly from the original data. The addition of data from Fiji is likely in a near future.

COMPARATIVE BIOGEOGRAPHY OF CHONDRICHTHYANS OF THE TROPICAL SOUTH-EAST INDIAN AND SOUTH-WEST PACIFIC OCEANS.

LAST P. R. & B. SÉRET

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The tropical Australasian region, which includes Australia, New Caledonia, New Guinea, and the eastern sector of the Indonesian Archipelago, breaches two major ocean basins. Its complex palaeohistory is strongly reflected in the size and structure of its chondrichthyan fauna where almost a third of the world's fauna (more than 300 species) occurs. The western (Indian Ocean) and eastern sectors (Pacific Ocean) each have surprisingly high levels of subregional endemicity that are evident at both sector and subsector levels. Despite poorer sampling efforts off Indonesia, diversity was found to be significantly greater in the Indian Ocean than the Pacific reflecting a strong regional influence of the mega-diverse Indo-West Pacific biota. The strength of widely distributed Indian Ocean elements diminishes from west to east across the region but it is still stronger off New Caledonia than the Pacific component reflecting the comparatively low biodiversity of the Pacific Plate. Tropical Australian subregions in both oceans are penetrated by substantial components from temperate areas to the south of which about half of the species are endemic to their respective oceans. Greatest biodiversity exists within demersal habitats with the continental slopes being slightly richer in species than the shelves adjacent. Slope habitats also exhibit higher levels of endemicity than shallow water habitats challenging the generality of the depth-dispersal paradigm. Recent French and Australian deepwater surveys of the region have provided new insights into the composition, structure and origins of this fauna.

SEXUAL PATTERN OF *NEMIPTERUS VIRGATUS* AND *N. JAPONICUS.*

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Threadfin bream (Nemipteridae) have rarely been studied for their sexual pattern despite the diverse sexuality found in allied families such as the sparids and lethrinids. The gonads of both *Nemipterus virgatus* and *N. japonicus* were studied histologically and the functional sexual pattern determined. Both *N. virgatus* and *N. japonicus* are functionally gonochoristic. However, testicular structure in all individuals of both species has a dorsal accessory duct structure which is determined to be homologous to the ovary. Based on the three types of evidence: morphology, ontogeny and cytology. If so, both *N. virgatus* and *N. japonicus* have functional male individuals which bear non-functional female gonad structure. These species may be considered as "rudimentary hermaphrodites" and are unusual in that all adult males retain a distinct rudimentary female-like phase. This condition in these functional gonochores may well reflect a hermaphroditic ancestry to the lutjanoid fishes.

FACTUAL DATABASE OF COASTAL FISH IN KOREA.

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The construction of a variety of scientific databases has been sponsored by the Korean R&D Information Center (KORDIC) in order to promote the exchange of scientific data. Under this program, we began to construct a Factual Database on Coastal Fish of Korea. Recently, fish catches in Korean waters tend to decline. It is suggested that this decline is related to the over-exploitation and destruction of nearshore nursery grounds by reclamation and water pollution. Many studies have been performed about environmental impacts on fish populations. However, only a few results have been published because many of these studies have been conducted by private companies to obtain authorization from the government for reclamation or other purposes. Our Factual Database tries to address this problem. Input data include species names, location (latitude and longitude), sampling time (month of year), method (gear, mesh size, area sampled), source (author, journal published), etc. When the fish database is established, users can retrieve species composition of fish vs. time by selecting the location on the map. Also, users can obtain the geographic distribution of selected species, morphological characteristics and general ecology. Our final goal is to create a factual database of spatio-temporal species composition and/or taxonomic data of coastal fish of Korea.

AGE AND GROWTH OF JAPANESE EEL LEPTOCEPHALI.

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Age and larval growth of Japanese eel (*Anguilla japonica*) were determined using leptocephali collected during the Hakuho-Maru Cruise, Ocean Research Institute, University of Tokyo in June 1991 around its spawning ground (14-17oN, 134-141oE). Samples were collected by IKMT with mouth opening of 8.7m2 and mesh size of 0.5 or 1mm. The net was obliquely towed up to the depth of 150 to 300m. The leptocephali collected between July 1 and 3 were composed of two size groups in length ranges of 10.2-16.0mm (12.7 - 1.42mm, Mean - SD) and 20.8-24.2mm (22.8 - 1.20mm). Two size groups were also distinct in July 15 to 18 samples: 16.8-20.2mm (18.61.12mm) and 27.0-32.7mm (28.9 - 1.77mm). The size increased ca. 5mm between two sampling periods with an interval of ca. 15 d regardless of size groups. The difference in length between two groups in each period was 10mm. It implies that the larvae were released in a month interval. Age was determined using daily growth increments in otoliths of 69 leptocepahli. Otoliths of leptocephali consisted of three distinct zones; 1) prehatching zone consisting of a central primordium surrounded by hatch mark, 2) preleptocephalus zone showing calcium rich thick ring between hatch check and yolk-sac absorption mark and 3) leptocephalus zone outside the yolk-sac absorption mark. Barely discernible 11 to 13 growth increments were deposited in the preleptocephalus zone. Growth increments in leptocephlaus zone were clearly seen under SEM. The age of leptocephali collected between July 1 and 3 was 21.4 - 0.9 d in the small sized group and 47.0 - 2.53 d in the large sized group. The age of July 15 to 18 samples was 36.00.85 d in the small size group and 63.0 - 1.89 d in the large one. Total length (L) was linearly related to otolith radius (R); $L = 3.53 + 0.47\ R$ ($r2 = 0.92$). Growth in total length could be represented by Von Bertalanffy curve; $L(t) = 79.4\ \{1 - \exp\{-0.0065(t+5.17)\}\}$ ($r2 = 0.95$).

COMPLEX BEHAVIOUR BY CORAL-REEF FISH LARVAE IN THE PELAGIC AND NEAR-REEF ENVIRONMENT.

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We present *in situ* observations of larvae of coral-reef fishes feeding, schooling and being preyed upon. In addition, we report on their behavioural interactions with adult and juvenile fishes. Observations on over 500 larvae of over 50 species near the end of their pelagic stage were made in both pelagic and near-reef environments. Nearly 10% of larvae were seen to feed in the pelagic environment, but <1% fed near the reef. Presettlement schooling was observed in four species of three families. We observed no predation upon larvae in open water (>1 km offshore) except near the bottom. Near the reef, 8.5% of larvae were eaten. The main predators near and on the reef were a species of wrasse and lizardfishes. Rates of predation seem to differ among genera of pomacentrids, perhaps related to differences in behaviour when settling. When confronted with adult fishes, which happened largely near the reef, larvae reacted with a limited range of behaviours, including sheltering near the observer, swimming to the surface, slowing or stopping, or swimming offshore. The frequency of these behaviours differed among larvae of three pomacentrid genera. Interactions with reef residents, particularly pomacentrids, were common, and usually involved aggression by the resident toward settling larvae. This may act to discourage settlement during the day when such residents are active. These data show that behaviour of late-stage larvae is complex and can greatly influence survival and recruitment. Further, behaviour differs among taxa, showing that not only are larvae not passive, but also that there is no such thing as a 'generalised larval behaviour'.

SWIMMING PERFORMANCE OF LATE PELAGIC LARVAE OF CORAL-REEF FISHES: IN SITU AND LABORATORY-BASED MEASUREMENTS.

LEIS J.M. & I. C. STOBUTZKI

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Two complementary methods provide important new insights into swimming performance of coral-reef fish larvae of 15 families initially captured by light trap. A laboratory swimming chamber, and *in situ* observation of larvae by divers supply data on swimming distance and speed, respectively. These late larvae are strong, effective swimmers, capable of speeds higher than ambient currents and capable of swimming tens of km non-stop. We found a strong positive correlation between speed and distance swum both among species and among families. However, within neither of the two best-represented families, Chaetodontidae and Pomacentridae, was the relationship significant, probably due to the low number of species for which we have data on both variables and the narrow range of values. Not all species are amenable to measurement by both methods, and the methods differ in advantages and disadvantages as well as in the data they provide. The exceptional swimming performance we document requires reassessment of views on dispersal and retention of reef-fish larvae.

STOCK ASSESSMENT OF COMMERCIAL FISHES IN THE NORTHERN NEW CALEDONIAN LAGOONS. 1: CORAL REEF FISHES.

LETOURNEUR Y., KULBICKI M. & P. LABROSSE

ORSTOM, Nouméa, Nouvelle-Calédonie

An assessment of the reef fish stocks was performed on the northern lagoons of New Caledonia. The area studied covers approximately 10 000 km2 with 500 km2 of reefs and can be divided into three lagoons, North, East and West. Only commercial species *sensus lato* were censused, along 50 m transects using visual censuses. A total of 921 transects were performed on three reef types: fringing, intermediate and barrier reefs. The most diverse families were the Scaridae, Acanthuridae, Serranidae, Lethrinidae and Lutjanidae. Species richness displayed no major differences between lagoons. Within each lagoon, most families displayed a gradient in species richness increasing from fringing to barrier reefs. Some families displayed the opposite trend, in particular Siganidae. Densities were slightly higher in the East and West lagoons. Within lagoons, there was a strong density gradient increasing from the coast to the barrier reef. The most abundant families were the Acanthuridae and Scaridae, especially on the barrier reefs. Lutjanidae were best represented on intermediate reefs and Siganidae on fringing reefs. Biomasses were much higher in the North than the West, the East lagoon having the lowest values. Biomasses in the North were approximately twice larger than elsewhere in New Caledonia or in other Indo-Pacific areas. Fish of exceptional sizes were observed in the North, due to the very low fishing pressure in this area. Standing stocks were estimated for each lagoon and each reef type, with a partition per species. Total stocks on the reefs reach 64 500 tons. Most of the stock is located in the North lagoon and on the barrier reefs. Estimates of MSY were estimated, each species being considered independently, resulting in an exploitable stock of about 7000 tons per year.

THE ABORE MARINE RESERVE (NEW CALEDONIA) - 2: ANALYSIS OF THE FISH DIVERSITY.

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Fish diversity was studied on a New Caledonian barrier reef, using visual censuses on three major biotopes: the reef flat, the inner reef slope and the "forest" (e.g. a submerged reef of branching *Acropora*). In addition, the reef was divided in two zones (each included the three biotopes), one is a permanent reserve, and the other is a reserve opened to fishing in September 1993. One survey was done in August 1993 and another in August 1995. A total of 69 stations was investigated, in which the substrate variables were also considered. Globally, the total species richness is of 377, including 252 species in the reef flat, 298 species in the inner reef slope, and 243 species in the forest. The most speciose famillies are the Labridae (69 species), the Pomacentridae (53), the Chaetodontidae (25), the Serranidae and Scaridae (23 each), and the Acanthuridae (22). These patterns remained the same in the different biotopes and zones. The mean species richness per station (MSR) was significantly higher on the inner reef slope (82.2) than on the reef flat (65.1) and the forest (71.0). Most families had a similar pattern. The MSR decreased between 1993 and 1995, globally (77.6 vs 69.4, respectively), and in the three biotopes. It remained stable in the marine reserve zone (76.4 vs 75.8), but decreased in the zone opened to fishing (78.3 vs 67.2). Most families displayed similar trends, in particular those of commercial interest. These different results are likely to be linked to the persistance of a marine reserve in part of the reef and to the opening to fishing of the other part. Some changes are also probably linked to changes in the characteristics of the substrate and/or percentage of cover by living organisms.

HPLC/MS/MS DETECTION OF CIGUATOXINS AT PPB AND SUB-PPB LEVEL IN FISH FLESH.

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Ciguatera is a significant disease caused by potent polyether toxins (ciguatoxins) which accumulate in ciguateric reef fish at levels above 0.1 ppb. Ciguatera is a major problem in Pacific, Indian and Caribbean waters and it is estimated that ~ 25,000 people are affected each year. Two families of ciguatoxins have been characterised from Pacific and Caribbean fish (P-CTX and C-CTX), with P-CTX- and C-CTX-1 being the major toxin in each Ocean, respectively. Research on ciguatera has been severely hindered by the lack of an analytical method to detect low levels of toxin (>0.1 ppb in flesh) in crude extracts of ciguateric fish. Recently, we developed a turbo-assisted, gradient reverse phase HPLC/MS/MS method that detects spiked P-CTX-1, C-CTX-1 and PBTX-2 in crude extracts from fish at levels as low as 0.05 ppb. Clinically effective levels in fish flesh can be detected in an extract from as little as 2.5 g flesh. The method has proved robust and gives a linear relationship between the quantity of ciguatoxin present and response. HPLC/MS/MS can be used to confirm the presence of ciguatoxin in fish suspected of causing ciguatera and will be invaluable in the establishment of much needed rapid screening methods for ciguatera. A rapid extraction procedure is being developed to reduce the analysis time associated with HPLC/MS/MS.

EFFECT OF EUTROPHICATION ON FOOD PROCESSING AND CYCLING BY THE DAMSELFISH *STEGASTES NIGRICANS* ON CORAL REEFS IN REUNION.

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Whereas herbivores play a key role in biogeochemical cycles on coral reefs, the effect of eutrophication on transformation and recycling of algal matter by herbivorous fishes is poorly known. Processing of algal turf (epilithic algal communities: EAC) by the territorial herbivorous damselfish *Stegastes nigricans* was investigated on Reunion coral reefs, in two sites located on the inner reef-flat, one in oligotrophic waters, the other in dystrophic (nutrient-enriched) waters. The effect of nutrient enrichment was analysed in quantifying organic matter percentages and nutriment (carbohydrate, lipid and protein) concentrations in algal food, digestive contents and faeces of *S. nigricans*. The EAC presented higher nutriment concentrations and higher organic matter percentages in the dystrophic site (27.0% versus 22.4% for the oligotrophic site). The digestive contents were also enriched in fishes sampled in the dystrophic site. Total assimilation efficiency was higher in fishes living in distrophic waters (34.7%) than in fishes from the oligotrophic site (20.8%), as well as nutriment assimilation efficiencies, resulting in a larger mean total length of fishes (11.4 cm versus 10.9 cm). The reinjection of nutriments in the environment by this herbivorous fish appeared to be enhanced by eutrophication, both through a rapid solubilisation of nutriments from faecal matter, and the action of microorganisms. Eutrophication appeared thus to accelerate carbon and nitrogen cycles. This study provided the first results on the effect of eutrophication on algal matter processing by herbivorous fishes on coral reefs.

DENSITIY MANIPULATION OF HOST POPULATIONS AND INFRAPOPULATION RECRUITMENT DYNAMIC OF MONOGENEANS (MONOPISTHOCOTYLEA-ANCYROCEPHALIDAE) PARASITIZING *STEGASTES NIGRICANS* AND *DASCYLLUS ARUANUS* IN FRENCH POLYNESIA.

LO C. M.

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Field and laboratory investigations of infrapopulation recruitment dynamics of the monogenean genus Haliotrema to two coral reef fishes (*Stegastes nigricans* and *Dascyllus aruanus*) were carried out on Moorea island (French Polynesia).The research consists of experimental work on the recruitment of Haliotrema to fish hosts and the influence of modified host densities on recruitment. The study on infracommunity recruitment dynamics involved in situ and aquarium experiments with chemically de-parasitized wild fish. The results of these two experiments give several previously unknown parameters of reef fish gill monogenean recruitment: 1) the incubation period of eggs lasts approximately 5 days, 2) sexual maturity is reached after either 7 or 20 days depending on the species, 3) immature monogeneans reach maximum density after about 10 days and adults after 30 days, and 4) hosts acquired their monogeneans from other nearby hosts and monogeneans tended to be overdispersed in the host population. One of the main results of this research is the rapid saturation of the gill habitat by monogeneans which may imply population regulating mechanisms. Changes of host population density were conducted in the lagoon of Moorea by adding or taking fishes from experimental sites. Initial densities were increased by 200 or 500% according to host species but final density increases were around 30%. Density reductions of host populations were about 50%. The results appear to contradict theorical models because neither increase or the decrease of host densities modified either prevalence or intensity of infection. These findings support the hypothesis of the existence of infrapopulation regulation mechanisms; and that interpopulation flow in the lagoon is continuous, even with low host population densities.

THE UV VISUAL WORLD OF FISHES.

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The last decade has suddenly revealed the potential importance of ultraviolet radiation in the visual world of vertebrate animals. This is especially true for marine animals since UV was earlier thought to be of insufficient intensity in ocean waters to be of biological significance. Coral biologists, in particular, demonstrated that this view was seriously flawed. Marine biologists began to extend study of UV vision from a few fresh water species to marine animals. At the same time, avian researchers began to reveal the critical importance of UV coloration in the lives of birds. One of the most compelling arguments for the importance of UV vision is the apparent trade-off between sensory benefits and the costs of damage to the retina from UV radiation. Species that lose UV sensitivity with age then block the no longer functional UV radiation from reaching the retina. One of the most unsettling arguments for the need for research is that we may well be missing a very critical set of adaptations in our research subjects. Our perception of their visual world may be seriously flawed. Fish research appears to be poised on the brink of accelerating discoveries. This workshop will present the general background of UV light in the sea, strategies for research in both birds, marine invertebrates and fishes, and new technology and forge a research plan for study of broad aspects of UV vision and coloration in fishes.

TEMPORAL VARIATION OF CORAL REEF COLONIZATION BY FISH LARVAE: A YEAR OF LARVAL COLLECTING OF ONE SITE IN RANGIROA ATOLL, FRENCH POLYNESIA.

LO-YAT A.

EVAAM, EPHE, UFP, Rangiroa, Polynésie Française

Most of coral reef settlement-stage fish larvae end their pelagic stage by crossing the reef crest. They then colonize the lagoon and recruit among adults. We monitored this colonization at one site in Rangiroa atoll (Tuamotu archipelago, French Polynesia) by using a net (1.5m wide x 0.75m high; 1mm mesh) erected in a channel that conects the ocean to the lagoon. Between Febuary 1996 and Febuary 1997, we collected fish larvae each month for at least 10 nights, mainly around new moon. From 206 samples, we counted approximatively 67,000 fishes representing 35 families and 126 lagoonal species (TL > 1.5cm, Leptocephalii excepted). However, these large larvae represent a very small part of the total amount of fishes caught by the net for we estimated to 3.5 (1.1) millions the number of small fish larvae (TL < 1.5cm). The high abundance and diversity of larvae demonstrate that the sampling technique used should be a better tool to evaluate the larval colonization of the lagoon.

A SELECTION OF FRENCH POLYNESIAN FRESHWATER FISHES OF INTEREST.

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A survey of French Polynesia islands for freshwater fishes has been conducted. Among the 37 species collected, a few have been selected in view of their special interest: -Ten are endemic: *Lentipes rubrofasciatus* Maugé, Marquet & Laboute, 1992; *Sicyopterus caudimaculatus* Maugé, Marquet & Laboute, 1992; *Sicyopus bitaeniatus* Maugé, Marquet & Laboute, 1992; *Stenogobius caudimaculosus* Watson, 1991; *S. genivittatus* (Valenciennes, 1837); *S. marqueti* Watson, 1991; *S. randalli* Watson, 1991; *S. squamosus* Watson, 1991; *Stiphodon discotorquatus* Watson, 1991; *S. tuivi* Watson, 1991. -Four are representative of the corresponding holotypes: *Awaous ocellaris* (Broussonet, 1782); *Stenogobius genivittatus* (Valenciennes, 1837); *Anguilla megastoma* Kaup, 1856; *Stiphodon elegans* (Steindachner, 1880). -Two are genitors of ina'a, a very popular local delicacy: *Sicyopterus taeniurus* (Günther, 1877) and *S. pugnans* (Olgivie-Grant, 1884).

A SELECTION OF NEW CALEDONIAN FRESHWATER FISHES OF INTEREST.

MARQUET G. & N. MARY

LERVEM, Université Française du Pacifique, Nouméa, Nouvelle-Calédonie

A survey of New Caledonia for freshwater fishes has been conducted. Out of the 33 present families, six families have been selected. Three are of economic interest: Anguillidae («anguilles»), Kuhliidae («carpes») and Mugilidae («mulets»); one is of biogeographical interest: Galaxiidae («Galaxias»); two are the most successful invaders of freshwaters: Eleotrididae and Gobiidae («lochons»). Distribution and ecological caracteristics are being given for the main species of each family.

COLOURS AND THEIR FUNCTION IN REEF FISH.

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In an attempt to understand the uses of colour on coral reefs, the colours of over 150 species of reef fish from the Pacific and the Caribbean have been measured using " Sub-Spec ", a submersible spectroradiometer. The wavelength range of the measurements is from 300nm to 800nm and therefore includes wavelengths in the near ultraviolet (UV) and infrared (IR) not available to human eyes. Such non-subjective quantification of reef fish colours is an essential first step towards understanding colour vision, colour communication and the functions of colour on the reef. Themes and patterns emerging from this data includes the following: a) Colours and colour patterns both within a fish and between a fish and its surroundings are often highly contrasting. Functions for this such as sexual display, camouflage and apposematism will be discussed. - b) Simple colour pattern contrasts such as yellow and blue or redd and green occur repeatedly and the spectral nature of these is compared accross a broad selection of families. Alternatively colour contrasts, such as those in labrids and scarids may be highly complex. - c) A number of mechanisms exist for enhancing colour contrasts at boarders between colours. The simplest of these is a black or white line. - d) Many fish colours may include a UV or an IR component. UV body regions are often selectively shown in certain circumstances. - e) Cleaner animals including shrimps and a variety of fish, may employ a specific " Cleaner Blue " signature. - f) Colours can be broadly categorised into 12 major classes. Their basis, eg whether pigmentary or structural is speculated upon. Using available data, colours and colour patterns will be discussed in the conteext of visual ecology.

REPRODUCTIVE PATTERNS IN SOME CYPRINIFORMES FROM BORNEO.

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In the tropics freshwater fishes are not necessarily constrained to seasonal reproduction by physical conditions. This study investigated the reproductive allocation of ten species of freshwater fishes from Sabah, East Malaysia to determine whether reproduction was seasonal and whether general patterns existed across species. Monthly ovary samples were taken from seven species of cyprinid and three species of balitorid and the gonado-somatic index (GSI) calculated. Eggs counts were also made and fecundity estimated. Two species of cyprinid, *Garra borneensis* and *Lobocheilos bo*, showed unimodal, seasonal reproduction with peak GSI values in December-January, corresponding with the major rainy season. The other species of cyprinid, *Nematabramis everetti*, *Osteochilus chini*, *Puntius sealei*, *Rasbora hubbsi* and *R. sumatrana*, and the balitorids, *Gastromyzon danumensis*, *G. lepidogaster* and *Homaloptera stephensoni*, all showed year-round reproduction. Populations of these latter species showed no reproductive synchronicity; randomly sampled individuals of the same size displayed large variations in their GSI. Peak GSI values for different species varied widely from 7.5-23.0%. These results indicate that different species pursue different life-history strategies in the allocation of reproductive effort. Given the stochastic nature of the physical habitat reproduction may be largely opportunistic in nature.

SHORT-TERM MOVEMENTS OF FRESHWATER FISHES IN SABAH, BORNEO.

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The short-term movements of some freshwater fishes from Sabah, East Malaysia were determined by mark-release-recapture experiments. Fishes were captured by multiple pass electro-fishing, batch marked with visible implant elastomer tags in a variety of head and body positions and released at the point of capture. Recaptures were made at the original marking site and at representative sites up to 300 m up- and down-stream, at intervals from one day to one month after tagging. Pool-dwelling cyprinids such as *Garra borneensis*, *Lobocheilos bo*, *Osteochilus chini* and *Rasbora sumatrana* showed high rates of movement over short time scales – for example marked fish were recaptured over 200 m from the tag site within one week. Rates of turnover at the original tag sites were also very high with large numbers of untagged fish being caught. Fishes were recaptured both upstream and downstream of the release site although more individuals were caught upstream. In contrast, riffle-dwelling balitorids such as *Gastromyzon danumensis*, *G.lepidogaster* and *Homaloptera stephensoni* were highly site-specific with the majority of recaptures occurring in the original tag location. All fish which had moved were found upstream of the tag site. These movements may be explained in terms of relative stability of the habitat and swimming ability of the fishes.

EARLY RESULTS FROM TROPHIC RELATIONSHIPS BETWEEN SOME FISH AND BENTHIC MACROINVERTEBRATES IN NEW CALEDONIAN FRESHWATERS.

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In 1995, New Caledonian Territory decided to realise a biotic index based on benthic macroinvertebrates (worms, lazrvae of insects, crustacea) for assessing water quality. Indeed, these organisms serve as valuable indicators of stream degradation because the presence or absence of some species indicate the quality of the water in regard to specific pollutants. However, benthic macroinvertebrates have many other roles in stream ecosystem function. They can influence nutrient cycles, primary productivity and decomposition of materiels. They constitute as well an important source of food for numerous fish, but quantifying the impact of fish predation on invertebrate communities is difficult even using enclosures. In this specific study, early results from invertebrate prey recorded in the guts of the most widespread and abundant fish of some New Caledonian rivers and streams will be discussed. These results will allow to improve knowledge of New Caledonian freshwater fish consumption and help to assess the influence of fish predation on populations of invertebrates for development of a biotic index.

REVISION OF THE BOXFISH FAMILY ARACANIDAE (TETRAODONTIFORMES).

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Boxfishes of the family Aracanidae consist of six genera, *Anoplocapros* (3 species), *Aracana* (2 species), *Caprichthys* (monotypic), *Capropygia* (monotypic), *Kentrocapros* (6 species including an undescribed species), and Polyplacapros (monotypic). These genera are easily distinguished from one another by the shape of the bony carapace encasing the body. *Anoplocapros* is characterized by having the well-developed dorsal ridge and no lateral ridges; *Aracana* by having no dorsal ridge but the dorso-lateral and ventro-lateral ridges with several sharp spines; *Caprichthys* by having the dorsal, dorso-lateral and ventro-lateral ridges, and no bony plates encircling the caudal peduncle; *Capropygia* by having the dorsal, dorso-lateral, and ventro-lateral ridges, and bony plates encircling the caudal peduncle; *Kentrocapros* by having no dorsal ridge but the dorso-lateral, lateral, and ventro-lateral ridges, which make the transverse section of the body hexagonal; and *Polyplacapros* by having no dorsal ridge but the dorso-lateral and ventro-lateral ridges. Except for the members of *Kentrocapros* and *Polyplacapros*, all the species are distributed in the southern part of Australia. The Hawaiian endemic species, *Aracana spilonota* Gilbert, has been known only from the holotype and paratype. The examination on the types and 11 additional specimens revealed that this species should be transferred to *Kentrocapros* because of characters of the bony carapace. Another rare species, *K. flavofasciatus*, which was previously recorded only from Japan, China and New Caledonia, has recently been found from the east coast of Australia. This is the only member of Aracanidae showing the antitropical distribution. In New Zealand waters two species of *Kentrocapros* have been found: the first is *K. eco* which was described as *Ostracion eco* by Phillipps based on a poor, washed-up specimen; the second is an undescribed *Kentrocapros* being similar to *K. eco* and *K. flavofasciatus* but distinguished from them by having a short, flattened spine on each dorso-lateral ridge.

OBSERVATIONS ON THE STREAMERFISH *AGROSTICHTHYS PARKERI* (REGALECIDAE).

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Agrostichthys parkeri is one of two species in monotypic genera in the family Regalecidae. Both are extremely slender, elongated fishes. *Regalecus glesne* is well known and widely reported, but *A. parkeri* is reported in the literature from less than 10 specimens, many of them only partly intact, from New Zealand, Tasmania and the southern Atlantic. However, there are about 40 specimens in the collections of the Museum of New Zealand from the New Zealand region. A recently taken beach-cast specimen was virtually intact and still alive. The collectors of this fish experienced pulsating electric shock, suggesting that the species an generate an electric current, an ability never before suggested for this or related species. It's morphological peculiarities are described and discussed.

ULTRAVIOLET RADIATION IN TROPICAL SEAS.

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Recent studies have demonstrated the presence of ultraviolet (UV) cone visual pigments in several freshwater and marine fishes, including some coral reef species. Until recently persistent dogma inferred that submarine UV radiation was so rapidly attenuated that it likely was of little significance in the visual activities of aquatic organisms. The distribution of UV-radiation in tropical seas near the surface is reviewed. UV-A radiation (from 320 to 400 nm) of the background spacelight in the horizontal and nadir lines of sight, which encompass the spectral absorption range of known UV photoreceptor pigments in fishes, can represent as much as 30-percent of the underwater radiation between 295 and 800 nm. A sufficient number of UV-A photons are thus available during the daytime to readily sustain photopic UV visual sensitivity in most near surface fishes, and certainly in coral reef fishes.

DEEPWATER FISHES OF THE GENUS *CAELORINCHUS* (MACROURIDAE) FROM NEW ZEALAND - DIVERSITY AND DISTRIBUTION.

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New Zealand has 20 known species of the macrourid genus *Caelorinchus* and up to eight may be endemic to the region. They comprise one third of the known New Zealand fauna of this family. Other areas with a high diversity for this genus include the Philippines-Indonesia region (23 species) and the Japan- East China Sea region (22 species). Within the New Zealand region eight species are widespread, 10 are northern and two are southern.

GRENADIERS OF NEW CALEDONIA: DISTRIBUTIONAL CONSIDERATIONS.

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The New Caledonian region has an astonishingly diverse grenadier fauna, comprising about 61 spp. representing 20 genera. This richness is compared with other regions in the western Pacific. Faunal relationships appear to be closest to that of eastern Australia, with 46% of the species also found in New South Wales. The genus Caelorinchus dominates the New Caledonian grenadier fauna, with 17 spp. (28%). The number of new species is high (15 spp. or 25%), but relatively few are found only off New Caledonia; most have broader ranges extending onto the Australian or New Zealand slopes. Many New Caledonian species are found over vast areas of the Pacific and Indian oceans. Some aspects of the vertical distribution of the species is discussed.

TOTAL NEURON NUMBERS IN THE ELECTROSENSORY HINDBRAIN OF FIVE ELASMOBRANCH SPECIES USING STEREOLOGICAL TECHNIQUES.

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By removing the effects of body size relationships from measures such as the brain size of an organism, significant differences in the quantitative structure of the brain can be revealed and analysed further. Studies conducted on a wide range of elasmobranch species showed many shark species to display large brain sizes when corrected for the differences in their body sizes (Northcutt, 1978). It does not necessarily hold true that sharks are therefore «more intelligent» but rather display neural variations in structure as a consequence of other correlates such as phylogeny, evolutionary and life history, behaviour and sensory or cognitive adaptations. In an MSc study carried out at the University of Otago in Dunedin, New Zealand, the brain sizes and total neuron numbers of five elasmobranch species were allometrically analysed to investigate differences in the size and neural structure of the dorso-octavolateralis `electrosensory' nucleus (DON) in the hindbrain. The «residual variation» in brain size and neuron number were matched with other correlates such as taxonomic relationships and migratory behaviour to investigate whether these properties could help explain differences in a sensory system believed to be multi-functional with respect to prey detection and navigational ability. Using reliable and unbiased Stereological methods, total neuron numbers in the DON of elasmobranchs have been obtained for the first time. A significant proportion of the brain size variation was attributed to variation in body size but total neuron numbers in the DON did not correlate well with either body size or peripheral ampullae receptor numbers.

HISTOLOGICAL STRUCTURE OF THE CAUDAL SPINE OF THE SURGEON FISH *CTENOCHAETUS STRIATUS* (TELEOSTEI, ACANTHURIDAE).

MEUNIER F.J. & H. FRANCILLON-VIEILLOT

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Caudal spines of Surgeon fish are considered as specialized scales. In *Ctenochaetus striatus* caudal spines are constituted of acellular bone. They are divided in two parts: a central one, the medulla, is made of vascularized bone and is surrounded by the second one constituted of cortical primary avascular bone. This cortical bone show concentric growth marks that indicates an appositional growth of the caudal spine. Medullar bone is clearly less mineralized than cortical bone and numerous cementing lines are seen. This means that medulla results of a remodeling phenomenon of primary bone. The relationships between the components of the caudal spine and those of scales are discussed.

THE STRUCTURE OF THE EXTERNAL LAYER AND OF THE ODONTODES OF SCALES IN *LATIMERIA CHALUMNAE* (SARCOPTERYGII, ACTINISTIA, COELACANTHIDAE) REVISITED USING TRANSMISSION ELECTRON MICROSCOPY.

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The scales of *Latimeria chalumnae* can be considered as elasmoid scales because of their organization: A mineralized ornamented external layer overlays a basal plate made of cellular unmineralized isopedine constituted by thick collagen fibrils (about 100 nm in diameter). The isopedine is a regular twisted plywood whose progressive rotation of the fibril directions is right-handed. The surface of scales presents radial ridges covered, by numerous odontodes in the posterior area only. The external layer is made of thin collagen fibrils (about 30 nm in diameter) organized in a loose network which contains an abundant extrafibrillar matrix rich in mucosubstances. Its ultrastructural aspect resembles that of the external layer of teleost elasmoid scales. Globular Mandl's corpuscles are found in the isopedine in the vicinity of the external layer. Their mineralization is inotropic as in the Mandl's corpuscles of teleost elasmoid scales. The odontodes associated to form odontocomplexes topping the outer ridges are made of mineralized tissues similar to those described in the buccal teeth of the Coelacanthe. Ultrastructural studies show the presence of cementing lines between the external layer and the basal cellular bony tissue (lamellar or pseudolamellar) which anchors the odontode to the underlying external layer.

SOME MORPHOLOGICAL AND HISTOLOGICAL ASPECTS OF HYPEROSTOSES IN THE EQUATORIAN MARINE FISH *PRIONOTUS STEPHANOPHRYS* (TELEOSTEI, TRIGLIDAE).

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All the fishes studied show the same hyperostosic bones: the two frontals, the ethmoid complex, the two operculars and one or two caudal vertebrae. It is the 21 th vertebra that always show hyperostose so as the next one in any case. The cranial bones show a typical thickenning of their whole part and for the vertebrae, it is only the centrum that is affected and it looks very swollen on each side. When the hyperostosic process is very expanded on the 21th and the 22th vertebrae one can eventually seen that the posterior half of the 20th centrum begin to swollen. The swolling of all these bones results of an active osteogenesis associated to resorbing proccesses that deposit spongy acellular bone. This cancellous bone is surrounded by a thin cortical bony layer. So the histological characteristics of the swollen bones of *Prionotus stephanophrys* are the same as those already described in other hyperostosic species whatever the hyperostosic bones may be. The causality and the biological signification of the hyperostosic phenomenon in these fishes seem unclear in the current state of knowledge but, according to the very specific vertebral development of hyperostoses, *P. spephanophrys* may represent an interesting model to study its etiology.

EFFECT OF ALGAL DIET ON THE GROWTH PERFORMANCE AND FATTY ACID PROFILE OF AN INDIAN MAJOR CARP, *LABEO ROHITA*.

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The interest in the long - chained polyunsaturated fatty acids (PUFA) of the n3 and n6 series has increased among different disiplines. The n3 PUFAs, eicosapentanoic acid and docosahexaenoic acid, common in fish oils have several biochemical effects on human metabolism. Since the origin of these valuable PUFA in fish is the planktonic algae, the present experiment was conducted to find out the growth performance and fatty acid profile of an indian major carp fed with different algal diets. Blue-green algae, *Cyanophyceae (Anabaena, Nostoc* and *Spirulina)* and green algae, *Chlorophyceaee, (Enteromorpha, Glacillaria* and *Westlopsis*) were used as the dietary algae either in mixture or individually, to find out algal nutrition on fish. When the algal mixture diet showed the poorest growth, the highest growth recorded with the diet containing *Westleopsis* and *Nostoc*. The changes in the fatty acid profile of the fish was also noticed with algal diet which was discussed in this paper.

CRYPTIC LINEAGE SPLITTING IN OPEN OCEANS: MITOCHONDRIAL PHYLOGEOGRAPHY OF THE DEEP-SEA FISH GENUS *CYCLOTHONE* (GONOSTOMATIDAE).

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In the oceanic environment, there exist numerous examples of morphologically conspecific organisms with circumglobal distributions along various latitudinal zones. The vast majority of them comprise diverse planktonic and micronektonic organisms, despite their low vagility and lack of active interoceanic migration. We here present the first evidence for large genetic differences within a circumglobal, highly monotypic species in the oceanic pelagic realm. Analysis of mitochondrial DNA sequences from 41 individuals of the deep-sea fish *Cyclothone alba* (family Gonostomatidae) collected from widely-separated regions in three oceans shows that individuals collected from the same region are monophyletic, and that individuals from different regions differ by as much as 10% in nucleotide sequence (range, 3-10%). The resultant interpopulational phylogeny explicitly indicated that such monophyletic populations have evolved from preexistent interoceanic populations, including a trans-Panamanian population that was subsequently subdivided by the closure of the isthmus ca. 3.2-2.8 million years ago. Furthermore, these ancestral interoceanic populations were themselves derived from earlier, within-ocean fragmentations of the original Pacific ancestral population. Such within-ocean intraspecific phylogenetic structures that extend over several million years with no interpopulational coalescent events suggest that, in the homogeneous oceanic environment, many cryptic allopatric lineage splittings have occurred without discernible biogeographic barriers. Such trends will result in a serious underestimation of oceanic biological diversity.

A REVIEW OF THE HAGFISH MYXINE OF TAIWAN.

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External, branchial and skeletal morphologies of 4 to 6 gill-pouch, white-headed *Myxine* morphological types from southwest waters of Taiwan, *Myxine garmani, Myxine circifrons* and *Neomyxine biniplicata* are compared to elucidate the taxonomic status of thesee morphological types from Taiwan waters. One out of the 648 *Myxine* speecimens examined from the above-mentioned waters had four gill pouches. 5 speecimens had six gill pouches and the remaining specimens had five gill pouches. All of them have 3/2 multicuspids. External morphology of these morphological types are indistinguishable and they reesemble *M. circifrons*. Skeletal character, however, exhibits obvious differentiation in *M. circifrons* which possesses a unique character of the nasal ring. These *Myxine* specimens from Taiwan are, therefore, treated as a new species, *Myxine hensleyi*. Data on the reproduction, sex ratio, egg-size distribution, etc..., of this new species are also presented.

BIOACTIVE AGENTS INVOLVED IN FISH POISONING: AN OVERVIEW.

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It is well known that consumption of a variety of fish is associated with an increasing number of human intoxications and diseases which are important public health problems world-wide. This presentation reviews the main types of fish-poisoning, with emphasis on the modes of action of the bioactive agents involved in those incidents. Tetrodotoxin (TTX) is one of the most lethal seafood toxins known. This toxin is present in most puffer fish species (family Tetraodontidae) living in the Indo-Pacific area. Even when puffer fish are easily recognized there are still many outbreaks of TTX-poisoning yearly. TTX also has been identified in freshwater puffer fishes (*Tetraodon palembangensis* and *T. fangi*) living in tropical inland waters. Recent findings indicate that the toxic principle of *T. fangi* is not TTX but saxitoxin (STX). TTX and STX are known to block, in a highly specific manner, voltage-dependent Na^+ channels in excitable membranes. Blockade of Na^+ channels prevents action potentials from propagating along axons, nerve terminals and muscle fibers, which leads to inhibition of nerve-impulse evoked neurotransmitter release in chemical synapses. Ciguatoxins (CTX-n) are a family of polyether toxins responsible for ciguatera, a complex form of fish poisoning characterized mainly by gastrointestinal, neurological and cardiovascular disorders. At present, ciguatera constitutes one of the largest seafood toxicities associated with consumption of many species of tropical and subtropical fishes widespread in the Indo-Pacific Oceans and Caribbean sea. Progress has been made in the identification of the chemical structure and the mode of action of CTX-n. These toxins cause persistent activation of voltage-dependent Na^+ channels, increase neuronal excitability and neurotransmitter release, impair synaptic vesicle recycling, and modify Na^+-dependent mechanisms in many cell types. Scombroid fish poisoning is a totally preventable disease that results mainly from consumption of Scombridae fish containing unusually high levels of histamine due to improper attention to principles of hygiene during distribution and storage of fish. Other forms of fish intoxication (e.g., those resulting from the presence of palytoxin in fish or implicating new marine toxins) also will be discussed.

SYSTEMATICS AND BIODIVERSITY OF CYNOGLOSSID FLATFISHES (CYNOGLOSSIDAE: PLEURONECTIFORMES) FROM THE WATERS AROUND NEW CALEDONIA.

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Cynoglossid tonguefishes (3 genera, ca. 138 species) are small to medium-sized sinistral flatfishes, commonly found in diverse habitats throughout tropical and warm temperate waters of the Indo-Pacific. The subfamily Cynoglossinae contains two genera, *Cynoglossus* (ca. 55 species) and *Paraplagusia* (ca. 5 species), whose species occur primarily in shallow-water environments (<1 to ca. 150 m). The subfamily Symphurinae comprises only the genus *Symphurus* with approximately 78 species, ca. 28 of which occur in the Indo-West Pacific, mostly inhabiting deep-water substrates (100-1500 m). Because of their relatively small size and deep-water habitats, many nominal deep-water species of *Symphurus* have been infrequently sampled and thus are known only from a small number of specimens. A recent series of research cruises exploring shallow and deep-waters in the New Caledonia region have yielded large numbers of cynoglossid tonguefishes. Species of *Paraplagusia*, which elsewhere occur on soft sand or silt substrates, are not represented among material examined. Only two species of *Cynoglossus* were collected from relatively shallow-water stations (< 150 m). Specimens of *Symphurus,* with at least four species retrieved during these cruises, represent one of the largest collections of deep-water tonguefishes from any single region in the Indo-West Pacific. The systematics, distributions, and biodiversity of the cynoglossid fauna of the New Caledonia region are compared with those from other Indo-West Pacific areas, including Australia, New Guinea, the Philippine Islands, Hawaii, Samoa and Indonesia.

SYSTEMATICS OF AUSTRALIAN FLATFISHES (CYNOGLOSSIDAE: PLEURONECTIFORMES): THE *CYNOGLOSSUS MACULIPINNIS* COMPLEX.

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Cynoglossid tonguefishes (3 genera, ca. 120 species) are small to medium-sized flatfishes, commonly found in tropical and warm temperate oceans in a variety of habitats. The subfamily Cynoglossinae contains two genera, *Cynoglossus* (ca. 49 species) and *Paraplagusia* (ca. 5 species). Of 49 species recognized in the most recent revision of *Cynoglossus*, six, including *C. bilineatus* (Lacépède, 1802), *C. broadhursti* Waite, 1905, *C. heterolepis* Weber, 1910, *C. maculipinnis* Rendahl, 1921, *C. macrophthalmus* Norman, 1926, and *C. ogilbyi* Norman, 1926, occur in Australian waters. A seventh species, *C. maccullochi* Norman, 1926 was considered synonymous with *C. maculipinnis* because the species share many similarities in morphology and pigmentation. Examination of ca. 300 specimens from Australian waters revealed that *C. maculipinnis* and *C. maccullochi* are both valid and differ in several features including pigmentation, and number of lateral lines and finrays. Identification of specimens is difficult, however, because three other undescribed species with similar size and morphology also occur in Australian waters. The species of the *Cynoglossus maculipinnis* complex are diagnosed and geographic distributions discussed.

SYSTEMATICS, TAXONOMY, AND DISTRIBUTION OF THE GOBIID SUBFAMILY AMBLYOPINAE.

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The suborder Gobioidei is a world-wide group of tropical and temperate fishes occurring in fresh, brackish, and marine waters. Affectionately known as gobies, gobioid fishes can be collected from mountain streams to the edge of the continental shelf. The vast majority of gobioids are shallow water demersal forms being found on sand, mud, rubble, and coral bottoms. Some taxa inhabit burrows and a few are symbiotic with shrimp. Most are small, in fact, the smallest vertebrate in the world is a goby that matures at 8mm. A few genera, however, attain lengths of 50cm. There are approximately 2000 gobioid species making them one of the most speciose groups of fishes; gobies comprise between 5 and 10% of all teleost species. Gobies outnumber the more famed Cichlidae by about 1500 species. Eight families of gobioid fishes are currently recognized. The family Gobiidae is the largest of these and is likely the largest family of fishes. The Gobiidae comprises five subfamilies: Gobiinae, Gobionellinae, Sicydiinae, Oxudercinae, and Amblyopinae. I will briefly mention each of the first four subfamilies and will focus on the fifth, the Amblyopinae. Amblyopine gobies are mud-dwellers in estuarine waters of the tropical Indo-west Pacific. The Amblyopinae, as presently conceived, is not speciose comprising about 25 species in approximately seven genera. A fin element to vertebra ratio of 2:1 is the defining synapomorphy for the Amblyopinae.

THE PRECAUTIONARY PRINCIPAL AND SHARK MANAGEMENT.

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Most sharks are long-lived, mature at an advanced age and have a small number of young. These vital parameters result in very low rates of intrinsic increase comparable to those found in sea turtles, whales and such terrestrial animals as African elephants. The history of virtually all unmanaged commercial shark fisheries has been one of rapid stock collapse and very slow recovery. A recent directed fishery for large coastal sharks along the U.S. Atlantic coast resulted in just such a scenario with rapid stock decline and little sign of recovery after belated implementation of a Fishery Management Plan. Although there was no significant density dependent increase in growth rate after stock collapse, or reduction in age at first maturity, survivorship of young-of-the-year appeared to increase substantially. Primary predators of these small juvenile sharks are larger sharks of several species all of which had been depleted by the fisheries. Therefore, monitoring older juveniles may not reflect the true status of the stocks even though recruitment of young-of-the-year may be closely correlated with parent stock size. Shark stocks must be managed using a precautionary approach, because once stocks are depleted, decades are required for recovery.

A TAXONOMIC REVISION OF *CHANNA MARULIA*-COMPLEX.

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The large tropical snakehead, *Channa marulia* (Hamilton, 1822) was originally described from Bengal, Ganges River basin. The species has been distinguished from all other congeners by an ocellus at the upper portion of caudal fin; 4.5-5.5 scales above lateral line; and its large body size. Since the species was originally described, many researchers have reported the species from almost every part of Indian sub-continent, Sri Lanka and continental part of southeast Asia. On the other hand, although several morphologically resembling species have been described so far, all of them are presently treated as junior synonyms of *C. marulia*. Based on specimens collected during field surveys in Laos, Thailand, Myanmar and India, as well as those deposited in museums including type materials of the synonyms, I concluded that five species would be included in what have previously been recognized as *Channa marulia*. All of them are distributed in allopatric. An original *C. marulia* is distributed in the most part of Indian sub-continent (Ganges-Brahmaputra, Krishna, Cauvery and Indus basins). A species restricted to southwestern coastal part of Indian sub-continent is an undescribed species. A species restricted to Sri Lanka Island, which is previously known as a subspecies *C. marulia ara*, is recognized as a valid species, *C. ara* (Deraniyagala, 1945). A species distributed only in Mekong basin is an undescribed species. A species distributed in Chaophraya, Meklong, Salween, Tenasserim, Sittang and Irrawaddy basins is *C. aurolineata* (Day, 1870).

THE REPRODUCTIVE BIOLOGY AND FISHERY OF *LEPTOSCARUS VAIGIENSIS* IN A HIGHLY EXPLOITED INSHORE LAGOON IN KENYA.

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The breeding biology and fishery of *L. vaigiensis*, a scarid fish abundant in the inshore lagoons of Kenya was studied. Data on ovary development, ova distribution the breeding season, spawning frequency, size at first maturity were based on observations for 1 year. The sequence of ova development in the ovary to maturity indicated one batch of ova developed in a single ovary in a year. Seasonal variations in relative gonad weight (GSI), relative condition factor (Kn.) and the percent occurrence of various maturity stages of gonads showed that the fish spawns throughout the year in which two distinct breeding seasons can be recognized. The Male: Female sex ratio was not significantly different from the 1: 1 sex ratio, and the variations throughout the year had no consistent trend related to the reproductive cycle. The minimum size at first maturity was determined as 16.8cm. Mean potential fecundity was estimated to be 670,000. The overall length-weight relationship obtained was log10 W=2.86 log10 L - 1.595. Growth and mortalities were determined from length frequency data. The analysis estimated the von Bertalanffy's Growth constants as (K) = 1.5 yr-1, Asymptotic length (L¥) = 28.9 Cm and Growth performance index (j1) = 3.10. Total mortality (Z), Natural mortality (M), fishing mortality (F), exploitation rate (E) estimated using the FiSAT program were; Z = 3.52, M = 2.30, F = 1.15 and E = 0.33. Optimum exploitation rate is achieved at E = 0.5 and so the stock is not optimally exploited. Nonetheless, growth overfishing in experienced as the fish was shown to recruit into the fishery at 11.7 cm.

IGENETIC TREMATODES FROM MARINE FISHES OF FIJI: SUBFAMILY HURLEYTREMATINAE (FAMILY MOONORCHIIDAE): A REVIEW AND DESCRIPTION OF SIX NEW SPECIES OF HURLEYTREMATOIDES.

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Six new species of *Hurleytrematoides* Yamaguti, 1954 are described: *H. fijiensis* from *Heniochus acuminatus, H. uspi* from *Chaetodon citrinellus, H. prevoti* from *Chaetodon melannotus, H. seetoi* from *Hentochus acuminatus, H. bartoliae* from *Heniochus monoceros* and *H. zebrasomae* from *Zebrasoma scopas*. The hurleytrematine genera *Hurleytrema, Hurleytrematoides, Pseudohurleytrema* and *Parahurleytrema* are briefly discussed and their validity accepted based chiefly on the structure of the male and female terminal structure The generic diagnosis of *Hurleytrematoides* is emended to include spiny or aspinose unipartite terminal organ. A key to the hurleytrematine genera and their species is given.

ACOUSTIC TRACKING OF BIGEYE THRESHER SHARK, *ALOPIAS SUPERCILIOSUS*, IN THE EASTERN PACIFIC OCEAN.

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Japanese longline fishing boats catch many kinds of pelagic sharks, however the ecology of pelagic sharks including dial behavior and movement are sparsely known. It is important to know their movements and behavior and to understand the mechanism of longline catch for avoiding the incidental catch of non-target species. Acoustic telemetry was used to identify short-term horizontal and vertical movement of two bigeye thresher sharks, *Alopias superciliosus*, in the eastern Pacific Ocean during the summer of 1996. Sharks were 175 cm female and 124 cm female in precaudal length, respectively and considered immature stage. Two sharks were tracked for periods of from 70 to 96 hours. The bigeye thresher shark revealed significant difference in their behavior and swimming depth between day and night. They stay 200-500 m depths in daytime and swin up and stay in 80-130 m depths at night. The maximum depth was recorded for one individual at 723 m depth. This must be the world deepest record of this species.

A METHOD TO TAKE PHOTOGRAPHS OF LIVE JUVENILE REEF FISHES.

NAKAZONO A.

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In the study of juvenile reef fish morphology, dead specimens collected by nets are usually examined. Specimens are fixed with formalin or ethanol immediately after collection. Because of this, skin pigmentation of these specimens disappears. Observation of living specimens immediately after collection is often attempted but is frequently unsuccessful because they are often damaged during net towing (usually over a long period of time) or during the course of transfer from the net to a bucket or bottle. To overcome this problem, a new method to photograph juveniles underwater immediately after collection by hand nets was developed. With this method, an extension tube was mounted on a Nikonos V underwater camera, a small glass case was also mounted at the focus distance of the lens. A strobe with TTL exposure metering provided illumination. Photographs taken with this method provided satisfactory detail of live juvenile color patterns. When taken from a right angle, the photographs showed both fin ray and scale number counts much clearer than those obtained from a macro-lens with a focal length long enough to approach the subject. The method also produced photographs that showed delicate patterns of pigmentation not seen in fixed specimens. This method is considered useful for the comparative study of the ecological and behavioral consequences of juvenile reef fish coloration.

THE PHILIPPINE AQUARIUM FISH TRADE INDUSTRY SUSTAINABLE ?

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Based on analyses of the density and distribution of chaetodontid species in over 100 transects in the 5 main biogeographic regions of the Philippines an evaluation of the sustainability of the aquarium fishing industry was undertaken. Export trade volume was utilized as the main demand for an input-output model to gauge whether a balance is feasible. Indications show that this balance cannot be sustained unless sufficient inputs are made on the supply side i.e. enhancing recruit survivorship. Ecolabeling either through larval rearing and growout mechanisms can be some options towards this end.

REPRODUCTIVE BIOLOGY OF *SEBASTISCUS MARMORATUS*.

NG W.-C.

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Sebastiscus marmoratus, the marbled rockfish, is a common species along the coast of east Asia. The species is ovoviviparous. Males become ripe about three months before females and copulation takes place before the females become ripe in winter. Sperms are stored inside the females until fertilization and two to three broods of larvae each about 4 mm in length are produced by individual females at about ten days intervals. The reproductive biology (seasonal cycle, mating and spawning period, size of sexual maturation) of *S. marmoratus* in Hong Kong was examined by regular field sampling and histological studies. Reproductive behaviour was studied by setting up mating experiments in aquaria. The paternal contribution to the larvae produced by individual experimental females was determined using a molecular method; DNA fingerprinting. Histological studies showed that the reproductive season of males starts in September, peaks in November and ends in December. The spawning season of females starts in November, peaks in January and ends in February/ March. Males exhibit vigorous territorial and courtship behaviour during the breeding season but females remained inactive. Paternity test, by DNA fingerprinting, carried out for two mating experiments suggested that one male can fertilize more than one female during a single reproductive season, while individual females were not fertilized by more than one male.

BEHAVIORAL DETERMINANTS OF THE INSTREAM DISTRIBUTION OF NATIVE HAWAIIAN STREAM FISHES.

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The Hawaiian freshwater ecosystem is comprised mainly of 376 small, torrential mountain streams driven by orographic rain. The entire complement of native stream fishes consists of only five species, belonging to the families Gobiidae and Eleotridae, and they share an amphidromous life cycle. Adults live in fresh water where they have a distinct longitudinal zonation pattern which varies predictably between streams. Variation in distribution can be explained by the behavior of recruiting juveniles, by a spawning migration in one species, by the natural ebb and flow of streams in response to rainfall, and by stream gradient, especially where the stream enters the ocean. Fish surveys in island streams should not be based solely on the presence or absence of species, but should take into account the behavior of recruiting juveniles in response to stream profile and flow.

LARVAE OF *BROTULOTAENIA NIELSENI* (OPHIDIIFORMES: OPHIDIIDAE: BROTULOTAENIINAE) WITH A COMPASION OF SOME OPHIDIID LARVAE.

OKIYAMA M & H. KATO

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Early developmental stages of the midwater ophidiid, *Brotulotaenia nielseni* (Ophidiiformes: Ophidiidea: Brotulotaeninae), are described from six specimens (10.0-69.5mm SL) collected in the tropical western Pacific. The larvae are deep-bodied and extremely compressed laterally with precociously elongated anterior dorsal and pelvic rays. During larval stages, proportionate lengths of the body depth, head length and elongated rays decrease but those of tail length increase with increasing body length. Other characteristic features of the larvae included the large size attaining to ca.70mm; slightly pendulous abdomen (not as in "exterilium" larva) accommodating a long gut of single coiling pattern; large pigment dots sparsely covering the body and abdomens; unusually long and precocious cartilaginous posterior process of the coracoid; and peculiar configuration of the proximal-middle radials. They are almost identical with the so-called "rubaniform" larva *sensu* Aboussouan (1980) which can be ascribed to *Brotulotaenia crassa*. Larval morphology provides some supports for the distinct subfamilial rank for *Brotulotaenia* within the Ophidiidae, whereas its probable association with some members of the Neobythiinae such as unidentifiable "exterilium" larva *sensu* Fraser and Smith (1974) is also suggested.

MOLECULAR PHYLOGENY OF THE MASU SALMON IN THE GENUS *ONCORHYNCHUS*.

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National Research Institute of Aquaculture, Nansei, Mie, Japan

In order to clarify the phylogenetic position of the masu salmon in the Pacific salmonids, we determined 2,162-bp sequences from the mitochondrial DNAs of the masu salmon *Oncorhynchus masou masou*, chum salmon *Oncorhynchus keta*, and Atlantic salmon *Salmo salar* by using polymerase chain reactions (PCRs). The obtained DNA sequences cover from the 3' region of the gene for ATPase subunit 6 to the 5' region of the gene for NADH dehydrogenase subunit 4L. With the aid of the previously obtained sequence data from other Pacific salmonid species, the evolutionary distances were calculated among the genus *Oncorhynchus*, using Kimura's 2-parameter model for the third codon positions. These distances were used to construct a neighbor-joining (NJ) tree. Further, a maximum parsimony (MP) tree and a maximum likelihood (ML) tree were constructed with the use of the computer programs PAUP and PUZZLE. The obtained evolutionary trees suggested that the masu salmon first had diverged from the common ancestor of the genus *Oncorhynchus*. The bootstrap probabilities for the branch of the masu salmon were 77.4% in NJ tree and 90.5% in MP tree. Adopting the evolutionary rate of 1.25 to 2.25% per third codon position between two lineages of salmonids, the branching time of the masu salmon was estimated as being 11 to 30 milion years ago. From our point of view, Neave's (1958) hypothesis on the evolution of Pacific salmonids should be critically re-examined.

EMBRYONIC DEVELOPMENT AND NUTRITION OF THE APLACENTAL VIVIPAROUS DEEP-SEA DOGFISH, *DEANIA HISTRICOSA*.

OOI R. & S. TANAKA

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Embryonic development and nutrition of the aplacental viviparous dogfish, *Deania histricosa*, were studied using 105 specimens from Suruga Bay, central Japan. Wet and dry weights, and length of the fertilized eggs (FE) and embryos with external yolk sac were measured. Uterus and embryonic intestine were sectioned and stained with haematoxylineosin and Periodic Acid Schiff solutions. Total protein of the uterine fluid and maternal blood plasma was analyzed. Water content in wet weight of FE ranged from 50 to 55%, while that in the embryos increased linearly to 70% with their growth. Dry weight of the embryos with external yolk sac smaller than 100 mm TL was almost equal to that of FE, but the embryos larger than 100 mm TL tended to be light with their growth. External gill filaments gradually elongated to about 30 mm in maximum length until embryos grow up to 60 mm TL. Those of the 140 mm TL embryo completely shrank and replaced by internal gills. Protein concentration of maternal blood plasma hardly changed with embryonic growth, while that of uterine fluid decreased; about 16 mg/ml to FE, 7 mg/ml to the 75 mm TL embryo, and less than 2.5 mg.ml to the embryos over 140 mm TL. Uterine fluid profiles showed proteins of 40-60 Kd specifically at the developmental stages from FE to the 105 mm TL embryo. Proteins of 14-40 Kd and 60-79 Kd were observed at every stage. Yolk matter was observed in the intestinal lumen of the embryos over 105 mm TL. Dry weight of the liver in the embryos began to increase suddenly after embryos had grown to 105 mm TL. These facts suggest that embryos smaller and larger than 100 mm TL are nourished with proteins of 40-60 Kd and mainly yolk matter, respectively.

CLUPEIFORMES ENDEMIC SPECIES OF THE PERSIAN GULF.

OWFI F.

Iranian Fisheries Research and Training Organization, Teheran, Iran

Clupeiforme fishes show a high level of endemism in the persian Gulf. In addition these small pelagic fishes are abundant and important for fisheries in this area (Area 51 in the FAO classification) which displays unique geographical, climatical and environmental factors. Between 1990 and 1995, IFRTO and FAO conducted a joint study on the small pelagic fishes of the Iranian waters. The endemic species *Herklotsichthys lossei* (Clupeidae) and *Thryssa whiteheadi* (Engraulidae) were identified during this study. Their distribution pattern was also analysed. These fish were collected by beach seins and gillnets in coastal areas but also offshore in a number of stations between 10 and 60m by RV " Akhtar ", " Lavar #2 " and " Darghahan #18 ". During this study, morphometric and meristic parameters were analyzed for more than 4500 specimen of *H.lossei*. In addition some of their behavioral patterns were studied. Diversity of endemic species of Clupeiformes is higher than in otehr groups of fishes. In addition, small pelagic fish diversity and abundance are very interesting for fisheries. Among fishing area (FAO 51), the Persian Gulf is one of the most important in ther paleartic area. Between 1990 and 1995, biological studies on smal pelagic fish in Iranian waters were carried out jointly by IFRTO and FAO. The endemic species, incluidng *Herklotsichthys lossei* (CLUPEIDAE) and *Thryssa whiteheadi* (ENGRAULIDIDAE) were recorded. Morphometrics and meristics of more than 4500 specimens of *H. lossei* were taken, as wele as some behavioral observation. *H.lossei* migrates to shallow waters in Marck for feeding and then migrates to dep water in June for spawning. The maximum length for mature specimens was 11-12 cm.

ABUNDANCE OF THE LARVAE OF A PARALEPIDID, *LESTROLEPIS JAPONICA*, IN KAGOSHIMA BAY, SOUTHERN JAPAN.

OZAWA T. & S. WATANABE

Kagoshima University, Kagoshima, Japan

Lestrolepis japonica, a paralepidid of synchronized hermaphrodite in oceans, occurs in Kagoshima Bay, southern Japan. Bi- or monthly collections of ichthyoplankton were made with a larva net at 9-14 stations from Oct. 1983 to Dec. 1993 in Kagoshima Bay, totalling 1,554 collections from 121 cruises. *L. japonica* larvae were one of the most abundant ones in most years, totalling 40,110 in number, and their temporal and spatial occurrence and abundance were studied. The surface water temperatures measured at each collection were fitted highly significantly to a sine curve in each year, which enabled to calculate a temperature on a given day. The larvae occurred from March to December, and their abundance followed highly significantly a normal distribution curve during each season, which enabled to separate the season into 5 periods: first, early intermediate, peak, late intermediate and last periods. The peak abundance periods were from early June to early October, and the surface water temperatures during the periods were from 25 to 30°C. Areas of larval abundance were determined cruise by cruise using a method for calculating geographic centers of larval abundance from stations having higher-than-average larval density and the two adjacent stations with the highest densities. The abundant areas at each period were widely distributed in the Bay.

KARYOLOGICAL SURVEY OF THE NOTOTHENIOID FISH OCCURING IN ADELIE LAND (ANTARCTICA).

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Museum national d'Histoire naturelle, Paris, France.

During ICOTA 1 campaign (January-February 1996), the fish fauna of Adelie Land (Antarctica) has been investigated between 0 and 400 meters depth. All species caught alive were analysed karyologically with conventional staining and banding techniques. The results are compared with other studies made on the same species from other Antarctic areas. For several species, there are significant differences in chromosome macro- and/or microstructure from one population to another. Such variations may indicate reproductive isolation between populations and, if confirmed, could be used as markers for Fish stock identification.

COMMON NAMES, INDIGENOUS KNOWLEDGE AND DATABASES: A CALL FOR COLLABORATION.

PALOMARES M.L.D.

International Center for Living Aquatic Resources Management (ICLARM), Makati, Philippines

Indigenous knowledge on fish, though strictly descriptive, can be converted to electronic form through the use of modern databases. FishBase, an electronic encyclopedia on fish offers this possibility. Using the common names, language and locality of a fish as a means of identifying ethnic groups, indigenous knowledge is structured and linked, through the scientific name, to other available information . There are so far more than 60,000 entries of common names in FishBase of which only about a sixth have associated etymologies. Of these, only about 100 have specific indigenous «stories» on life cycle and/or local fisheries management mostly obtained from the work of R.E. Johannes in Palau. We call on scientists and enthusiasts attending this conference to help us complete the common names and indigenous knowledge records for fishes of the Pacific region. An easily installed «user database» is available in the FishBase 97 CD-ROM for this purpose.

INDIGENOUS KNOWLEDGE IN FISHBASE: A PHILIPPINE CASE STUDY.

PALOMARES M.L.D. , GARILAO C. & D. PAULY

International Center for Living Aquatic Resources Management (ICLARM), Makati City, Phillipines

An analysis of the common names of fishes in the Philippines obtained from the COMMON NAMES Table of FishBase, a biological database on key information on fishes, was performed. A comparison of the Austronesian and Indo-European origins of common names grouped in 10 Philippine languages were used to show the impact of the Spanish colonization on the use of fish in Philippine culture. The commercial importance of a fish species was expressed as a function of the number of common names given or reported for a given species. The relationship, theorized by Brent Berlin, between the length of fish and the occurrence of the letters «i» and «a» in non-composite common names was tested. The use of databases, such as FishBase, as a repository of indigenous knowledge on fish is discussed.

INDIGENOUS KNOWLEDGE IN FISHBASE: A PHILIPPINE CASE STUDY.

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MOVEMENTS OF JUVENILE AND ADULT FISHES ON REEFS AND ADJACENT SAND FLATS IN HAWAII.

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Studies of demersal fishes living in mixed coral and sand habitats are often limited by the state of knowledge regarding their movements at all life stages. As part of a larger study on the use of habitat by demersal reef-related fishes, several common species were given individualized marks and subsequently recaptured or observed under water over periods up to many months. Underwater sightings indicated that some marked post-larval " reef " fishes moved at least 100m across open sand between artificial reefs within days or weeks after first settlement. It was clear that early migration has effects on estimates of initial settlement and early mortality of juveniles. Certain " edge " environments, including patch reefs and sandy areas near the reef edges, provided important habitat for older juveniles. Sandy areas were more heavily used by " reef " fishes at night. Most marked adult residents of hard substrate showed high fidelity to limited areas within larger, similar, contiguous reef tracts, but occasional individuals moved several hundred meters. The general scale of movement of adults in this study was consistent with limited results from other studies. The early and substantial movements across open sand by recent post-larval settlers may challenge assumptions commonly made in studying local dynamics of this life stage.

IMMUNOCHEMICAL METHODS FOR CIGUATOXINS DETECTION IN PACIFIC HERBIVOROUS AND CARNIVOROUS FISH.

PAUILLAC S., SASAKI M., NAAR J., INOUE M., BRANAA P., CRUCHET P., CHINAIN M., & A.M. LEGRAND

Institut Territorial de Recherches Médicales Louis Malardé, Papeete, Tahiti, Polynésie Française

Ciguatoxins (CTXs), a class of marine lipid soluble polyether toxins produced by the benthic dinoflagellate *Gambierdiscus toxicus* are transferred from the benthos to herbivorous and then to carnivorous coral reef fish via marine food chain. These potent sodium channel activators are responsible for ciguatera, a human food poisoning endemic throughout the Caribbean and Indo-Pacific regions. The clinical picture is characterized by a variety of gastrointestinal, neurologic and occasionally cardiovascular symptoms. Besides its obvious adverse effects on public health, ciguatera fish poisoning generates a negative impact on local fisheries, trade and tourism. In this study we report our strategy towards the development of a laboratory antibody-based assay that could be scaled up to fit the requirement of a routine cost-effective mass screening of fishes prior to consumption. 1) The occurrence and structure of CTX congeners have been investigated in either herbivorous and carnivorous fish or from certain cultured strains of *G. toxicus*. 2) Due to the lack of pure CTXs, conjugates of a synthetic fragment of CTX-1B -the major toxic compound in carnivorous fish-, with two carrier proteins have been synthesized in bulk quantities. In addition, this ring fragment encompassing the right-hand tetracyclic terminus portion of CTX-1B is structurally related to CTX-3C -the major toxic compound of parrot fish-. 3) Mice polyclonal antibodies (PAbs) exhibited strong cross-reactivity to pure CTX-1B in standard or miniaturized competitive ELISA formats. 4) Preliminary assays using crude fish extracts revealed a detection limit of 7 picomoles CTX-1B equivalent for the standard format. 5) As a model before direct handling of pure CTX-1B or other relevant congener, specific mice PAbs have been produced using only 400 µg of PbTx-3 a member of the brevetoxins family, another class of marine polyether toxins. 6) A new simple and rapid RIA format allowed a detection limit of 0.33 picomoles PbTx-3. Finally current hapten immunochemical knowledge and guidelines for future application of a CTXs-specific antibody-based assay are discussed.

TROPICAL INDO-PACIFIC DEEPSEA FISHES, WHERE ARE THE LACUNAE?

PAXTON J.

Australian Museum, Sydney, Australia.

Tropical deepsea fishes of the Indo-Pacific are much less sampled than those of temperate waters. Deepsea waters of the northeast Pacific are the most heavily sampled, as well as temperate deepsea waters of Australia, Japan, New Zealand and Peru-Chile. In the tropics, deepsea waters around Hawaii have been the most intensively sampled, while significant collections have been made in the tropical eastern Pacific and far western Pacific. Massive gaps remain, the most serious of which are around the Indo-Australian Archipelago and the Philippines, both areas with high fish diversity. Important tropical deepsea fish collections are held by Scripps Institution of Oceanography in La Jolla, Shirshov Institute of Oceanology and Moscow State University in Moscow, Muséum National d'Histoire Naturelle in Paris (from the ORSTOM, Noumea collections), US National Museum of Natural History in Washington, DC, and the Australian Museum, Sydney. Tropical deepsea fishes of the Indian Ocean are very poorly sampled. The gaps in Indo-Pacific sampling are huge, including virtually all waters below 2000 m, both benthic and pelagic. All rocky bottoms below 200m are also virtually unknown, with new collecting methods required. To fill these gaps the trends of decreasing research vessels, decreasing fish taxonomists, and decreasing funds for fish biodiversity survey must be reversed.

AUSTRALIAN FISH BIODIVERSITY, ESTIMATES OF KNOWN VERSUS UNKNOWN.

PAXTON J., HOESE D. & M. MCGROUTHER

Australian Museum, Sydney, Australia

Our current total of Australian fish species is 4378 in 302 families, with 3923 described species and 454 species either new and undescribed, or currently indeterminate but recognised as different species. This total excludes fishes of the non-continental portions of our EEZ, such as Antarctic territorial waters and islands, like Lord Howe, Norfolk, etc. The 4378 species is 778 more than the 1985 estimate of 3600 species (a 21% increase) in the Zoological Catalogue of Australia, Pisces part 1. A total of 2027 species in 200 families were included in that volume. Since then for those 200 families an additional 266 species (>11%) have been collected/recognised from Australian waters. Most of the increases were from benthic slope waters. While relatively few additions are expected from inshore waters, the deepsea is undersampled, with all below 2000m virtually unsampled. The rate of increase since 1985 indicates that we are not close to discovering all Australian fish species, and that the final total will exceed 5000 species. As the number of Australian fish species is increasing, the number of Australian fish taxonomists is decreasing. In 1990 there were 14 full time fish taxonomists in Australia; in 1997 the total is 9 and decreasing.

ACANTHOCEPHALANS IN THE INDO-PACIFIC REGION.

PICHELIN S.

South Australian Museum, Adelaide, Australia.

Acanthocephalans have a cosmopolitan distribution and are known to infect birds, mammals, reptiles, amphibians and fish; acanthocephalans use invertebrates as intermediate hosts and may also use paratenic hosts. About half of the acanthocephalan species described use marine and/or freshwater fish as their definitive hosts. In the Indo-Pacific region, about 181 species in 11 families have been recorded from about 242 species in 74 fish families. All Indo-Pacific acanthocephalan families have been recorded from more than one host family but 63% of these acanthocephalans are restricted to one host species suggesting some degree of host-specificity is present. Most of the Indo-pacific acanthocephalans that have been recorded from more than 10 host species have had some problems with their taxonomy. Preliminary studies on fish acanthocephalans in Australian coral reefs and coastal areas have revealed many new fish hosts. These range from planktivores, herbivores to both diurnal and nocturnal predators. An understanding of host behaviour and diet can help elucidate parasite lifecycles. For example, should the intermediate hosts of marine acanthocephalans be gammaridean amphipods, then infections probably occur after settlement as gammarideans are usually associated with reef surfaces. Although it is certain that the diet of the host will influence whether it becomes infected and to what degree, there appear to be other factors influencing parasite distributions, such as host range and site attachment, which will also be discussed. The possibility that paratenic hosts (i.e. planktivorous fishes) act as a trophic link between reefs and open water fish will also be discussed.

IDENTIFICATION OF CARIBBEAN CIGUATOXINS AS THE CAUSE OF AN OUTBREAK OF FISH POISONING IN HAITI.

POLI M.A , LEWIS R.J., DICKEY R.W., MUSSER S.M., BUCKNER C.A. & L.G. CARPENTER

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On 24 February 1995, six U.S. soldiers serving with the Multinational Force in Haiti became ill after eating a locally caught fish later identified as the greater amberjack *Seriola dumerili*. The victims presented with nausea, vomiting, watery diarrhea and abdominal cramps 5-8 hours after consumption. Also present in some victims were numbness in the extremeties or perioral region, bradycardia or scalp paresthesia. Patients were treated with i.v. hydration therapy and antiemetics. All recovered without sequelae over the course of 1-3 months. A portion of the cooked fish was obtained for analysis. A semipurified lipid extract was prepared according to standard methods and analyzed for the presence of Na^+ channel site 5 binding activity using a brevetoxin receptor binding assay. By this assay, the fish sample contained he equivalent of approximately 20 ng Caribbean ciguatoxin per gram of cooked flesh. The presence of the major Caribbean ciguatoxin (C-CTX-1) was confirmed by liquid chromatography mass spectrometry. Using the receptor binding assay to monitor activity in TSK and PRP-1 column fractions, two minor toxins were detected in addition to C-CTX-1. One of these minor toxins was more polar, and the other less polar, than C-CTX-1. These data provide firm evidence that a family of ciguatoxins is responsible for ciguatera in the Caribbean.

CONSERVING THE FRESHWATER FISH FAUNA OF NEW CALEDONIA.

PÖLLABAUER C.

ERBIO, Nouméa, Nouvelle-Calédonie

Situated in the southwestern Pacific Ocean, the main island of New Caledonia covers a surface of 16,890 km2. As a consequence of the strategic position like old geological connections, its complex orographic and climatic characteristics, the New Caledonia exhibits a great variety of natural regions and singular habitats in which, an exceptional fauna and vegetation diversity have originated. From 1990 to 1997, the bibliographical data about New Caledonian freshwater fishes were compiled, a critical analysis of them were performed and the fish fauna of 71 rivers in the South Province (6904 km2) and 17 in the North Province were investigated. A total of over 3000 specimens have been collected and 89 species belonging to 57 genera and 33 families were examined. On the basis of these results, the rare, endemic, threatened or endangered species have been identified. For every species a file have been carried out containing aspects like descriptions, drawings, photographs, risks, spatial dristribution maps and conservation efforts that should be made to reduce the risk.

DISTRIBUTION OF INDO-PACIFIC COLOCONGRID FISHES.

QUÉRO J.C. & L. SALDANHA

IFREMER, La Rochelle, France

Four species of *Coloconger* are recorded from the Indo-Pacific between about 35°N and 35°S: *C. raniceps* from Japan (35°N) to Mozambique Channel (21°24'S) and La Réunion Island (21°23'S), depth 480-1134 m; *C. scholesi* from China Sea (19°22'N) to Natal (about 30°S) and South-Eastern Australia (34°30'S), depth 412-1115 m; *C. japonicus* from South Japan (29°38'N) and the South China Sea (7°50'N), depth 750-777 m and *C.* sp. Nov.from the New-Caledonia, depth 580 m. The colocongrid fishes are not recorded from the Eastern Pacific or the islands of the Central Pacific. These four species are benthic mostly on continental slope at depth 4122-1134 m, one known metamorphic leptocephalus of *C. raniceps* being bathypelagic (4040 m). If the extreme depths of the catches of *C. raniceps* and *C. scholesi* are similar in the Mozambique Channel, the French catches of *C. raniceps* (6 specimens: depths 480-720 m, mean 596 m; 5 specimens of La Reunion Island: depths 700-760 m, mean 728 m) are less deep than those of *C. scholesi* (9 specimens: depth 675-12200 m, mean 975 m; 8 specimens of New-Caledonia: depth 412-970 m; mean 790 m).

ZOOGEOGRAPHY OF CORAL REEF FISHES OF THE INDO-PACIFIC REGION.

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The vast tropical and subtropical Indo-Pacific region extends from the Red Sea and east coast of Africa to the Hawaiian Islands and Easter Island. Within the Indo-Pacific, clearly the richest fish fauna is found in the Indo-Malayan region (southeast Asia, East Indies, and northern Australia). Within this area, Indonesia and the Philippines are estimated to have 2,500 species of reef and shore fishes. One reason for the rich diversity of species is the stability of the region with respect to temperature during an ice age. Extinction rates were high in the higher latitudes and on the eastern side of the three oceans with tropical biota where cool currents compress the tropical zone. By contrast, the west side with a broader tropical zone, was affected less by ice age temperature drop. Another reason is the result of a barrier to east-west dispersal of a large percentage of reef and shore fishes during an ice age. Over the last 700,000 years there have been at least three (but perhaps as many as six) glacial periods capable of lowering the sea level enough to close the Torres Strait, the Malacca Strait, and the Sunda Strait (between Sumatra and Java). However, there was not a total east-west land barrier. What made it a total barrier to east-west dispersal of purely marine species was the low salinity and high turbidity resulting from discharge of large rivers in the area, coupled with postulated upwelling of cooler water from the larger land masses. Thus we have the potential, with each ice age (the last was 18,000 years ago) to double the number of species in the area, hence a scenario comparable to the land barrier that occurred in Panama during the last glacial period that produced the geminate fish species of Jordan (i.e. very closely related Caribbean and eastern Pacific species pairs). When an interglacial period followed and sea level rose, the isolated faunas could intermix. Some incipient species merged, whereas others remained as distinct sister species. Many examples of such species pairs are known, such as *Chaetodon lineolatus* and *C. oxycephalus*, but perhaps there are others that may have differentiated ecologically, behaviourly, or physiologically, but not enough morphologically for us to readily detect. Springer and Williams (1990) provided examples of species with distributions in the Pacific and Indian Oceans but without any records for the Indo-Malayan region. They postulated that such species may have become extinct in the Indo-Malayan region during a glacial period and not been able to reinvade later. Perhaps these are species for which some ecological requirement is needed to complete their life history, such as clear oceanic water for the development of larvae. Or in this richest area there may now be too much competition for them to resume their niche. Or perhaps there are now predators, parasites, or diseases which preclude their recolonization. We also have north-south disjunct populations in the western Pacific termed antitropical and antiequatorial. The same explanations could apply as the east-west dislocations, plus the obvious possibility of these being species adapted to subtropical temperatures, hence unable to survive in low latitudes during interglacial periods. The principal Indo-Pacific areas of endemism other than the Indo-Malayan region are the Red Sea; Natal; Madagascar, Réunion and Mauritius; southern Oman; Andaman Sea; western Australia; southern Japan; southeastern Australia; Lord Howe Island and Norfolk Island; Hawaiian Islands, Marquesas

Islands; Pitcairn Group and Rapa; and Easter Island. Of these, the reef and shore fishes of the Hawaiian Islands have the highest percentage of endemism, 24.3%, but closely followed by Easter Island with 23%. These percentages change as our knowledge of the faunas increases. Gosline and Brock (1960) determined the endemism for reef fishes in Hawaii as 34%. The discovery of alleged Hawaiian endemics elsewhere and the reporting of new records of wide-ranging Indo-Pacific species to Hawaii (some apparently only as waifs) has lowered the number of endemic species. Some authors believe that speciation can only be the result of a vicariant event, such as the separation of the western Atlantic and eastern Pacific marine biota with the emergence of a land barrier in Panama during a glacial period. However, it seems clear for the highly isolated islands, such as those of the Hawaiian Islands and Easter Island, that speciation has occurred as a result of the chance colonization by larvae, followed by a long period of little or no gene flow. No vicariant event is needed. A successful spawning by the progenitor stock, coupled with just the right current pattern (such as entering a gyre at just the right time) could result in a pulse of larvae to an area not reached before and not likely to be attained again in the near future. The sister species of some of the Hawaiian and Easter Island endemics can be readily identified. Others are clearly relics for which no closely related species are known. Examples are the scorpionfish *Pterois sphex*, the grouper *Epinephelus quernus*, the butterflyfish *Chaetodon fremblii*, the angelfishes *Centropyge potteri* and *Genicanthus personatus*, the wrasse Coris flavovittatus, and the parrotfish *Chlorurus perspicillatus*. The Hawaiian Islands have been forming intermittently over a fixed volcanic site in the Pacific Plate for at least 70 million years, so there has been ample time for a species to become extinct except in Hawaii where the cause of extinction elsewhere, such as more efficient predatory or competitor species, did not happen. A unique example of a relic species is the hawkfish *Cirrhitops fasciatus*, known only from the Hawaiian Islands, Mauritius, and Madagascar.

TEMPORAL VARIABILITY OF SMALL-SCALE REEF FISH ASSEMBLAGE DISTRIBUTION.

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Fish visual surveys were undertaken in Escarceo Point, Puerto Galera, Philippines to determine if any small-scale patch patterns may be discerned. Observations were made for 32 months at various intervals. Fish species were recorded for every 5 meter segment in a fixed 150 m x 10 m belt transect. Patch distribution was obtained by a combination divisive clustering, species-area curve and occurrence analyses at different scales (every 5 m, 10 m, 15 m, 20 m, 25 m). Insights are given as to the fish's possible swimming range, affinity to habitat and association with other fish species present.

BUTTERFLYFISHES AS INDICATORS OF CONDITIONS ON CORAL REEFS.

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The abundance, distribution and behavior of coral feeding butterflyfishes, Family Chaetodontidae, serve as indicators for the assessment of ecological conditions on Pacific coral reefs. Species belonging to the corallivore feeding guild are the best indicator species. They are conspicuous, diurnally active, and their behavior is measured easily, even by relatively unskilled observers. They tend to be strongly site attached and territorial, predictable in their movement patterns, and long-lived, making them long-term, permanent residents of the living coral reef. Since they live on the reef, shelter on it at night and feed on living coral during the day, they are intimately associated with the reef. Since reef fishes are mobile, but corals are not, changes in the abundance, distribution and behavior of the coral feeders indicate changes in ecological conditions on the reef. The method is useful where perturbations to the reef are occurring slowly but chronically. A sensitive indicator method is not needed to detect massive, episodic changes to the reef. The method is useful to detect changes over time on a specific reef. It is not appropriate to compare conditions on two or more reefs at the same point in time because differences in the butterflyfishes on the reefs may be due to other processes such as recruitment. It is an inexpensive and easily implemented method which promises to be useful to assess long-term, slow but chronic changes to coral reefs. Currently studies are in progress simulating this kind of change.

USE OF MICROSATELLITE LOCI TO RE-EXAMINE LEVELS OF GENETIC VARIATION IN CULTURED ATLANTIC SALMON FROM TASMANIA, AUSTRALIA.

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Atlantic salmon (*Salmo salar* L.) were imported into Australia in the mid 1960s with an initial population established in New South Wales. Ova from this founding stock were then introduced to Tasmania over a three year period in the mid 1980's to form a significant and expanding industry producing 7000 tonnes in 1995-96. Potential inbreeding was assessed in 1993 with seven variable allozyme loci and mitochondrial DNA variation; the Tasmanian broodstock was compared with the parental River Philip population in Nova Scotia, Canada. Small but significant differences in some allozyme allele frequencies were observed. The mean heterozygosity per allozyme locus was 0.207 for the Tasmanian fish and 0.182 for the Canadian fish. Mitochondrial DNA variation was very limited but there was no evidence of a reduction in variation in the Tasmanian fish. In 1996 a study was undertaken to re-examine the same individuals for eight polymorphic microsatellite loci. Small but significant differences in allele frequencies between the two samples of fish were found for four of the eight loci. Mean heterozygosity per microsatellite locus was more than twice that of the allozyme loci, at 0.434 (n=63) for the Tasmanian fish and 0.509 (n=63) for the Canadian fish. The three approaches all suggest that there have been some changes in the genetic makeup of the Tasmanian fish as compared with the Canadian fish, but that diversity levels have generally been maintained. We hope to monitor levels of genetic variation every few generations to check on any long-term changes.

CAMALLANID NEMATODES OF INDO-PACIFIC CORAL REEF FISHES.

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Among the metazoan parasites of coral reef fishes, mainly digeneans, monogeneans, and copepods have been investigated. These are by far the most abundant and speciose parasites of coral reef fishes. Other, less studied, parasite groups include the acanthocephalans, cestodes, isopods and nematodes. The adult nematodes of coral reef fishes are, with some notable exceptions, found within the gastrointestinal tract. One of the more common nematode groups found in Indo-Pacific reef fishes are camallanids. Worms of this family are easily recognizable by their red body and conspicuous buccal capsules. These nematodes are found within the host's intestine, there they attach to the mucosa via their buccal capsules and feed on the host's blood. The strong differences in buccal capsule structure between genera, and some species, make them easily distinguishable. In Indo-Pacific fishes, this family is represented by 4 genera (out of the 10 genera found in freshwater systems): *Spirocamallanus, Camallanus* and less commonly by *Procamallanus* and *Onchophora*. Low host specificity and a simple 2 host life cyle may have contributed to the wide geographic distributions of some of these worms (though *Onchophora* seems to be restricted to pelagic fishes) and thee lack of a cline in species numbers from west to east in the South Pacific, as seen in most other free living organisms (and their parasites). In French Polynesia, we investigated both the ecology and taxonomy of these worms. There, we found species differences between carnivorous and herbivorous fishes, habitat types and between archipelagos. However, these worms appear to have low speecificity within these boundaries. Lastly, we found no size reelated patterns in fish hosts in French Polynesia.

THE MICROPYLE OF FISH EGGS - MORE THAN A PERFORATION OF THE EGG ENVELOPE.

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All eggs of teleost fishes are all surrounded by an acellular envelope. This envelope is mostly called zona radiata. The morphology of the variable zona radiata presents an impenetrable barrier for sperm cells. In addition, apart from two known exceptions in *Lepidogalaxias salamandroides* (Lepidogalaxiidae) and *Gambusia affinis* (Poeciliidae), none of the teleost spermatozoa have acrosomes. As these vacuoles in the sperm heads contain substances which lyse the various membranous egg envelopes they aid penetration of the genetic material. For this reason another mechanism for the entry of the sperm into the egg had to be developed to ensure fertilization. This is achieved by a predetermined perforation in the envelope, the micropyle. All hitherto investigated teleost fishes only have one micropyle but in sturgeons, for example, there may be as many as 52 of these pores. To date four different types of micropyles have been described. The micropyle has different functions. These are 1. penetration of the spermatozoa, 2. prevention of polyspermy, because polyspermy leads to maldevelopments in teleosts, 3. attraction of spermatozoa by pheromones and 4. influx of water during the formation of the perivitelline space. It has been shown recently in the medaka (*Oryzias latipes*, Oryziidae) and in the Schneider (*Alburnoides bipunctatus*, Cyprinidae) that the micropyle is closed by a plug of cytoplasm immediately after the first spermatozoon has passed through it. Spermatozoa are able to find the micropyle by means of three different ways: 1. By accident. This is the easiest way, because there are immense quantities of spermatozoa, 2. by attraction of pheromones and 3. and by sperm guiding systems as described recently in cyprinids, anabantoids and loricariids.

THE SANDFISH, *GONORYNCHUS FORSTERI*, FROM BATHYAL DEPTHS OFF NEW CALEDONIA, WITH NOTES ON NEW ZEALAND SPECIMENS.

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The Australasian sandfish, *Gonorynchus forsteri* Ogilby, is recorded for the first time from the New Caledonian EEZ. The record is based on two adult specimens, one running ripe female and one spent or resting male, captured at 960-1233 m depth on the Loyalty Island Ridge and Lord Howe Rise during French exploratory cruise HALIPRO2. Their unexpected presence in bathyal depths, over 500 nautical miles from the nearest known populations, is discussed and compared with the occurrence of the species in New Zealand waters. It is hypothesized that adult sandfish migrate along oceanic ridges to spawn in southern New Caledonian waters. Project supported in part by the New Caledonian ZoNéCo Programme and NZ FRST contract MNZ603.

FISHES OF THE NAM THEUN WATERSHED IN LAOS, WITH REMARKS ON ENVIRONMENTAL IMPACTS OF THE PROPOSED NAM THEUN 2 HYDROPOWER PROJECT.

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The Nm Theun, a moderately large high gradient Mekong tributary in a high rainfall area in central Laos, has a distinctive fish fauna (about 100 species, many of them undescribed). Nam Theun fish faunal relationships are with the relatively cool water higher elevation tributaries of the Mekong in Yunnan, Burma, and northern Laos, rather than with warmer low elevation tributaries in southern Laos, Thailand, and Cambodia. Among the more distinctive fish species is a predatory barbine reportedly reaching 3 m and over 100 kg and preying on monkeys. A large proportion of the cyprinid-dominated fish fauna is strongly migratory. Fishes and fish ecology of the Nam Theun watershed are threatened by no less than 5 substantial hydropower projects. At least one project, the Norwegian-backed Theun-Hinboun, is under construction. The project with the worst preddicted environmental consequences, is the Australian, French, and Thai-backed Nam Theun 2 project. This double-diversion scheme will have severe negative impacts on the Nam Theun and two adjacent river systems that would otherwise suffer little or no impact from hydropower development, the Xe Bang Fai and the Nam Hinboun. Environmental impact assessments of hydropower projects in Laos commissioned by the project proponents, typically overlook the worst environmental impacts.

BIOSYSTEMATICS OF NEW ZEALAND EEZ FISHES PROJECT.

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The known fish fauna of New Zealand has doubled over the last 15 years, and continues to increase at the rate of a new species every 2-3 weeks. Currently over 140 species are held in the national fish collection awaiting proper description, including numerous commercial, ecologically important, and endemic species. In addition, many described species are poorly diagnosed and are therefore very difficult to identify. The main objective of this project is to carry out biosystematic investigations on New Zealand EEZ fishes in order to facilitate their accurate identification. Taxonomic specialists from New Zealand and overseas have started to prepare c.1200 species descriptions and 230 family keys over a six-eight year period, and make these available through a comprehensive illustrated guide to EEZ fishes and in other scientific and popular publications. Reliable descriptive information on the New Zealand fish fauna is required by the fishing industry, fish stock managers, regulatory authorities and researchers to underpin the research, conservation, management and utilisation of this diverse and valuable natural resource. NZ FRST contract MNZ603.

SIZE AND AGE AT SETTLEMENT OF FOUR SPECIES OF REEF FISHES.

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Pelagic larval duration and size at settlement of four species of coral reef fishes, were studied during two lunar cycles at Rangiroa atoll, French Polynesia. Settlement stage fish of two species of acanthurids (*Acanthurus triostegus* and *Ctenochaetus striatus*) and two species of pomacentrids (*Pomacentrus pavo* and *Chromis viridis*) were collected using crest nets. Morphometry, pelagic larval duration and dispersion time of arrivals were compared on each species. Condition index was studied for *Acanthurus triostegus* and no variation was shown during the lunar cycle. Results suggest that colonization strategies may differ among different species for the same family. Those differences may or not be related to the plasticity of the pelagic larval duration. Results show two patterns of colonization. For *Ctenochaetus striatus* the larvae arrived at only one day of the lunar cycle and at different sizes and ages. For the three other species sizes and ages at the arrival were similar. Arrivals were unimodal for *Pomacentrus pavo* and multimodal over the entire lunar cycle for *Chromis viridis* and *Acanthurus triostegus*. Additional studies are needed to know the plasticity of size and age at setlement for the other species of reef fish.

TEMPORAL CHANGES IN FISH ASSEMBLAGES OF SHALLOW SEAGRASS AND ALGAE BEDS IN THE NEW-CALEDONIA LAGOON.

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Between March 1996 and February 1997, the fish assemblages of 8 seagrass beds and 8 algae beds located in shallow coastal areas near Noumea (New-Caledonia), were sampled monthly using visual census in order to detect temporal changes in fish composition, density and biomass and determine if these habitats played a nursery role for lagoonal fishes. A total of 213 species representing 39 families was recorded, 140 species (31 families) were present on seagrass beds and 178 (36 families) on algae beds. Mean species richness (pooled over the year) was higher on algae beds (32 species·transect^{-1}) than on seagrass ones (20). Mean fish density was similar on both habitats (between 1.8 and 2 fish·m^{-2}) but mean biomass was twice higher on algae beds (43 g·m-2) than on seagrass ones. However, these values fluctuated greatly over the year, especially on seagrass beds, with minimums observed in winter (0.5 fish·m-2, 15 species·transect^{-1} and 6 g·m-2 on seagrass beds) and maximums in summer (7.5 fish·m-2, 25 species·transect^{-1} and 30 g·m-2). The variations were due to the arrival of large schools of juvenile fishes, mainly *Siganidae* and *Lethrinidae,* in late spring and early summer, followed by a progressive decrease in fish abundance, several species disappearing totally during the winter. Additionally, the juveniles observed on both habitat types appeared later and were generally larger on algae beds than on seagrass ones. These results suggest that some lagoonal fishes recruit on seagrass beds, move afterwards on adjacent habitat types such as algae beds and finally leave the coastal areas to colonize others parts of the lagoon.

NEW RECORDS OF RED SEA MIGRANT FISH IN THE SYRIAN WATERS: INFLUENCES OD ENVIRONMENTAL FACTORS AND MAN-MADE STRUCTURES.

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The influx of Red Sea biota into the Mediterranean Sea via the Suez Canal ("Lessepsian migration"") has fascinated scientists since the end of the last century. Until the last twenty years, the study of Lessepsian fish was limited to monitoring and inventory. In order to make an environmental and systematic survey in Syrian waters, we collected fish specimens from October 1992 to November 1993 with demersal trawls all along the Syrian coast. This survey allowed to bring 4 new records for Syrian waters: Apogon taeniatus, Callionymus filamentosus, Cynoglossus sinusarabici, Silhoueta aegyptia, known from Red Sea and Indian Ocean. This migration is the result of environmental changes which happened in the eatsern basin of the Mediterranean Sea. whose water characteristics became close to those of the Red Sea.

REPRODUCTIVE CYCLE AND FECUNDITY OF UPENEUS MOLUCCENSIS (BLEEKER, 1855) INDO-PACIFIC SPECIES IN SYRIAN MARINE WATERS (EASTERN MEDITERRANEAN SEA).

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Upeneus moluccensis is a new Lessepsian migrant which now occurs in the Syrian waters. The repoduction of this new migrant has been studied with samples collected from commercial landings in Lattakia from 1992 to 1994. The gonado-somatic index (RGS), hepato-somatic index (RHS) and condition factor (K) were measured. As a result, U. moluccensis breed from June to August and from September to beginning of October in Syrian waters. Standard length at first maturity was estimated to 12 cm for females and 11 cm for males. The relative fecundity was estimated at 6433 # 1732 eggs/g ovary. The characterization of the main stages of the reproductive cycle was achieved by visual inspection of ovary morphology and ponderal analysis, as well as by histological examination.

MARICULTURE IN SOUTHEAST ASIA; JUST ANOTHER CAPTURE FISHERY?

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Mariculture in Southeast Asia is characterized by the grow-out, in captivity, of wild-caught juveniles. It is thus heavily dependent on juvenile availability from the wild in terms of both abundance and species. Traditionally, mariculture based on wild-caught juveniles has been viewed as an important supplementary means of enhancing protein production over and above capture fishery levels because of the assumption that the majority of juveniles taken for grow-out would otherwise have perished before recruiting into any fishery. This assumption stems from the high mortality levels inferred in marine species producing pelagic eggs between the egg stage and early post-settlement. However, since our understanding of pelagic and early settlement phase mortality levels is so poor and since juveniles of several important species (such as the groupers, *Epinephelus* spp.) are often well past the early settlement phase when captured for mariculture, there is clearly a need to re-examine our assumptions about the sustainability of mariculture practices in the region based on wild capture. Increasing difficulties reported in procuring juveniles for grow-out, or in locating preferred species, and the use of damaging techniques to collect them, should further signal a need to re-examine current approaches to mariculture. Examples will be presented to illustrate these problems. The role of, and need for, regional governments and NGO's in developing a healthy and sustainable mariculture sector based on hatchery-rearing, rather than wild-capture, are examined.

THE EFFECT OF ACCLIMATED TEMPERATURE ON THE ACTIVITIES OF ASPARTATE AND ALANINE AMINOTRANSFERASE AND GROWTH PERFORMANCE OF *CHANNA STRIATUS.*

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Three groups of *Channa striata* collected in May (summer), February, December (winter) were exposed to three experimental temperature i.e. 16°C, 21°C and 32°C respectively. The experimental fish along with the corresponding control fish, adapted to natural temperature were maintained with a formulated diet containing 45% protein for thirty days to find out the effect of temperature on the growth, feed efficiency and the activities of aspartate (AsAT) and alanine (AlAT) aminotransferase in liver, white muscle and serum. The feed consumption was found to decrease with decrease in temperature in both control and experimental fish. The growth of the fish was found to be higher in the February (control 2) and at an experimental temperature of 21°C with highest protein and feed efficiency. The AsAT activity was found to be higher in all the tissues in both experimental and control fish at all the temperatures than that of AlAT. Except the activity of AlAT in the liver of control fish, which remained almost same, the aminotransferases in liver and serum of both experimental and control fish were found to increase with the increase in water temperature. The AsAT of muscle increased significantly with the increase in the experimental temperature from 16°C to 32°C when the activity of AlAT remain unchanged. In control groups, the highest activity of muscle AsAT was observed in winter-adapted fish when the AlAT activity was found to be the same for summer - and winter - adapted fish.

THE ABORE MARINE RESERVE (NEW CALEDONIA) - 5: COMPARISON OF DENSITY, BIOMASS AND SIZE STRUCTURE OF FISH COMMUNITIES.

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Two studies of the coral reef fish population of Abore marine reserve were performed, the first one in August 1993, when this area was protected and two years later, in August 1995, when part of the reef was opened to fishing. Three biotopes were identified: the reef flat, the inner slope and the 'forest'. During this study the length, the density and the biomass of fish were estimated using underwater visual census transects. During the period between 1993 and 1995, the results show that the average length of species decreased. This trend is systematically more important in the fished area, and mainly for species of commercial interest, than in the reserve. The density of fish increased in the protected area (2.9 vs. 4.4 fish/m^2) opposite to the fishing zone (5.4 vs. 4.9 fish/m^2). The decrease in biomass observed during this period, in the reserve (321.1 vs. 253.3 g/m^2, 21% less) is less important than in the area opened to fishing (454.7 vs. 294.2 g/m^2, 35 % less). In each biotope these general trends are confirmed. As shown by the results, these differences are due to the opening of part of the reef to the fishing, but also to environmental change in the substrate and also benthos. Correlations between the trophique structure of the fish assemblages and their environmental parameters are also presented.

DETERMINANTS OF MONOGENAN SPECIES RICHNESS AND SPECIFICITY.

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A comparative analysis was performed among published data of parasite studies in order to investigate i) the determinants of Monogenean species richness of Mediterranean Sea fishes; ii) the determinants of monogenean specificity. The phylogenetic independent contrasts method has been used to resolve the problem of non-independence of data (i.e., traits measured across different species) in comparative studies (Felsenstein, 1985; Martins & Garland, 1991; Pagel, 1992; Garland et al., 1992). Our results show that host size is the main factor responsible of the monogenean species richness. The positive relationship between fish body size and the number of parasite species may be explained by the hypothesis that larger host body size increases host vagility which in turn enhances exposure to more and more parasite species. Monogeneans usually have a restricted host range but some monogenean species can be found on several host species. We hypothesised that the reduction of the host range - that is an increase in host specificity - may correspond with a better adaptation of the parasite to a then more predictable host environment. We assume that the more predictable host environment can be evaluated by its body size since numerous life-traits such as longevity are positively correlated with size. Our results show that strictly specific parasite species are found on larger hosts. Moreover, we found a significant relationship between host size and parasite size for specific parasite species. Results are discussed in term of mecanical contraints existing on

PARASITISM AND BIOLOGICAL CONSERVATION OF FISHES.

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Protected or endangered host populations are considered to be very sensitive to parasites or pathogens. However, little is known on the effects of a parasite introduction into naïve host populations. Several hypotheses have been proposed on the outcome of a new host-parasite association suggesting a local adaptation (parasite are better adapted to their local host) and/or a higher virulence. We have tested these hypotheses by performing a laboratory experiment. A parasite species (Labratrema minimus, Digenea) was confronted to its local fish population (sympatric combination) and to four geographically and genetically, naïve host populations (allopatric combinations). We evaluated host responses to the parasite at both epidemiological and histological levels. We found no significant differences in term of host susceptibility between the different combinations tested. However, the parasite development was better, and both histological and physiological responses of the host were stronger for the sympatric combination. This study supports the local adaptation hypothesis but also suggests that a better adaptation is not linked with a lower virulence. These results are discussed in relation with biological conservation programs.

SYSTEMATIC STUDY ON THE INDO-PACIFIC SPECIES OF *APRISTURUS* SCYLIORHINIDAE).

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The deep-water catshark genus *Apristurus* currently contains 32 species from the world. The taxonomy of the genus is still in confusion, because of the presence of many new, little-known nominal species and synonyms. Here we refer to the taxonomy of Indo-Pacific species and discuss their relationship within the genus. Based on morphometrics and meristic counts taken from all the existing types and more than 600 specimens, the taxonomy of the genus was reviewed. Consequently, at least seven undescribed species were found particularly from southern Indo-Pacific, and two synonym relations were clarified (i.e., *A. acanutus* with *A. platyrhynchus*; *A. internatus* with *A. gibbosus*). Detailed comparative morphology of the skeleton, musculature, lateral line system and egg capsules were done in 20 *Apristurus* species. Some anatomical characters, e.g., supraorbital canal, skeleton and musculature associate with branchial arches and pelvic girdle indicated two distinct subgroups (*brunneus* group and *spongiceps* group) in the genus *Apristurus*.

SPATIAL PATTERNS OF CONCURRENT SETTLEMENT OF THREE DAMSELFISHES AT MOOREA, FRENCH POLYNESIA.

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The larvae of three species of damselfish in the genus *Dascyllus* have similar planktonic durations (~ 24 days) and settle to coral reefs on Moorea, FP during the same part of the lunar cycle. This implies that a larval cohort of all three species are subjected to the same oceanographic processes that transport and deliver them. Therefore, in the absence of larval behavior, the three species may be expected to show qualitatively similar spatial patterns of settlement. We examined patterns of concurrent settlement by these damselfishes at a series of sites distributed evenly around the triangular-shaped island of Moorea, and at sites nearer to and farther from shore. The same amount of settlement habitat (corals and sea anemones) used by these damselfish was placed at each location, and counts of new settlers were made daily at each site. One settlement pattern was consistent among species and appeared to have a simple oceanographic explanation. Settlement to sites near the 'corner' of an island side was twice as great as that to sites nearer the center of a side, a pattern that mirrored measured differences in water flow at the locations. Two other settlement patterns varied considerably among the species. At the island scale, one species (*D. trimaculatus*) primarily settled on the north half of Moorea, a second (*D. aruanus*) mostly settled in the southern portion, and the third (*D. flavicaudus*) settled most heavily on the western half. With respect to inshore - offshore location within a lagoon, *D. trimaculatus* displayed no difference, *D. aruanus* primarily settled nearshore, and *D. flavicaudus* mostly settled offshore. These results suggested that larval behavior may play a major role in shaping spatial patterns of settlement.

TAIL SPINE CHARACTERISTICS OF STINGRAYS FOUND IN THE NORTHWEST ATLANTIC OCEAN.

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Scientists usually ignore or cannot correlate spines, often imbedded in sharks, fishes, sea turtles, bottlenose dolphins or man with their stingray host. Stingrays use their bilaterally asymmetric serrate tail spine(s) defensively. Eleven of 12 stingray species found in the northwest Atlantic Ocean possess one or more tail spine(s). Six species are Dasyatids, one Urolophid, and four Myliobatids. Each species' serrated spine(s) can be easily distinguished by the number of serrated lateral teeth, spine shape and configuration, and spine structure. Each species will be depicted and discussed, including how many multiple spines can exist/species and how they arise.

POSITIVE AND NEGATIVE OUTLOOKS FOR UNITED STATES AND WORLD SHARK FISHERIES.

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Worldwide concerns have steadily increased regarding catches of seemingly decreased, depleted or overfished elasmobranchs. A gloom and doom atmosphere has developed concerning continued existence of sharks. Such views led to management plan(s) implementation(s) for many sharks and world fisheries. Unfortunately most shark management plans are based on poor or little solid biological data, extrapolations, reliance on models, and lack long term tagging or biological stock data. Most plans also fail to consider short or long-term environmental or species cycles that offset abundance, presence, or seasonal availability. Model accuracy is further compounded by attributing catch data to landing port, not capture site. Limiting number of fishermen, trip quotas, and seasons have drastically affected commercial and sport fisheries worldwide. Several shark fisheries increased along the Atlantic (basking, porbeagle) and Pacific (shortfin mako, spiny dogfish, California thresher, California soupfin, angel shark) U.S. following federal encouragement of fishermen to target sharks useable for food, fins, etc. Following dramatic catch increases (1970-1980's) and disregarding the dearth of biological information, management plans were initiated for the Atlantic and Gulf coasts. Nationally 35 Atlantic, 31 Gulf of Mexico, and 27 Pacific Ocean species were affected by regional or national plans. Longlining the same mid-Atlantic shelf stations (April-November 1967-present) off Shackleford Banks, NC, CPUE's/100 hooks varied between 0.033 (1992) and 0.136 (1977) for 20 of 28 commonly captured sharks. Abundances of three species increase prior to the 1991 management plan. It is premature to note the effects of the plan as commercial catches have also increased. Post plan CPUE's may be influenced by factors other than the plan. Decreased commercial catch quotas have driven many commercial fishermen to other underutilized areas and species. Sharks will persist in spite of man.

CURRENT RESEARCH ON CHONDRICHTHYES IN FRANCE

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From the early time of Ichthyology, French naturalists have been involved in studies on chondrichthyan fishes. Thus, from Risso (1810) to J. Y Cousteau, a number of studies have been carried out on sharks, skates and sometimes on chimaeras from coasts of France but also from those of overseas French territories and former colonies. Nowadays, there are still researches on these fishes but there are limited due to lack of shark experts. However, the needs, both public and private, exist and even are somewhat increasing with the development of a more general feeling for nature and resource conservation. So what should be done ?

DISTRIBUTION AND DATABASE OF FISHES IN TAIWAN WATERS.

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The total number of fishes in Taiwan compose of 233 families and 2357 specie. Most of them are marine fish, 2300 species. Their distribution in Taiwan waters have been established in two databases and now can be accessed interactively on the internet. (http: //fishdb.izas.sinica.edu.tw). The database were constructed on the GRASS and Informix Online with dbsQL interface. User can easily check the actual distribution areas of each species on the map (in a grid system, 10' each) or obtain a species list distribution for each grid. For economical fish within 12 nautical miles from the coastline, 404, 304, 290, 370, 528, 208 species have been recorded in the north, north-eastern, south-eartern, south, south-western, and north-western parts of Taiwan respectively. For coastal (mostly coral reef) fishes, 1104 (Kenting, south), 715 (east), 663 (north), 650 (west), 646 (Penghu), 601 (Green Isl.), 601 (Hsiaoliuchiu), 558 (Orchid Isl.), and 332 (north-eastern) species have been included. Faunistic similarity measure and clustering results of the above distribution data have shown that the distribution pattern of Taiwan fishes are mainly affected by temperature, i.e., Ocean current (warm Kuroshio coming up from south and cool China coastal waters come down from north) and substratum. Fish fauna are quite different between the north and south especially those dominant reef species. The overlapping area are in Penghu on the west and in the north-eastern Taiwan on the east of Taiwan.

COMPARISON OF THE NUTRITIONAL STATUS OF *CYPRINUS CARPIO* LARVAE FED WITH LIVE AND ARTIFICIAL DIETS UNDER THREE STOCKING DENSITIES.

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The aim of this work was to study the influence of two diets on the nutritional status of common carp, *Cyprinus carpio* larvae under three stocking densities in recirculating systems. The evaluation criteria for food quality were: survival and growth of larvae and proteolytic enzyme activity. Common carp larvae (10.5 + 2 mg) were cultured in 15 L aquarium under three stocking densities - 25, 50 and 100 larvae/aquarium. Larvae were offered two differen tdiets: live food (natural zooplankton) and artificial diets. After a 30-day experiment, significantly higher ($P<0.001$) survival and growth of larvae were obtained in 25 larvae/aquarium density of live food system. Growth of larvae was inversely related with stocking density regardless of diets supplied. Significantly higher ($P<0.001$) proteolytic activity (0.782 + 0.013 mg tyrosine/mg of protein) was obtained in 25/aquarium density of live food system. Length of the digestive tract showed a direct relationship with proteolytic activity. Study of water quality paremeters showed that significantly lower values of ammonia and nitrite were prevailed in the low density live food system, which were conducive for better survival and growth of larvae in this system.

AMPHIDROMOUS MIGRATION OF FRESHWATER GOBIOIDS IN TAIWAN AS INDICATED BY OTOLITH MICROCHEMISTRY.

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A total of 12 species of Gobioidei was collected in Long-Long Brook, northeastern Taiwan during the period from 26 Sep.1995 through 4 Nov.1996. Migratory history of the 12 species were examined by otolith microchemistry using electron probe microanalysis (EPMA). Gobioidei is the most dominant group of freshwater fishes in Taiwan. Time-series changes of Sr/ Ca ratios in otolith of the 12 species indicated that *Rhinogobius brunner* belongs to freshwater species, *Glossogobius biocellatus* and *Favonigobius reichei,* the estuarine species, and the other 9 species, *Awaous melanocephalus*, *Eleotris acathopoma*, *Glossogobius celebius*, *Oligolepis accupennis*, *Redigobius bikolanus*, *Rhinogobius flumineus*, *Rhinogobius nagoyae formosanus, Sicyopterus japonicus* and *Stenogobius genivittatus,* the amphidromous species. The Strontium content in otolith of amphidromous fishes in marine phase (Sr/Ca wt % ratios, 10-17 %**0**) was higher than in freshwater phase (below 10 %**0**). The larval duration in marine phase lasts from one month in *Oligolepis accupenni* to six months in *Sicyopterus japonicus*. Accordingly, analysis of otolith Sr/ Ca ratios by EPMA provided valuable insights into a fish's past life history.

THE COST OF CHANGING SEX OF THE WRASSE, *HALICHOERES MARGINATUS* AT KUCHIERABU-JIMA, SOUTHERN JAPAN.

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Reproductive behavior of males and growth of males during sex change were studied in the sexually dichromatic (dark-brown initial phase females and dark-green terminal phase (TP) males), protogynous wrasse *Halichoeres marginatus* by underwater observations of tagged individuals and continuous sampling from 1989 to 1990. During the morning and early afternoon both males and females fed solitarily on the hard substrate in the inshore area. In the late afternoon large TP males migrated offshore, set up temporary mating territories on the slope and pair-spawned with females, which migrated to such territories each day. Non-territorial small TP males (including intermediate color phase individuals) intruded repeatedly into territories to mate by sneaking, streaking and group spawning. However, although they spent x=131 min./d for mating-related behavior and migrated x=1549.5 m/d for mating-related activities, they were able to mate with only x=1.1 females/d. Non-territorial large TP males migrated widely to contest territorial males for territories before the spawning time, and often remained near the territory and repeatedly courted females migrating to the territory to pair-spawn. They spent x=213 min./d and migrated x=2456.4 m/d for mating-related behavior, but were able to mate with only x=1.3 females/d. Territorial males, which frequently expelled intruders by rush and chase before and during the spawning time, spent x=250 min./d and migrated x=1694.7 m/d for mating-related behavior, and were able to mate with x=9.6 females/d. All five tagged individuals observed during sex change grew rapidly during the color-change phase, which lasted x=26.3 d. Two of these individuals spawned as males after about 26 d and acquired territories approximately 56.5 d after last spawning as females. It is suggested that the cost of changing sex offset by rapid growth, which enables 'new' males to soon become large enough to contest efficiently for territory possession.

BIOLOGY OF PENCIL SHARKS (*HYPOGALEUS HYUGAENSIS*) CAUGHT BY GILLNET IN SOUTH-WESTERN AUSTRALIAN

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The biology of *Hypogaleus hyugaensis* was examined using specimens caught in a demersal gillnet fishery in south-western Australia. *H. hyugaensis* is an uncommonly caught species in this fishery, representing less than 1% of the catch in numbers by the fishery. It is captured throughout south-western Australia, most commonly in waters deeper than 40m. Specimens captured in gillnets ranged in size from 64cm to 106cm, with most between 86cm and 100cm. The sex ratio was not significantly different from 1:1. Males mature at approximately 82cm fork length, and females at 86cm fork length. Ovulation takes place in March. Litter sizes range from 3 to 15, with a mean value of 10. The length of gestation could not be determined conclusively, but is most likely to be approximately 9 months. Large, full-term embryos, 27 to 32cm total length, were observed in December. Mature females do not breed each year, with ovarian follicles enlarging only in non-pregnant individuals. The diet is composed mostly of telesot fish and some cephalopods.

SYSTEMATIC ON THAI FRESHWATER FISH GENUS *ACANTHOPSIS* (PISCES: CYPRINIDAE).

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The fish of the genus *Acanthopsis* in Thailand has many color patterns which may due to ecological variation, but they belong to a single species. Specimens from Mae Preeg, Sukhothai Province and Huey Thab Saloa, Uthaithani Province are different not only in having larger lateral spots but also dark patches on caudal tips instead of plain caudal fin, number of dorsal fin rays 13 instead of 122, and depth of the head in head length 1.5 instead of 2.0 as found in *Acanthopsis choirorhynchos* respectively. The name proposed for this new species is *Acanthopsis thiemmedhi.*

REVIEW OF CURRENT RESEARCH ON ELASMOBRANCHS IN AUSTRALIA.

STEVENS J. D.

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Unlike the situation in most other countries, the impetus for elasmobranch research in Australia has come from the countries relatively important commercial shark fisheries. From the late 1940s up to the present time fishery laboratories have carried out the majority of elasmobranch research, studying the biology, ecology and population dynamics of commercially important shark species. The majority of fishery-related elasmobranch research is carried out at three laboratories; the Marine and Freshwater Research Institute in Queenscliff, Victoria, the CSIRO Division of Marine Research in Hobart and the Fisheries Department of Western Australia in Perth. The level of funding for elasmobranch fisheries work from traditional sources has reached a plateau. Some new sources for funding associated with ecotourism and conservation and management of elasmobranch resources may be opening up. The Indo-Pacific region has a very diverse elasmobranch fauna and museums, as well as some fishery labs, in Australia have undertaken considerable taxonomic work on elasmobranchs. Historically, universities have done little work on sharks and rays, however, that situation is beginning to change with a number of biological and behavioural studies on these fishes now underway. This talk will review current elasmobranch research at fishery laboratories, museums, universities and medical institutes around the country.

SATELLITE AND ACOUSTIC TRACKING OF WHALE SHARKS IN WESTERN AUSTRALIA: TRIALS AND TRIBULATIONS.

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Aggregations of whale sharks (*Rhincodon typus*) occur each year during March and April off Ningaloo Reef, Western Australia, where they form the basis of an ecotourist industry. During the 1997 season, we carried out some acoustic telemetry and satellite tracking of whale sharks to provide information on their short and long term movements, and behaviour. One shark was tracked acoustically on two separate occasions for 25 and 14.5 hours; this followed two previous tracks up to 26 h in length which were carried out in 1994. The behaviour of the sharks on all tracks were similar showing frequent dives between the surface and the bottom. A towed satellite tag system was developed which used a hydrodynamically designed float, housing the tag, which generated about 70° of lift and 'flew' above the shark when the animal was below the surface. The float was attached to the shark by a 2-5 m stainless wire tether. Attachment methodology for both types of tags involved a snorkeller firing a stainless steel head into the thick dermal layer of the shark below and alongside the first dorsal fin. Problems were encountered with the attachment method and with the wire satellite tag tether, which were compounded by a lack of sharks during the study period. These initial problems have been overcome and it is planned to deploy the satellite tags, as well as some archival tags, on whale sharks during the 1998 season.

THREE *RHYNCHICHTHYS* LARVAE FROM KADAVU PASSAGE, FIJI (BERYCIFORMES, HOLOCENTRIDAE).

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Three rhynchichthys larvae were collected in the Kadavu Passage, south of Viti Levu Island, Fiji, during the 1st Joint Research Cruise of National Fisheries University, Japan, and the University of the South Pacific on 4-7 December 1996 aboard NFU Training Ship Koyo-maru (2,342GT). Fish larvae were caught using either a surface plankton net (130 cm diameter, 1 mm mesh) or Isaac Kid Midwater Trawl (IKMT) net (3 mm mesh). A total of 11 *Rhynchichthys* larvae were collected from near Beqa (5 individuals) and Kadavu (6 individuals) Islands, and are classified into three different types by means of morphological analyses. Type 1: N=6, 24.7-28.6 6mm in SL, D.XI, 12-13, A.IV,8, P_1. 13-14, BD/SL 28. 7-32.2%, preopercle spine moderate beyond the margin of opercular bones but does not reach the insertion of the pectoral fin; Type 2: N=3, 15.5-19.1 mm, D.XI, 12, A.IV, 8, P_1.15, BD/SL 30.2-32.3%, preopercle spine long with serrations and reaches the insertion of the pectoral fin; Type 3: N=2, 16.3- 25.5 mm, D.XI, 13, A.IV, 12, P_1. 15-16, BD/SL 34.9-37.4%, preopercle spine short and robust, and does not reach the insertion of the pectoral fin in the larger specimen but reaches the insertion of pectoral fin in the smaller specimen. These larvae were tentatively identified as: Type 1 *Neoniphon sammara*, Type 2 *Sargocentron diadema, S. ittodai, S. microstoma, S. praslin or S. tiere*, Type 3 *Myripristis randalli.*

AG-NORS BEARING CHROMOSOMES OF THREE *LAMPETRA* SPECIES (PETROMYZONTIFORMES).

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Chromosomes and nucleolus organizer rigions (NORs) of three species of *Lampetra, L. (Lethenteron) reissneri, L. (L.) japonica* and *L. (L.) kessleri* were examined. Chromosome preparaion was used mouth, gills, intestine and liver, from anmocoetes larvae and juveniles after metamorphosis. Many metaphase plates derived from mouth and gills of larvae of each specimens. Three species of *Lampetra* in this study, all of them of metaphases showed a large number of small dot-like and minute like chromosomes. Chromosome number of *L. (L.) reissneri* showed a variation from 152 to 173. *L. (L.) japonica*, the chromosome number of this species showed distribution ranging from 159 to 165. *L. (L.) kessleri* also had a variation 152 to 165. In *L. (L.) reissneri* and *L. (L.) japonica*, NORs appeared a single pair of interstitial of the long arm of the largest meta- or submetacentric chromosomes, while not appeared NORs in *L. (L.) kessleri* in the present investigation. The present study deals with Ag-NORs chromosomes and chromosome preparation methods in *Lampetra* species and discussied with present and published data.

COMPARATIVE KARYOLOGICAL STUDIES AND DISTRIBUTION OF NUCLEOLUS ORGANIZER REGIONS (NORS) IN CYPRINOID FISHES.

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Karyotypes and distribution of NORs of 4 species of cyprinoid fishes were examined. Triploid *Carassius auratus langsdorfii* from Lake Abashiri (3n=150±) have 2-4 NORs, while diploid *C. a. langsdorfii* from Lake Akan (2n=100) have 2-3 NORs located on terminal region of the short arms of acrocentric chromosomes. The Leuciscinae *Phoxinus percnurus sachalinensis* from Lake Abashiri (2n=50±), has 3 NORs situated on terminal region of acrocentric chromosomes. The Nemacheilinae *Micronemacheilus pulcher* (2n=50) showed a single pair of NORs-bearing acrocentric chromosomes. In contrast, the Gastromyzoninae *Beaufortia* sp. (2n=48), has a pair of interstitial NORs in the long arm of its largest submetacentric chromosomes. This report deals with Ag-NORs number and location both in our cytogenetical investigation and literature, and discuss the chromosome features of these fishes.

APPLICATION OF UNDERWATER VISUAL CENSUS TO ASSESSING CORAL REEF FISH STOCKS IN THE TROPICAL PACIFIC.

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The complexity of fisheries on coral reefs where there are many species, many landing sites, and several gears, makes the assessment of stocks difficult. Invariably, information on the state of theses stocks is lacking. These fisheries, at both a subsistence and artisanal level, are an integral part of life for many Pacific Island people, and provide a primary source of protein. The application of underwater visual census techniques to assessing stocks of coral reef fish was investigated in Fiji and Solomon islands as a collaborative research project between the Fisheries Divisions of Fiji, Solomon Islands and the Queensland Department of Primary Industries. A study location was established in each of the Pacific Island countries, in which intensive underwater visual census (UVC) survey and fishery surveys were undertaken over a period of thirteen months. The aim of the research was to compare estimates of stock abundance obtained from the UVC surveys, with estimates of catch and effort in the fishery obtained from the questionnaire and creel surveys. This comparison was to form the basis for the development of a stock assessment procedure based on the surplus production model which predicts maximum sustainable yield. Each study location was divided into different areas selected to represent different levels of fishing pressure. This selection was based on interviews with fishers, village chiefs and discussions with the Fisheries Division Officers. Three primary areas were selected to represent high, medium and low fishing pressure. The stationary point count UVC method was used throughout the project UVC surveys were done in each of the fishing pressure areas, in two reef habitats (slope, lagoon), at three different times during a twelve month period. Surveys estimated both numbers and lengths of fish from a pre-selected list of 59 species. No relationship was found betweenh UVC estimates of stock abundance and fishery CPUE. In fact there were no differences in stock abundance or catch rates between the different fishing areas that could be attributed to fishing. There was a difference in total effort between the high and low fishing pressure areas, but this was no reflected in catch rates The project found negligible difference in stock abundance and catch rates among three areas purported to represent a range of fishing intensities. The abundance of species surveyed, catch composition, and catch rates suggested that the fisheries on coral reeef fish were not heavily exploited.

GENETIC DIFFERENTIATION OF NINESPINE STICKLEBACKS, GENUS *PUNGITIUS*, IN NORTHERN FAR-EAST.

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Ninespine sticklebacks were classified to three species; *Pungitius pungitius*, *P. sinensis* and *P. tymensis* based on number of dorsal spines and lateral plate morphology. *P. pungitius* and *P. sinensis* were distinguished by partial plate row and complete plate row, respectively. Allozyme survey on the populations of *Pungitius* in northern Japan revealed *P. pungitius* and *P. sinensis* were divided into three genetic groups based on reproductive isolation; the brackish water type, the Omono type and the freshwater type independent of plate morphology. In the present study, we investigated genetic relationships between these three genetic groups in Japan and several *Pungitius* populations including *P. tymensis* collected from Russia and Korea by allozyme and mtDNA RFLP analyses. Adding to the three genetic groups in Japan, two genetic groups of the Primoria type and the Sakhalin-Okhotsk type were newly detected by allozyme analysis, when *P. tymensis* was used as an out group. The Primoria type, which had only complete plate row, was genetically closer to the Omono type. The Sakhalin-Okhotsk type had lateral plate dimorphism. Four haplotype groups were found by RFLP analysis of mtDNA from *Pungitius* populations in northern Far-East include Japan. Two of the three genetic groups detected by allozyme analyses; the Primoria and Omono types, and *P. tymensis* were detected as highly diverged haplotype groups by RFLP analysis of mtDNA. Another haplotype group was consisted of the freshwater, brackishwater and Sakhalin-Okhotsk types with lower nucleotide divergence. Disagreement of genetic grouping between allozyme and RFLP analyses suggests that secondary contact and introgression of mtDNA occurred between the freshwater type and the brackishwater or Sakhalin-Okhotsk types, after these three types had evolved from the common ancestor.

LIFE AND HABITAT OF OXUDERCINE GOBIES IN AREAS ALONG THE STRAITS OF MALACCA.

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In order to know the diversity in life modes of oxudercine gobies, observations and collections were conducted in mudflats in the west coasts of middle Sumatra, Indonesia and Penang and Selangor, Malaysia. Eight species from Malaysia and 10 from Sumatra, both 6 genus group, respectively were collected. They lived from the sea shores to the tidal reaches of rivers. The habitat range of each species was large and the zonation did not seem to be decided by the salinity or the distance from the sea. The life mode varied from the terrestrial to the aquatic. All *Periophthalmus* species stayed almost inactive on the shore during high tide and walked around actively during low tide. *Boleophthalmus*, *Scartelaos* and *Periophthalmodon* species stayed under the water in the burrow during high tide, while walked around actively exposing their bodies on the mudflat during low tide. *Oxuderces* and *Pseudapocryptes* species always stayed in the water, although the former occasionally came out of the water and walked for a short distance when moving to the next pool. Both species seemed to be active in the water during high tide. *Periophthalmus* and *Periophthalmodon* were carnivorous, *Boleophthalmus*, *Oxuderces* and *Pseudocryptes* were herbivorous, and *Scartelaos* was omnivorous. Herbivores fed on Pennales diatoms and blue-green algae. *Periophthalmodon schlosseri* exclusively ate crabs and shrimps, while other carnivores took various aquatic and terrestrial animals. Seasonal changes in GSI indicated that each species spawned all year round, although it was likely that there were some changes in the spawning intensity with time or by populations.

GROWTH INCREMENTS ON DORSAL SPINES OF DEEP-SEA LONGNOSE DOGFISH, *DEANIA CALCEA* AND *D. HISTRICOSA*.

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The first and second dorsal spines were collected from 125 *Deania calcea* and 119 *D. histricosa*, caught in Suruga Bay to estimate their age and growth rate. The external morphology of the spines was examined and the spines were cross sectioned about 30-50 mm using a freezing microtome after their decalcification They were stained with Mayer's haematoxylin and observed with microscope. The dorsal spines of both species had no growth band on their surface. The linear relationships between body size and, total length, external length, external width and external depth of the spines were significant for both species. These indicate that the spines elongate with the body growth. Based on our observations of the cross section of both spines, we found that the spine consisted of five structural components; mantle, protruding dentine portion, stem, pulp cavity and cartilaginous tissue. The stem consisted of the inner and outer dentine layers. The inner dentine layer occupied a great part of the steem near the tip of the spine. Growth bands were observed on the inner dentine layer. The newly growth band was formed inside the inner dentine layer. The smallest *D. calcea* (308 mm TL), which seems to be just after birth, had one band in the inner dentine layer. The number of growth bands increased with body size in both species. The possible use of the dorsal spines as ageing structures are discussed.

GEOGRAPHICAL VARIATION IN AGE AND GROWTH OF *SQUALUS MITSUKURII* (ELASMOBRANCHII: SQUALIDAE) IN THE NORTH PACIFIC.

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Age and growth of *Squalus mitsukurii* were compared for three localities in the North Pacific, i.e., off Choshi (app. 36°N, 141°E) near Ogasawara Islands (app. 27°N, 142°E), and on the Hancock Seamount (app. 30°N, 180°E). The second dorsal spines were employed as an age character. Annuli were supposed to be formed once a year according to the former research conducted for *Squalus* spp. Theree were linear relationships between total length and spine length for each locality. von Bertalanffy growth equations were calculated based on a mean total length for each age because the position and increment of each annual ring varied largely from specimen to specimen. Asymptotic lengths for females were larger than for males in each locality. The reverse is true of growth coefficients. Two growth parameters show geographical variations. The asymptotic length was largest off Choshi while smallest in the Hancock Seamount for both sexes. On the contrary, the growth coefficient was highest in the Hancock Seamount while lowest off Choshi for males, but it was highest in the Hancock Seamount while lowest in Ogasawara Island for females. The age at maturity was estimated to be about age 19-220 off Choshi, and age 15-17 in the other for females whiles age 11-12 off Choshi, 10 near Ogasawara, and 7 on the Hancock Seamount for males.

REPRODUCTIVE MODE OF THE TAWNY NURSE, *NEBRIUS CONCOLOR*, SHARK IN THE OKINAWA WATERS, WITH INDIVIDUALS MISSING THE SECOND DORSAL FIN.

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Two female nurse sharks, *Nebrius concolor*, measuring 280 and 272 cm TL were captured in waters near Ishigaki Island, Okinawa, in October 1994. A gravid 272 cm TL female was found to be missing the second dorsal fin. However, a 59.5 cm TL embryo found in this female had two, first and second, dorsal fins. Based on observations of female reproductive organs and a 59.5 cm TL embryo, the reproductive mode of *N. concolor* was suggested to be oophagy. The reproductive mode and the individuals that were missing the second dorsal fin (abbreviated as IMSD) were described previously (Teshima et al., 1995). Additionally, embryos and several IMSD were obtained. Based on the previous observations and the additional information, we would like to suggest future research to clarify embryonic development and the mechanism that induces the lack of the second dorsal fin.

SHARKS CAUGHT IN THE SETO INLAND SEA, JAPAN IN 1996; THEY ENTERED COASTAL AREAS TO GIVE BIRTH ?

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Sharks gained public attention throughout Japan when a commercial diver collecting the fan shells was attacked by a large shark (probably, a white shark) in the Seto Inland Sea, Japan in March of 1992. Soon after the accident, a shark network was established by the fisheries related organizations. Through the network any information on sharks in the Seto Inland Sea was collected by the Seto Inland Sea Fisheries Coordination Center, Fisheries Agency of Japan and released immediately to the public. Information on species, length, and location caught or found has been accumulated. From 1992 to 1996, 13 species of sharks (nine genera in seven families) were identified and nine species in five genera were confirmed in 1996. Most were taken in June and July. The nine 1996 captures of sharks, the white shark, *Carcharodon carcharias*, silky shark, *Carcharhinus falciformis*, dusky shark, *C. obscurus*, and hammerheads, *Sphyrna* spp. (*S. lewini* and *S. zygaena* were identified) were thought to have entered the shallow waters to give birth to neonates based on the size of individuals captured. In addition to the previous report (Uchida et al., 1996), a smaller white shark (1.3 m TL) caught in the Seto Inland Sea in 1996 suggests that the white shark may use these coastal areas of the western part (the Pacific Ocean side) of Japan including the Seto Inland Sea as a pupping ground in spring through early summer. Small pelagic fish such as mackerel and sardine were caught abundantly in waters between the eastern Kyushu and the western Shikoku when these sharks are seen in these waters.

THE ABORE MARINE RESERVE (NEW CALEDONIA) - 4: PRELIMINARY RESULTS OF THE EFFECT OF MARINE RESERVE ON FISH BEHAVIOUR.

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Coral reef fish assemblages were sampled by underwater visual censuses, using line transect method, on Aboré Reef, New Caledonia. Sampling took place after 3 years of protection in 1993, prior to the opening of the northern part of the reef to fishing. Similar sampling was undertaken in 1995. Consequently, four sets of data were available: South Aboré reef 1993 (Protected I), North Aboré reef 1993 (Unfished), South Aboré reef 1995 (Protected II) and North Aboré reef 1995 (Fished). Distance of fish to the line transect (DLT) were compared in order to assess behavior changes which may be related to protected measures. Fished vs Unfished data was used to test the effect of the opening of the reserve to fishing, Protected I vs Protected II was used as control. 29 commercial species, recorded adequately in all 4 conditions, were used in the analysis. Similar trends in average DLT changes on both areas were recorded for most species (increase: 12 spp., decrease: 3 spp.) An increase of average DLT in the area opened to fishing together with a decrease of average DLT in the marine reserve was observed for 8 species, mainly Scarids (5 spp.). This finding may indicate that these target fishes became scared because of the fishing pressure in the northern part of Aboré reef. However, the significance of such could not be established, using either average DLT or DLT frequency distribution data. Fish size, school size and biotope which are known to influence DLT may explain some of the differences between 1993 and 1995. These results indicate that interannual variations in fish behavior may have a great influence on the results of underwater fish censuses. The effects of such variability could be much more important than the expected effects of marine reserves on fish behavior.

STABLE-ISOTOPE ANALYSIS OF REEF-FISH TROPHIC RELATIONSHIPS IN A SOUTH PACIFIC LAGOON.

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The sources of sustenance to large fishery species in the coral reef environment are little known and need to be identified. (15N and (13C values were determined for potential source materials and various fish species from three lagoonal sites (coastal, intermediate and barrier reef stations) in the Southern Province of New Caledonia, in order to help identify the principal trophic pathways supporting fishery species. Incremental enrichment in 15N was found across trophic levels, but relatively low 15N enrichment found at the top trophic level, in comparison to other ecosystems, suggests high levels of nitrogen fixation in the reef environment. Depleted 13C was characteristic of planktonic food-chains. The data suggest diet variability within the planktivore trophic group; certain planktivorous fish exhibited clear signs of an omnivore diet, but stable-isotope data did not reveal site-specific feeding strategies, indicated by such studies elsewhere The planktivore pathway was not shown to contribute a substantial source of carbon to fish productivity at any of the three lagoonal sites. Relatively enriched 13C was associated with benthic trophic pathways; turf algae and macrophytes were indicated as the main source of sustenance to grazing fishes, and the benthic algal pathway contributed significantly to piscivore production. In spite of its poor nutritional quality, the high benthic algal production is probably the principal support for the large lagoonal reef fishes examined.

RECENT DEVELOPMENTS IN AUSTRALIAN EFFORTS TO MANAGE THE IMPACTS OF EXOTIC MARINE SPECIES.

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Over 100 introduced marine species are currently known in Australina coastal waters, of which six (one phytoplankter, two algae and three macro-invertebrates) have been designated "pests" and targeted for control efforts. Following its establishment in 1994, the CSIRO Cnentre for Research on Introduced Marine Pests has begun investigations into physical, chemical and biological means of reducing the adverse environmental and economic impacts of the worst of these pests. Current initiatives include targeted herbicidal approaches to an invasive alga, physical removal of several macro-invertebrates and overseas specificity trials on potential biological control agents againts two species. Transgenic approaches to pest management is also being investigated. The current status and likelihood of success of these different appoaches will be discussed.

OBSERVATIONS ON LEPTOCEPHALUS LARVAE OF *ISTIEUS GISSU* (ALBULIFORMES: ALBULIDAE) COLLECTED FROM WESTERN NORTH PACIFIC.

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Istieus gissu is a rare albulid fish distributed in deep water in Japan. This fish is known to have leptocephalus larval stage, but only the metamorphosing (after fully grown stage) specimens had been available. In this study, the premetamorphosing (before fully grown stage) leptocephalus larvae of *I. gissu* is first described from 45 specimens (117.2 - 194.5 mm SL), collected by step-tow of otter trawl (mouth opening: 20x20m) at Kuroshio extension area of western North Pacific in May of 1995-1997. They are characterized by having the poorly developed fin rays except caudal, the translucent body, the branched melanophore beneath the eye and the punctuate melanophores along the dorsal part of alimentary canal. Previously the fully grown leptocephalus is estimated to be about 130 mm SL from the size distributions of metamorphosing specimens. However, present specimens show the fully grown leptocephalus of *I. gissu* exceed 180 mm SL. Although leptocephali of both Albuliformes and Elopiformes have well developed caudal fin, *I. gissu* leptocephali are similar to Anguilliforms rather than Elopiforms with respect to organismal developments.

AGE OF PACIFIC TARPON, *MEGALOPS CYPRINOIDES*, AT ESTUARINE ARRIVAL AND GROWTH DURING METAMORPHOSIS.

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The age of Pacific tarpon *Megalops cyprinoides* (Broussonet) collected in the estuary of northern Taiwan between 15 to 24 September 1995 was estimated from otolith increment counts. Validation of age and growth pattern of metamorphic stage fish were examined using reared fish. The tarpon were at the 1st metamorphic stage when collected in the estuary. Their mean size ranged between 17.8 and 32.9 mm TL and their age between 20 and 39 d with a mean of 28.5 d old after hatching. A metamorphic mark in otolith indicated that the fish began to metamorphose several days before arriving the estuary. Negative correlation between the daily age and both somatic and otolith growth rates indicated that faster-growing tarpon arrived in the estuary earlier than slower-growing ones. Otolith grew continuously while body length diminished during metamorphosis. The duration of metamorphic stage was approximately 14 days.

COMPARATIVE STUDY OF BUCCAL MORPHOLOGY IN FOUR DAMSELFISHES (POMACENTRIDAE).

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The family of Pomacentridae is characterized by a great number of species, living mostly on coral reef. This biodiversity would be explained by the variation of ecological habits. There are few differences in external morphology that could representing this richness among Damselfishes. A way to approach this problem is the utilisation of ecomorphological methods based , in this study, on comparison between the habits, the feeding and the osteological and muscular morphology of the cephalic region.. Four species, caught on a coral reef of Papua New-Guinea (Laing's Island), were chosen to start this work. *Dascyllus aruanus* and *Chromis retrofasciata*, ranged in the subfamily of Chrominae, are respectively described to be omnivore and planktivore. *Chrysiptera biocellata* and *Chrysiptera unimaculata*, ranged in subfamily of Pomacentrinae, are descibed to be omnivore and planktivore. The buccal region is described, moreover skeletal structures than musculature. There is several differences between the species of the two subfamily. The most evident difference is about teeth. The Pomacentrinae have two tighter rows of incisiform teeth, while Chrominae have several rows of conical teeth, biggest on the front. Others differences are described for the shape of skeletal structures: articular heads and lateral flange of the hyomandibular, thickening of quadrate, symplectic, orientation of the dentary-quadrate articular head, ... There is also variations whithin a subfamily, notably in the thickeness and the articular heads of structures. The shape and the orientation of the muscular bundles are directly infuence by the osteological morphology. So, these four species, externally similar, present particularities in the organization of the feeding apparatus, explaining in part the great diversity holded in this family.

ANATOMICAL AND FUNCTIONAL PARTICULARITIES OF THE HEAD IN FOUR CARAPIDS (PISCES, TELEOSTEI).

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The present study focuses on the skeleton and musculature of the head of four Carapidae species: *Carapus acus*, *Encheliophis boraborensis*, *Encheliophis homei*, and *Encheliophis gracilis* in order to see whether the buccal organisation of the four species reflects their diet. The toothed jaws are strong. The hyomandibular is wide and shows significant thickenings which seem fit, as they are oriented, to bear at least the stresses imposed by the well-developed adductor mandibulae muscles. *Carapus acus*, *Encheliophis boraborensis*, and *Encheliophis homei* can protrude their upper jaws, an infrequent ability among paracanthopterygians. In *Encheliophis gracilis*, insertion of A_1 over the entire length of the maxillary and the general organisation of ligaments in relation to the premaxillary and maxillary seem to prevent protrusion of the upper jaw. The branchial region is modified by the development of the sonic muscle joining the front of the swimbladder to the orbit, which principally results in the displacement of the upper insertion levatores branchiales muscles onto the hyomandibular and the lack a of rigid suspension on the neurocranium. These latter modifications probably make the pharyngeal jaws unable to handle food. The four species' cephalic morphology is in keeping with their carnivorous diet. Particularities linked with carnivorous behaviour are the most pronounced in *Encheliophis boraborensis*. *Encheliophis gracilis*, on the other hand, shows the least robust features, in keeping with its stomach contents, consisting of soft food. Generally speaking, the food treatment should be limited to a buccal jaws catching and the simple translation to the stomach by the pharyngeal jaws.

FISHES OF MANIPUR, INDIA, A BIOGEOGRAPHIC STUDY.

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Manipur is a small hill girt-state in the north eastern frontier of India. This distinct geographical entity has a total area of 22,327 sq. km. Hill ranges of 1,500-2,994 m (a.s.l.) surround a little valley of 1,800 sq km (800-1000 m a.s.l.) in the middle. The western hills are drained by the Barak river and its tributaries, which form a part of the Brahmaputra basin. The central valley and eastern hills are drained by rivers and streams that finally flow into the Chindwin of Myanmar. There was no detailed information on the fishes of this state. A survey of the fish fauna of this state revealed that there are 155 species belonging to 10 orders, 29 families and 77 genera. All the species are medium to fast running torential forms except a few. Endemic Manipur elements are mostly confined to the hill streams. Hill stream fishes show great species diversity. However, generic diversity is not observed. The evolution of diverse groups and endemic species in relation to the present concept of geological history of this part of the country has been discussed in the paper.

NON-INVASIVE STUDIES ON ELASMOBRANCH FISHES USING HIGH RESOLUTION MAGNETIC RESONANCE IMAGING.

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Biomedical imaging systems (Computed Axial Tomography, Ultrasound Imaging, Magnetic Resonance Imaging) can be used to provide information about the internal structure of zoological specimens. Application of high resolution MRI to the study of fixed elasmobranchs in museum collections is a major new advance which enables non-destructive " dissection " of specimens in any plane and, in combination with computerised three dimensional reconstruction methods, allows isolation of anatomical structures and their manipulation on the computer screen. High resolution MRI is particularly relevant to the study of elasmobranch skeletal and soft tissues; it therefore has the potential to resolve a wider range of tissue types than radiography, provides higher levels of accuracy than conventional techniques (e.g. staining, dissection), and avoids the problem of specimen damage whilst providing for multiple analyses on each specimen. Raw data (spin-echo MR images) were collected using a 1.5-T GE Scanner and a 4.7-T Oxfordd/SISCO-200 Scanner. Slices were less than 1 mm thick and in-plane resolution was 500-800 microns; slices were obtained in both sagittal and horizontal planes. Elasmobranchs (13 species from six orders) were obtained from the collections of the Natural History Museum, London. Anatomical 3D reconstructions from 2D slices were made with the ANALYZE softwazre (Mayo Clinic, U.S.A.). The 3D relationships of a new hypobranchial muscle in the Black Shark (*Dalatias licha*) are discussed and novel internal features of the spine of " notochordal sharks " are shown. The internal anatomy of the only known specimen of the Ridgeback Shark (*Centroscymnus macracanthus*) was successfully explored in the first MRI study of a holotype. These results show that MRI and 3D reconstruction have important implications for studies on elasmobranchs (and other fish groups) that will revolutionise our understanding of ichthyological anatomy, functional morphology and phylogenetics.

AGE AND GROWTH HISTORY OF TWO LARVAL ANCHOVIES, *ENCRASICHOLINA PUNCTIFER* AND *ENGRAULIS JAPONICA*, IN THE TANSHUI RIVER ESTUARY, TAIWAN.

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Daily growth increments in otoliths were used to elucidate the age and growth history of two larval anchovies, *Encrasicholina punctifer* and *Engraulis japonica* in the coastal waters off Tanshui River Estuary, northern Taiwan. The larvae were sampled daily by commercial set-nets during the fishing seasons of 1992 and 1993. *E. punctifer* larvae commenced to recruit to the estuary from October to March. Standard lengths at recruitment ranged 16 to 40 mm and ages 16 to 89 days. Mean lengths among sampling dates were not significantly different, while mean ages increased with time. This led to different growth rates from 1.04 mm/d in October to 0.38 mm/d in February. On the other hand, *E. japonica* larvae mainly recruited from March to May, minor in October and November. Standard lengths of the larvae at recruitment ranged 12 to 36 mm, ages 19 to 45 days, and growth rates 0.72 to 0.82 mm/d. Mean lengths, ages and growth rates among sampling dates were all not significantly different. The growth histories of the larvae, reflected in the time-series change in increment widths, were different between individuals and species. These results suggest that the growth of anchovies vary with season and are detectable by otolith daily growth increments.

THE ABORE MARINE RESERVE (NEW CALEDONIA) – 3: STRUCTURE OF THE REEF FISH COMMUNITY

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The fish community of Aboré reef was studied in August 1993, after 3 years of protection from fishing. Four fish communities characterized by different species assemblages were identified by a correspondence analysis. The first assemblage occurred on coral heads (mean depth 11 m, 63 species, 65.44 fish m^{-2}, 829.8 g m^{-2}). The trophic structure of this assemblage was dominated by zooplanktivores (47 % of the biomass). The second fish assemblage occurred on the back reef (mean depth 7.1 m, 215 species, 4.78 fish m^{-2}, 460.1 g m^{-2}). Piscivores dominated this community (39% of the biomass). The third assemblage was mainly found on the inner reef slope (mean depth 2.0 m, 194 species, 8.56 fish m^{-2}, 222.5 g m^{-2}) and the fourth assemblage on the reef flat (mean depth 1.4 m, 243 species, 13.55 fish m^{-2}, 270.5 g m^{-2}). These two communities were distributed along a reef slope - reef flat gradient. Microherbivores dominated the trophic structure in both assemblages (> 40% of the biomass). A similar survey was conducted in July 1995, two years after the opening of the northern part of Aboré reef to fishing. The coral head assemblage, which was located in the fishing zone, was not identified in 1995 and replaced by a back reef community. The back reef assemblage was comparable to 1993. The inner reef slope and the reef flat assemblages were difficult to separate but were still distributed along a reef slope-reef flat gradient. Density and biomass of the fish assemblages did not change significantly. Trophic structure of the inner reef slope and the reef flat remained comparable but microherbivores became the most important in biomass on the back reef. The impact of temporary marine reserves on the structure of the overall fish community is limited.

SETTLEMENT OF A FISH COMMUNITY ON THE F/V *'CALÉDONIE TOHO" 2* WRECK NEAR NOUMÉA (NEW CALEDONIA).

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The *F/V Calédonie Toho 2* (44.7 m long, 121 tons) was sunk Friday 9 August 1996 between 20 and 23 m depth to create a diving site near Nouméa (New Caledonia). The settlement of a fish community on the ship wreck was studied during 13 months. A nearby assemblage of US marine floating bridge boxes sank between 1942 and 1945, and the Ricaudy reef (reference station) were also surveyed. Species richness on the *Calédonie Toho 2* increased regularly to reach 42 species 183 days after the scuttling (a total of 78 species censused). Overall species interactions were more important with the US boxes (54 species in common) than Ricaudy reef (20 species), and the number of species in common increased at each dive during the 13 months. Density of fish increased during 100 days after the scuttling to reach a mean of 8.15 fish m^{-2}. Variations were important because of the occasional presence of schooling fishes (small Clupeidae and Apogonidae) with maximum of 27 fish m^{-2}. Biomass of fish increased in two steps. The first increase was observed just after the scuttling, with the arrival of schools of pioneer species (Carangidae, Serranidae, Acanthuridae) and the recruitment of small Pomacentridae (*Chromis fumea*), to reach an average biomass of 176 g m^{-2}. The second step appeared after 200 days, with the recruitment of Clupeidae and Apogonidae to reach 375 g m^{-2}. Fish community structures of *Calédonie Toho 2* and US boxes were different from Ricaudy. Temporal factor explained the variations observed in *Calédonie Toho 2* community structure. Four species assemblages were identified on the *Calédonie Toho 2* from a pioneer assemblage to an evolved assemblage.

EXTINCTION OF *SICYOPTERUS NIGRESCENS* AND THREATS TO SICYDIINE GOBIES.

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Many sicydiine gobies have distributions identifiable to particular faunal regions and may occur in several archipelagoes (*Sicyopterus macrostetholepis, S. taeniurus, Sicyopus zosterophorum, Stiphodon elegans*). Others are restricted to single archipelagoes (*Sicyopterus marquesensis, S. stimpsoni, Stiphodon tuivi*). There are many others with very restricted distributions and known from a single island or a single stream (*Lentipes armatus, Sicyopterus sarasini, Sicyopus* sp. 'New Caledonia,' *Stiphodon* sp. 'Guam,' *S.* sp. 'Kosrae'). The island of New Guinea has species that are endemic to a particular river system (*Lentipes watsoni, Stiphodon larson*) where they complete their life history. Obvious threats to many species are habitat alterations (agriculture, land development, highways, etc.), and introduction of exotic organisms. A foreseeable threat to small islands with relatively low elevation is change in sea level as a possible effect of global warming. The most pressing problem is the uncertain systematics of sicydiine gobies, with many undescribed species. No conservation measure, regardless of how well thought out, will be effective if you do not know what you are trying to conserve. *Sicyopterus nigrescens,* from the Hawaiian Islands, is the only sicydiine goby known to be extinct and disappeared around 1880.

POPULATION AND COMMUNITY ECOLOGY OF SCAD MACKEREL, *DECAPTERUS* SPP, IN THE JAVA SEA, INDONESIA.

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Scad mackerel (*Decapterus* spp), which consisted of two species, namely *D. russelli* and *D. macrosoma*, contributed more than 25% of the annual landings of small pelagic fish in the Java Sea. The first species was occurred in the inshore part of the waters while the second was more offshore one. Along with several other species of the carangids (i.e. *Selaroides leptolepis* and *Selar crumenophthalmus*), scombroids (*Rastrelliger kanagurta* and *R. brachysoma*) and clupeoids (*Amblygaster sirm, Sardinella gibbosa* and *S. brachysoma*) they produced nearly one half of the annual production of the marine fish in the area concerned of about 550,000 metric tons.

THE IMPORTANCE OF ECOLOGICAL FACTORS IN INFLUENCING THE DISTRIBUTIONS OF SPECIES OF AN INSHORE, TROPICAL, MARINE FAMILY OF INDO-PACIFIC FISHES.

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The distribution patterns of the members, e.g. species and subspecies of any family of organisms has been determined by three kinds of factors: historical episodes, dispersal abilities and niche requirements. In other words, distribution patterns can be interpreted in both an evolutionary and ecological context. This paper focuses on the contribution made by ecological factors using the Siganidae for a case study. While tolerance to low temperatures clearly plays a decisive role in influencing the latitudinal range of taxa, and the availability of a particular type of habitat can also clearly limit the range of some species, competitive exclusion between congeners appears to play a significant role in limiting the distribution of over half the species.

AGE, GROWTH AND REPRODUCTION OF THE STARSPOTTED-DOGFISH, *MUSTELUS MANAZO*, FROM NORTHERN TAIWAN WATERS.

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The starspotted-dogfish, *Mustelus manazo*, is one of the most common coastal sharks in Japan and Taiwan, and is an important fishery resource. However, in Taiwan, there is little information on its biology. The aim of this study is to clarify age, growth and reproduction of *Mustelus manazo* from northern Taiwan waters. Age and growth were examined from centrum analysis using soft x-radiography. Based upon seasonal centrum edge analysis, dark (opaque) ring was formed annually, mostly in June and July. The von Bertalanffy growth equations were fit to back-calculated length using a nonlinear regression technique. The growth until 3 years was similar in both sexes, but over 3 years females tended to grow much larger than males. The observed maximum lengths was 707 mm TL for males and 865 mm TL for females, and the maximum age was 5 years old for males and 9 years old for females. The specimens attained their first maturity at 547 mm TL (age 2) for males and 597 mm TL (age 2) for females. All specimens over 640 mm TL (age 4) for males and over 700 mm TL (age 5) for females were fully mature. The gonad index for males reached its minimum during June and August, and ova diameter was the largest in June and August. It was indicated that the mating and fertilization occurred during this period. The fertilized eggs were found in the uteri in August, and the largest embryos occurred in April. Parturition may occur in May, the gestation period was estimated at about 10 months. The litter size increased with total length of the mothers ranging from 2 to 14 (mean 5.1) embryos.

THE EFFECT OF BIRTH DATE ON GROWTH AND SURVIVAL OF JUVENILE WHITE-SPOTTED CHARR, *SALVELINUS LEUCOMAENIS*.

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An individual's growth opportunity may be influenced by the date on which it was born. To examine the effects of birth date on growth in juvenile (Age 0+) white-spotted charr, *Salvelinus leucomaenis*, individual birth dates were identified by counting the daily growth increments in the otolith. The significant linear relationships were found between fork length at catch and birth date; early born individuals tended to be larger than late born ones at a given time. About one quarter or half of the variability observed in fork length could be explained by birth date variation. Differences of birth date among individuals within a cohort may have significant influence on later stages of life history, such as age at seaward migration.

CURRENT RESEARCH ACTIVITIES ON ELASMOBRANCH BIOLOGY IN JAPAN.

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Japan is surrounded by seas on all sides and sustained fisheries aree critically important. Many species of sharks, skates and rays, including rare species, inhabit around Japanese waters and are collected by the fisheries. The curreent state of field and laboratory studies on the biology of sharks collected from Japanese waters will be presented, including infrequently encountered species such as, the megamouth shark, *Megchasma pelagios*, the goblin shark, *Mitsukurina owstoni*, the frilled shark, *Chlamydoselachus anguineus*, and the squaloid shark, *Trigonognathus kabeyai*. Several fatal shark attacks occurred in Japan from 1992 and served as the stimulus to establish a research project devoted to shark attacks and the bahavior of sharks. We studied the behavioral response of sharks to several stimuli, including sound, smell, visual and electric. The methods and results of the studies on the behavioral response of sharks to several stimuli will be presented.

CHONDRICHTHYAN FISHES OF THE RYUKYU ISLANDS, JAPAN.

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The Ryukyu Islands are located on subtropical areas of the southern Japan. The distribution and species composition of chondrichthyan fishes of the Ryukyu Islands were studied. The juveniles of *Negaprion acutidens, Carcharhinus limbatus, Triaenodon obesus,* and *Nebrius ferrugineus* were mainly collected in the lagoon areas. In the coral reef slope and off shore areas, carcharhinid sharks, *Galeocerdo cuvier, Carcharhinus albimarginatus, C. plumbeus,* and *C. brachyurus* were mainly collected. *Sphyrna lewini, Manta birostris* and *Aetobatus narinari* were also present in these areas. In the epipelagic areas, dominant species included *Prionace glauca* and *Dasyatis violacea. Isurus oxyrinchus, Alopias pelagicus, A. superciliosus* and *Carcharhinus falciformis* were also present in these areas. Dominant genera at the deep sea areas were *Squalus, Centrophorus, Etompterus* and *Galeus*. Differences in faunal ecology among locations are discussed.

CAPTURE OF A MATURE FEMALE MEGAMOUTH SHARK, *MEGACHASMA PELAGIOS*, FROM MIE, JAPAN.

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A mature female megamouth shark, *Megachasma pelagios*, was collected while purse seining for mackerel at 12 miles south from Mikizaki, Owase City (33°46'N, 136°16'E) at 11:40P.M., 30 April, 1997. This is the 10th record of capture of a megamouth shark and the largest specimen of this species yet recordded. The total length is 5.44 m and the weight is 1040 kg. The surface water temperature was 18.1°C, and the current was 0.5 knot to northward. The external morphology and measurements as well as the anatomy of selected viscera are described. The total number of tooth rows is 55 m the upper jaw and 75 in the lower jaw. The vertebral numbers are 151 in total and 64 in precaudal. The ileum has a ring-type spiral valve with 23 turns. The stomach contents consisted of dark-red chyme containing many fragments of carapaces, eyes and eye stalks of euphausiids. The stomach was relatively full of chyme. Mating scars were found on trunk, head and first dorsal fin. The right ovary possessed a large number of whitish yellow ova, about 5-10 mm in diameter. The expanded uteri measured 260 mm in width. The reproductive organs of the specimen were mature.

TOXINS INVOLVED IN CIGUATERA, CLUPEOTOXISRN, AND SHARK POISONING.

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Ciguatera is the most widespread fish poisoning in the Indo-Pacific region. The structure of the principal toxin, ciguatoxin, was unambiguously determined including the absolute configuration. numerous analogs were characterized by HPLC and MS data. The biogenetic origin of toxins was identified as the epiphytic dinoflagellate *Gambierdiscus toxicus*. Clupeotoxism, highly fatal and rnysterious intoxication resulting from ingestion of sardines or herrings, was elucidated to be caused by palytoxin or its analogs. Most probably, the benthic dinoflagellate *Ostreopsis siamensis* is the progenitor of the toxins. Sharks are known to cause highly fatal poisoning. Two toxins named carchatoxins A and B were isolated and shown to differ from ciguatera toxins in chromatographic and toxicological properties.

CODES FOR AUSTRALIAN AQUATIC BIOTA (CAAB): RECENT IMPROVEMENTS AND FUTURE POTENTIAL.

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Effective management and protection of the environment depend on the accurate collection, analysis and interpretation of biological data. Many fisheries departments around the world have developed a coding system to assist with the entry and retrieval of such data from databases. While a number of such systems have been used in Australia, the 8-digit Codes for Australian Aquatic Biota (CAAB) has become the standard. Its precursor, the 6-digit FISHLIST, was developed by CSIRO fisheries biologists in the late 1970s. The first three digits represent family (based on a system adopted by Australian museums) and the last three digits represent species. This list of names and codes expanded well beyond the scope of its originally intended use, and finally became inadequate and unreliable. The system was recently expanded and upgraded to eight digits to allow for the future systematic inclusion of invertebrates. The new system (CAAB) is stored on an Oracle relational database. Each code relates to a species and each species is to be represented by a voucher specimen; if a species' scientific name changes (based on new information), its code remains the same. Each entry consists of the 8-digit code, the species' name, author and date, the voucher specimen number and location, a common name, links to name and code synonyms, and comments. CAAB provides a framework to code the Australian aquatic biota systematically. It is primarily a cataloguing system but provision can be made for phylogenetic sorting.

AUSTRALIAN COMMERCIAL FISHES: IDENTIFICATION OF WHOLE FISH AND FILLETS USING CLASSICAL AND GENETIC TECHNIQUES.

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Australia has an expanding fishing industry which makes use of more than 350 local fish species from about 70 families. Numerous common and marketing names are used and this has caused great confusion in the seafood industry. Furthermore, fish are often marketed either with the heads removed or as fillets, which makes them difficult to identify. Buyers and consumers therefore often lack confidence in their seafood purchases. Reports of fish substitution in the market place (whether deliberate or inadvertent) are common. Protein fingerprinting (using Titan III™ cellulose acetate gel plates) was used to distinguish between Australia's commercial fishes. This is a simple genetic technique which compares the protein composition of the white muscle (fillet) of different species. In addition to protein fingerprinting, fillets were distinguished using characters such as length vs depth ratio, thickness, skin colour, flesh colour, peritoneum colour and number of myomeres. A number of taxonomic issues remain unresolved even among important commercial species. For example, *Lethrinus* sp. (lesser spangled emperor) and *Lutjanus* sp. (eastern Moses perch), both common in market places, appear to be undescribed. The production of an identification guide to whole fish and fillets is nearing completion.

NUTRITIONAL VALUE OF AUSTRALIAN FISHES: OIL, FATTY ACID AND CHOLESTEROL COMPOSITION.

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Fish contain high levels of nutritionally important omega-3 polyunsaturated fatty acids (PUFA). The key PUFA are eicosapentaenoic acid (EPA, 20:5(n-3)) and docosahexaenoic acid (DHA, 22:6(n-3)). PUFA decrease the incidence of coronary heart disease and stroke in humans and also play a role against a range of other disorders, including arthritis. The oil, fatty acids and cholesterol content and composition of about 150 species of commercial Australian finfish were examined; data on about 40 species are presented. Species specific differences and regional variation in lipid profiles highlight the ecological significance of this class of biochemical compounds. A comprehensive database is being established on the nutritional composition of principal Australian commercial fishes. The results of this database will shortly be available for strategic marketing of Australian fishes as well as for use by various medical and consumer groups.

THE REPRODUCTIVE BEHAVIOR OF THE ANEMONEFISH *AMPHIPRION CLARKII* IN HONG KONG.

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The anemonefish, *Amphiprion clarkii,* has been well studied in both tropical and temperate regions. However, the biology of this species in a sub-tropical region, such as Hong Kong, is unknown and may differ from that of tropical and temperate regions. For example, studies in Japan report that six colour phases can be distinguished on the basis of caudal fin coloration which corresponds well to six gonad phases (i.e. juvenile, 3 stages of nonbreeder, male, sex-changing fish and female). However, based on field and laboratory observations, a population of *A. clarkii* in Hong Kong shows fewer distinct color phases; the relationship between caudal fin coloration and gonad phase in Hong Kong is presented. Spawning season, fecundity, courtship behavior, date of spawning and incubation period were also investigated in Hong Kong waters by both field and aquarium observations in local water and compared with those from tropical and temperate areas. The species of host anemones associated with each spawning pair was recorded and the size of territory of each spawning pair was estimated.

GENETIC DIVERSITY AND CONSERVATION OF THE CHINESE STURGEON (*ACIPENSER SINENSIS*): RESULTS FROM PROTEIN ELECTROPHORESIS AND RAPD.

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Chinese sturgeon (*Acipenser sinensis*), regarded as a " living fossil " is an anadromous fish belonging to the order Acipenseriformes, one of the most primitive fish group and the largest freshwater fishes as well. Due to overfishing, habitate destruction and pollution, the abundance of the chinese sturgeon has been declining and it is now limited to the Yangtze river. In order to preserve this important resource, research on population structure and genetic diversity of the chinese sturgeon has been conducted at the protein and DNA levels. All samples were collected from the Yangtze river during the breeding season. Protein electrophoresis showed than only one loci (MDIII) was polymorphic among more than 25 loci screened. The percentage of polymorphic loci was 4%. Compared with other species of bony fishes the genetic diversity at the protein level is poor. Further study by more sensitive approaches (RAPD: random amplified polymorphic DNA) was applied using 40 random primers. 26 primers gave positive results, of which 6 produced polymorphic bands. The average percentage of polymorphic loci was 11.1%. Most of the sturgeon studied were born before the construction of the Gezhouha dam, which is the largest hydropower dam on the Yangtze. These fish are representative of the population before the Three Gorges project dam on the Yangtze river. Therefore, the present data represents a basic picture of genetic diversity before dam constructions ofn the Yangtze river and will be a base line for future comparison on the impact of these dams on the genetic diversity of the chinese sturgeon. Protection of the chinese sturgeon from a genetic point of view will also be discussed.

GENOME SIZE AND PLOIDY CHARACTER OF SEVERAL SPECIES OF STURGEONS AND PADDLEFISHES WITH COMMENT ON CELLULAR EVOLUTION OF ACIPENSERIFORMES.

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With the use of DNA of chicken blood (3 .22 pg/cell) as a standard genome size (somatic nuclear DNA content) of five sturgeons and paddlefishes including Chinese paddlefish (*Psephurus gladius*) , Yangtze sturgeon (*Acipenser dabryanus*) , Chinese sturgeon (*Acipenser sinensis*), Amur sturgeon (*Acipenser schrencki*) and American paddlefish (*Polyodon spatula*) were determined by microspectrometry. The DNA contents of each of these species were 4.11 pg, 8.26 pg, 9.07 pg and 3.84 pg respectively. The genome size of three species including the Yangtze sturgeon, Chinese sturgeon and Amur sturgeon is twice as large as that of Chinese paddlefish and American paddlefish. Obviously, Chinese paddlefish and American paddlefish belong to the tetraploidy group (4n) whereas Yangtze , Chinese and Amur sturgeons are octoploid (8n). Combination of present results and data reported among Acipenseriformes including two families and six genera indicate that the genus *Acipenser* possesses 4n, 8n, 12 n and 16 n while the other five genera only possess 4n. The polyploidization took place at an early time in the formation of the Acipenseriformes and within the genus *Acipenser*. Polyploidization has played an important role in the diversity of *Acipenser*, which has more than 65% of the Acipenseriforme species.

ICHTHYOFAUNA AND SUSTAINABLE UTILIZATION OF FISH RESOURCES IN LANCANGJIANG RIVER (UPPER MEKONG).

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The upper Mekong River in China is called the Lancangjian River. This basin is rich in natural resources, such as hydroelectric, mineral and biological (plants and animals) resources. Because the Mekong River strides across tropical, subtropical, temperate and cold zones, its fauna diversity is very important. This basin has one of the highest biodiversity in China and faces rapid economic development. It therefore needs special attention for its conservation and sustainable utilization of its fish resources. The examination of the literature and of recently collected material indicates that there are 137 species endemic to this basin and 15 species introduced to this area. Most of the species occuring in the middle and lower Lancangjiang are also known from Laos, Thailand and Southern Vietnam. Some of the spatial distributions of these species show special patterns. The situation of the fish resources, the factors influencing fish survival, the conservation scheme and the sustainable use of these fish resources are also discussed.

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