VIII International Symposium of Fish Parasites

26-30 September, 2011
Viña del Mar, Chile

ABSTRACT

Dear Ichthyoparasitologist

As decided in the last ISFP (International Symposium on Fish Parasites), the 8th ISFP will be held in Viña del Mar Chile, from the 26 th to the30th of September, 2011. All ichthyoparasitologists around the world are invited to join our community in this beautiful city with exceptional facilities, beautiful beaches, excellent seafood, cafes, bars; and less than half an hour from Valle de Casablanca, one of Chile's finest and world renowned wine-producing regions.

Fish Parasites have an enormous impact not only in the environment but also on important economic activities such as fish farming and fisheries. This Symposium will be an important forum for the discussion and distribution of new findings in this rapidly expanding field. The theme of the conference is "***Fish parasitology: from classical taxonomy to holistic approach"***. We hope to develop an exciting scientific program that will provide an update in our field of research. We are sure that the diversity of themes in the dynamic field of fish parasitology will be the most favourable platform for strong and positive collaborations between fish parasitologists. We are planning an intense program including preliminary talks, mini symposiums, and oral presentations. Poster sessions will be an important aspect of 8th ISFP. Competitive awards for students and postdoctoral scientists from developing countries will be offered. In addition, a diverse and enjoyable program of social activities will also be provided in order to showcase the best of our traditions and culture. More details will be provided in the near future.

We look forward to welcoming you to our country in 2011. Chile and South America are waiting for you.

On behalf of the South American Ictioparasitologist Consortium

Dr. Marcelo E. Oliva

A Brief History of the International Symposia on Fish Parasites

The discipline of fish parasitology developed around the middle of the 20th Century and certainly by the 1960s, as a young PhD student, I referred to myself as a 'fish parasitologist'. However, the number of involved researchers in Western Europe and North America was small in comparison with those in Eastern Europe and the Former Soviet Union (FSU), where the fields of aquaculture and both freshwater and marine parasitology were much more developed. Due to the facts that Soviet workers published in Russian and only a few of their books were translated, they rarely attended international meetings and there were only limited personal contacts, this discipline evolved relatively independently on either side of the 'Iron Curtain'. However, in 1983, through the perseverance and foresight of George Lom, Frank Moravec and colleagues at České Budějovice in the then Czechoslovakia, a meeting of 'ichthyoparasitologists' was arranged. This was a good site, as it was one which workers from both east and west could attend. I recall the meeting well (sharing a room with Robin Overstreet from the US), not only because of the presentations and English/Russian translations, but because of great 'names' who were there – these included influential Soviet workers, such as Oleg Bauer, Yuri Kurochkin, Alex Gusev, Amur Parukhin, Boris Kuperman and Valentina Nikolaeva, plus Kalman Molnár from Hungary, Glenn Hoffman and Gerry Esch from the US, Leo Margolis from Canada, Clive Kennedy and Jimmy Chubb from the UK, Klaus Rohde from Australia, Klaus Odening from Germany, a large contingent of Scandinavians and many others. At one barbecue I recall, along with many others being honourably assaulted by Czech fishermen armed with live carp. This very memorable meeting was such a success that it was decided to hold another meeting after four years.

The second meeting took place in 1987 at Tihany in the beautiful surroundings of Lake Balaton in Hungary, and was organised by Kalman Molnár and colleagues. Many of the same people attended this meeting, but included were more well-known names, such as Albina Gaevskaja and Anna Uspenskaja from the FSU, Ilan Paperna from Israel plus several workers from Japan and other parts of Asia.

The third meeting, certainly the most memorable, was in the Soviet Union and was organised by Eugeny Ieshko and colleagues at Petrozavodsk in Karelia. Memorable because it was 1991 and the time of the Soviet Coup d'État Attempt – tanks were on the streets of Moscow during the meeting and the Finnish contingent were all for walking for the border. In fact, although it was a worrying time for relatives, most had a really good time. At this meeting Oleg Bauer decided that the series of meetings needed a committee to discuss various aspects, such as future venues: 'David, you can be the chairman', he said to me, 'and we'll have Arthur, Ieshko, Molnár, Ogawa, Pugachev and Valtonen on the committee' – it was all very democratic. Actually, it proved to be an astute move, since the next venue fell through and the committee had to find a new one at short notice – something that has happened twice during the history of these meetings. I acted as Chairman until 1995 and was followed by Kazuo Ogawa (Japan) (1995–2003), Jo Van As (South

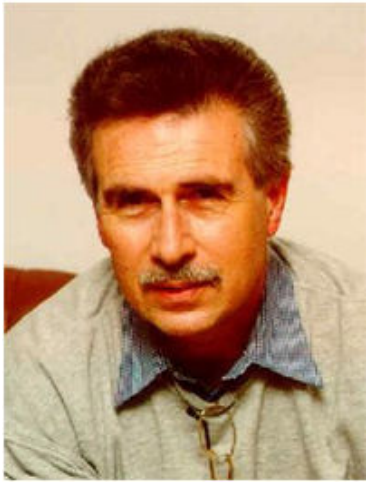
Africa) (2003–2007) and Simonetta Mattiucii (Italy) (2007 – present). It was also at ISFP 3 in Karelia that Kazuya Nagasawa (Japan) proposed the preparation and circulation of the *International Ichthyoparasitological Newsletter*, which he edited for several years. This newsletter is currently at Issue 16 and is edited by Leslie Chisholm (Australia).

The fourth meeting in 1995 was intended to be in eastern Germany but was transferred to western Germany and organised by Rudolf Hoffman and colleagues in Munich. This was a huge and very successful meeting; perhaps the first that could really be termed truly international, with people from all continents (250 persons from 26 countries). This really put the series of meetings on the parasitological calendar, and all subsequent meetings have been well attended by fish parasitologists from all corners of the globe.

The fifth meeting, 1999, was back at České Budějovice and organised by Frank Moravec, Iva Dyková, Tomáš Scholz and colleagues. This was another well-attended and very successful meeting, although, like later meetings, with fewer delegates from the FSU countries. I recall some very nice social events.

ISFP 6 was held for the first time outside Europe in 2003. This meeting, organised by Jo Van As, Linda Basson and colleagues in Bloemfontein, South Africa, was the smallest of recent meetings and more in line with the size of the first three, but nevertheless very successful and enjoyable. Many delegates participated in wonderful pre- or post-conference holidays, taking full advantage of the spectacular scenery and wildlife for which South Africa is famous.

The most recent International Symposium on Fish Parasites took place to the north of Rome, at Viterbo in Italy, and was organised by Simonetta Mattiucci and colleagues in 2007. This was another large and successful meeting (320 people from 46 countries) sited in a wonderful ancient walled city full of places of interest and good restaurants. The historical sites included the ‘Pope's Palace’, where the inauguration of the symposium took place and where the Bishop of Viterbo, in his welcome, referred to ‘fish paradise’ rather than ‘fish parasites’. Among the social events was a concert of “Viterbo’s Baroc Festival 2007” in the S. Martino al Cimino Cathedral.



Dr. D. Gibson
British Museum Natural History

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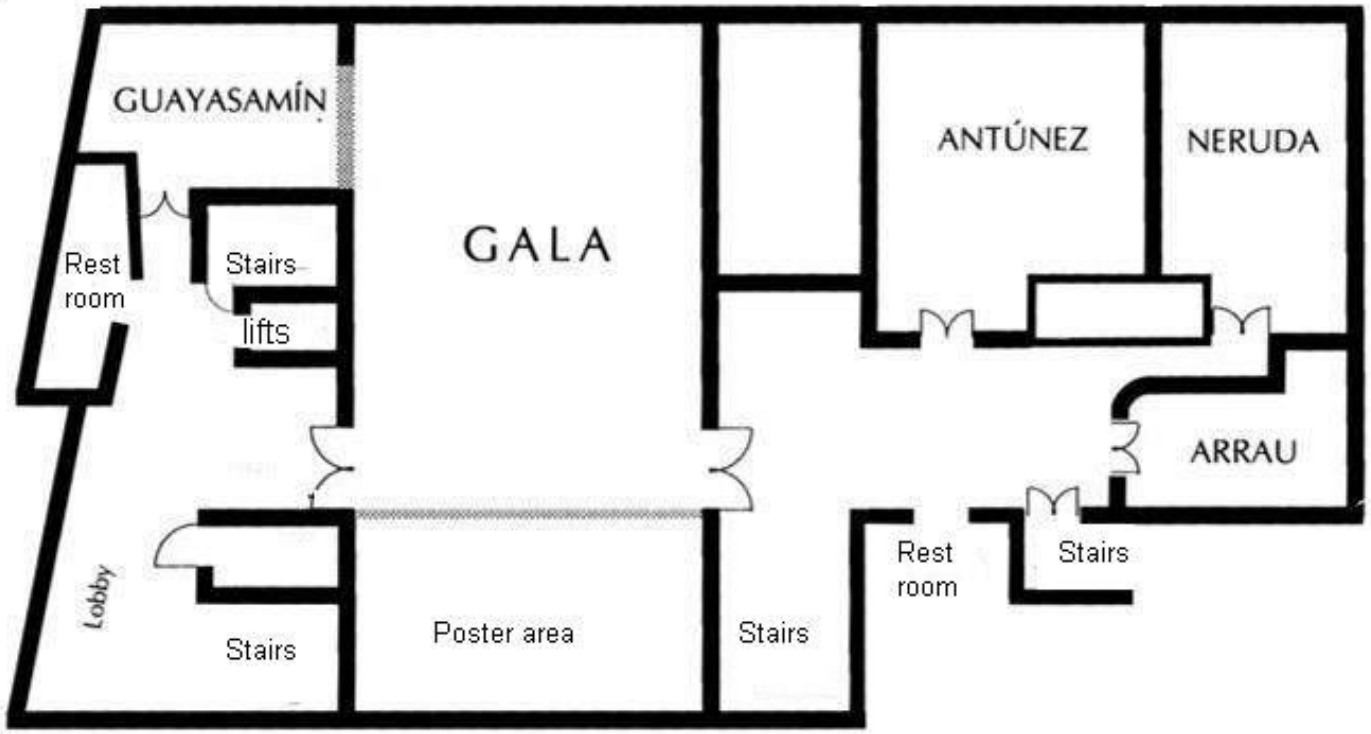
Gala Hotel & Convention Center

Second level



GUAYASAMIN ROOM	***MONDAY 26***
09:30 -13:00	Registration
15:00 - 18:00	Registration

GALA ROOM	***Monday 26***
18:00	Welcome to the 8 ISFP
19:00	Conference
	Biodiversity of fish parasites in South America:
	Learning from our history and shaping the future.
20:00	Cocktail

	GALA ROOM			
	TUESDAY 27	***WEDNESDAY 28***	***THURSDAY 29***	***FRIDAY 30***
08:30 - 09:50	Taxonomy and Systematics I	Evolution and co-speciation	Ecology and Biogeography I	Life Cycles I
09:50 -10:20	Coffe break	Coffe break	Coffe break	Coffe break
10:20 - 12:10	Taxonomy and Systematics II	Epidemiology	Ecology and Biogeography II	Life Cycles II
12:30 - 13:10	Conference ***Fish Parasites:*** ***From Linnaeus to Molecules***	Conference ***Are we ever going to figure out?*** ***Why some fish species have*** ***more parasite species than others?***	Conference ***Advances and Trends on Anisakids*** ***nematodes and Anisakidosis***	CLOSSING CEREMONY
14:30 - 15:50	Taxonomy and Systematics III	Poster Session II	Fish parasites:another view	
15:50 - 16:20	Coffe break	Coffe break	Coffe break	
16:20 - 18:30	Poster Session I		Poster Session III	
19:00 - 19:40	Conference ***Fish Parasites and Food webs***		Conference ***Parasites and Fisheries***	

	ANTUNEZ ROOM			
	TUESDAY 27	***WEDNESDAY 28***	***THURSDAY 29***	***FRIDAY 30***
08:30 - 09:50	Fish Parasites and Aquaculture	Biodiversity of Fish Parasites I	Fish Parasites and Fisheries I	
09:50 -10:20	Coffe break	Coffe break	Coffe break	
10:20 - 12:10	Fish Parasites and Pathology	Biodiversity of Fish Parasites II	Fish Parasites and Fisheries II	
14:30 - 15:50	Taxonomy and Systematics IV			
15:50 - 16:20	Coffe break			

PROGRAM
MONDAY 26

GUAYASAMIN ROOM
09:00 - 13:00 : Registration
15:00 - 18:00 : Registration

GALA ROOM

18:00 Welcome to the 8 ISFP

19:00 CONFERENCE: ***BIODIVERSITY OF FISH PARASITES IN SOUTH AMERICA: LEARNING FROM OUR HISTORY AND SHAPING THE FUTURE***
Dr. José Luis Luque. Universidade Federal Rural Rio de Janeiro, Brasil

20:00 COCKTAIL

TUESDAY 27

GALA ROOM
SESSION TAXONOMY AND SYSTEMATIC I
PRESIDENT: R. ADLARD SECRETARY: G. MUÑOZ

08:30 -08:50 Key Note Speaker: Dr. R. Adlard, Perspectives on the taxonomy and systematics of the Myxozoa
08:50 - 09:05 Santos, JM., Cavaleiro, F., Teixeira, F. & Martins, M. Amoeba can act as a “silent infection” on the aquaculture european sea bass *(Dicentrarchus labrax* l.)
09:05 - 09:20 Sanders, JL., Myers, M.S., Tomanek, L, Oquendo, J. & Kent, M.L. A new *Ichthyosporidium* sp. (Microsporidia) from the gonads of arrow goby (C*levelandia ios*)
09:20 - 09:35 Heiniger, H. & Adlard R. High prevalence and intensity of *Kudo*a sp. (Myxosporea) from the pericardial chamber of apogonid fishes from the Great Barrier Reef, Astralia
09:35 - 09:50 Van As, L. & Van As, J.G. Protist-Crustacean-Fish hyperepibiosis

09:50 - 10:20 Coffee break

SESSION TAXONOMY AND SYSTEMATIC II

PRESIDENT DR. C. P. SANTOS SECRETARY DR. J. CARDENAS-CALLIRGO

10:20 - 10:40 Key Note Speaker: Dr. C. P. Santos. Monogenean contributions to the International Symposia on Fish Parasites
10:40 - 10:55 Paladini, G., Rubio-Godoy, M., Domingues, M.V., Whittington, I. D., Shinn, A. P. & Bron, J. E. A beginner's guide to "flukology"
10:55 - 11:10 Domingues, M.V., Diamanka, A. & Pariselle, A. Monogenoids (Diplectanidae, Polyonchoinea) from the gills of mojarras (Perciformes, Gerreidae) with the resurrection of *Neodiplectanum* Mizelle & Blatz, 1941 and the proposal of a new genus
11:10 - 11:25 Cohen S. C., Kohn, A & Boeger, W.A. Nine new species of Dactylogyridae parasites of *Salminus brasiliensis* from Paraná river, State of Paraná, Brazil
11:25 - 11:40 Paladini, G., Rubio-Godoy, M., Freeman, M. A., Garcia-Vásquez, A. & Shinn, A. P. *Gyrodactylus salmonis*: a strain-ed relationship
11:40 - 11:55 Abdullah S.M.A. Checklists of monogeneans parasitizing freshwater fishes of Kurdistan region, Iraq
11:55 - 12: 10 Yoon, G.H., Al-Jufaili, S., Al-Mazrooei, N., Bron, J.E., Freeman, M.A. & Shinn, A. P. A new genus and species (Microcotylidae; Monogenea) from the gills of *Argyrops spinifer* (Forsskal) (Sparidae; Pisces) from the sea of Oman

12:30 - 13:10 CONFERENCE: ***FISH PARASITES: FROM LINNAEUS TO MOLECULES***
Dr. D. T. J Littlewood, Department of Zoology, Natural History Museum, UK.

SESSION TAXONOMY AND SYSTEMATIC III

PRESIDENT D.T.J. LITTLEWOOD SECRETARY M.E. OLIVA

14:30 - 14:50 Key note Speaker Dr. D. T. J Littlewood. Littlewood, D.T.J & Bray, R. A What's needed for a comprehensive molecular phylogeny of the Digenea?
14:50 - 15:05 Cavaleiro, F. I., Pina, S., Russell-Pinto, F., Rodrigues, P., Formigo, N.E., Gibson, D.I. & Santos, M. J. A new diplostomid metacercarial genotype from the eye lenses of the European flounder, *Platichthys flesus* (L.) (Teleostei: Pleuronectidae)
15:05 - 15:20 Justine, J-L., Rehulková, E. & Briand, M. How to get parasites from moray eels?
15:20 - 15:35 Martínez, A. & Pérez - Ponce de León, G. Molecular prospecting of the genus *Margotrema* spp. (Digenea: Allocreadiidae), parasites of the subfamily Goodeinae freshwater fishes (Cyprinodontiformes: Goodeidae) endemic to central Mexico

16:20 - 18:30 Poster Session I

18:50 - 19:30 CONFERENCE: ***FISH PARASITES AND FOOD WEBS***
Dr. K. Lafferty. Marine Science Institute, University of California, Santa Barbara. USA

ANTUNEZ ROOM

SESSION FISH PARASITES AND AQUACULTURE

PRESIDENT K. OGAWA SECRETARY L. GONZALEZ

08:30 -08:50 Key Note Speaker Dr. K. Ogawa. Control of parasitic diseases of fish in Japanese aquaculture
08:50 - 09:05 Bravo, S. Principle parasites affecting salmonids farmed in freshwater in southern Chile
09:05 - 09:20 González, L. Use of Degree-Day model to estimate the development time of *Caligus rogercresseyi* sea louse and history of its control strategy in Chilean salmon aquaculture
09:20 - 09:35 Kent, M.L., Rossignol, P.A., Jacobson, K.C. & Ferguson, J.A. Mortality of coho salmon (*Oncorhynchus kisutch*) associated with multiple parasite species
09:35 - 09:50 Tripathi, A. Aquarium fish trade and invasive parasitic monogenoids: an Indian perspective

09:50 - 10:20 Coffee break

SESSION FISH PARASITES AND PATHOLOGY

PRESIDENT K. BUCHMANN SECRETARY L.M. BRADEN

10:20 - 10:40 Key note Speaker Dr. K. Buchmann. Fish parasites and Pathology
10:40 - 10:55 Braden, L. M., Barker, D.E., Ben F. Koop, B.F. & Jones S.R.M. site-specific defense responses in salmon skin elicited by the ectoparasite *Lepeophtheirus salmonis*
10:55 -11:10 Cruz-Quintana, Y., Santana-Piñeros, A. M. & Vidal-Martínez, V. M Histopathological damage produced by parasitic helminths in blackcheek tonguefish *Symphurus plagiusa* from the Campeche bank, Mexico
11:10 - 11:25 Hallett, S. L., Holt, R. A., Stinson, M. E. T., Banner, C. R., Christie, M. R., Blouin, M. S. & Bartholomew, J. L. No Hatchery Effect on Disease resistance in *Oncorhynchus mykiss*
11:25 - 11:40 Hallett, S. L, Holt, R.A., Ray, R. A., Hurst, C. N., Buckles, G., Atkinson, S. D. & Bartholomew, J. L. Linking density of waterborne *Ceratomyxa shasta* with salmon mortality
11:40 - 11:55 Pert, C.C, Noguera, P., Bruno D.W., Beck, M. & Williams, C. A prevalence assessment of red vent syndrome in wild Atlantic salmon (*Salmo salar* L.) in the UK
11:55 - 12: 10 Kim, S.R.., Kim, J.H, Park J.J. & Park, M.A. Characteristic of Parasitic Leech, *Limnotrachelobdella sinensis* and host reaction in Crucian carp, *Carassius auratus*
12:10 - 12:25 Shirakashi S., Ishimaru K., Okada, T. & Ogawa, K. Control of blood fluke infections in cultured Pacific bluefin tuna, *Thunnus orientalis*

12:30 - 13:10 CONFERENCE **(**Gala Room)

SESSION TAXONOMY AND SYSTEMATIC IV

PRESIDENT F. MORAVEC SECRETARY L. CARDENAS

14:30 - 14:50 Key note Speaker Dr. F. Moravec Achievements of recent studies on philometrid nematodes (Philometridae), important parasites of fishes
14:50 - 15:05 Masova, S., Barus, V. & Seifertova, M. Preliminary findings on African species complex *Procamallanus* (*Procamallanus*) *laeviconchus* (Wedl, 1862)
15:05 - 15:20 May-Tec, A. L., Pech, D., Aguirre-Macedo, M. A., Lewis, J. W. & Vidal-Martínez, V. M. Temporal variation of *Mexiconema cichlasomae* (Nematoda: Daniconematidae) infection in the cichlid fish *Cichlasoma urophthalmus* from Yucatan, Mexico
15:20 - 15:35 Yooyen, T., Wongsawad, C. & Moravec, F. Helminths fauna in some marine fish from Gulf of Thailand with two new species of *Cucullanus* Muller, 1777 (Nematoda: Cucullanidae)
15:35 - 15:50 Prikrylova, I., Vanhove, M. P. M., Gelnar, M., Volckaert, F.A.M. & Huyse, T. Molecular phylogeny of African gyrodactylid monogeneans

15:50 - 16:20 Coffee Break

16:20 - 18:30 Poster Session I

18:50 - 19:30 CONFERENCE (Gala Room)

WEDNESDAY 28

GALA ROOM

SESSION EVOLUTION AND CO-SPECIATION

PRESIDENT R. POULIN SECRETARY J.L. LUQUE

08:30 -08:50 Key Note Speaker Dr. R. Poulin. Putting some ecology back into host-parasite cophylogenetic studies: interaction frequency in geographic space
08:50 - 09:05 Benesh, D. Optimality, microevolutionary, and macroevolutionary perspectives on the life cycle of *Schistocephalus solidus*
09:05 - 09:20 Cepeda, P. B., Mendoza-Franco, E. F., Ceccarelli, P.S. & Luque, J.L. Morphological variation of *Characithecium costaricensis* (Monogenoidea: Dactylogyridae): is an evidence of initial steps of speciation?
09:20 - 09:35 Schoelinck, C., Samadi, S. & Justine, J. L. Speciation studies within congeneric monogenean parasites
09:35 - 09:50 Vanhove, M.P.M, Snoeks, J., Volckaert, F.A. M. & Huyse, T. Monogenean speciation under host radiation: cichlids and gobies through the magnifying glass
09:50 - 10:05 Vignon, M. Is host-switch stressful for parasites? Host-parasite evolutionary history affects the degree of fluctuating asymmetry in the attachment apparatus of gill parasites

10:05 - 10:35 Coffee break

SESSION EPIDEMIOLOGY

PRESIDENT B. NOWAK SECRETARY R.M. TAKEMOTO

10:35 - 10:55 Key Note Speaker. Dr. B. Nowak . Epidemiology of parasitic diseases in fishes
10:55 - 11:10 Okoye, I. C., Abu, S.J., Obiezue, R.N.N., Amoke, C.O., Ubachukwu, P.O. & Ugbomoiko, U.S. Aspects of biology and parasitic infections of fishes in Agulu Lake, South Eastern Nigeria
11:10 – 11:25 Pert, C.C., Weir, S.J., Jones, S.R.M. & Bricknell I. R. The Role of Three-spined Sticklebacks in *Lepeophtheirus salmonis* (Krøyer, 1837) Transmission in Scottish Sea Lochs
11:25 - 11:40 Ab Aziz, R., Walker, A., Williams, C., Aprahamian, M. & Brooks, D. Monitoring *Anguillicoloides crassus* infections in the European el, *Anguilla anguilla*, within UK river systems
11:40 - 11:55 Rahemo, Z. I. F. Parasitic fauna of the freshwater fish (arath) *Acanthobrama marmid* caught from River Tigris passing through Mosul City, Iraq.
11:55 - 12:10 Antar, R., Gargouri ben Abdallah, L. & Maamouri, F. Digenean fauna diversity in teleost fish from Bizerte lagoon in the North east off Tunisia
12:10 – 12:25 Lester, R. J. G. Frequency distributions revisited
.
12:40 - 13:20 CONFERENCE: ***ARE WE EVER GOING TO FIGURE OUT WHY SOME FISH SPECIES HAVE MORE PARASITE SPECIES THAN OTHERS?*** Dr. R. Poulin. Department of Zoology, University of Otago, New Zealand.

14:30 - 16:30 Poster Session

ANTUNEZ ROOM

SESSION BIODIVERSITY OF FISH PARASITES I

PRESIDENT T. SCHOLZ SECRETARY R. CHAVEZ

08:30 -08:50 Key Note Speaker. Dr. T. Scholz. Hot spots of cestode diversity in teleost fish: a brief summary of the systematic studies on fish tapeworms
08:50 - 09:05 Van As, J.G. & Van As, L.L Parasite-host associations of African freshwater fish
09:05 - 09:20 Nie, P. Diversity of helminth parasites in fish in flood-plain lakes of the Yangtze River
09:20 - 09:35 Gargouri Ben Abdallah, L., Antar, R. & Maamouri F. Digenean species diversity in labrid and sparid fish from Tunisian coasts
09:35 - 09:50 Tombi, J. & Bilong C. F. Microhabitat of *Dactylogyrus* (Monogenea) and *Myxobolus* (Myxosporidia) gill parasites of *Barbus martorelli* Roman, 1971 (Teleostei: Cyprinid) in the Centre Region, Cameroon
09:50 - 10:05 Smit, N. J, Grutter, A. S. & Davies, A. J. Biodiversity and ecology of fish parasitic gnathiid isopods and fish blood protozoans from Lizard Island, Great Barrier Reef, Australia

10:05 - 10:35 Coffee break

SESSION BIODIVERSITY OF FISH PARASITES II

PRESIDENT V.M. VIDAL-MARTINEZ SECRETARY A.L. LANFRANCHI

10:35 - 10:55 Key Note Speaker Dr. V. M. Vidal-Martinez. Fish parasites in the neotropics
10:55 - 11:10 Civanova K., Navratilova P, Costedoat C., Gilles A. & Simkova A The variability of MHC genes and parasite diversity in two cyprinid species, *C. toxostoma* and *C. nasus*, in hybrid zone
11:10 – 11:25 Ribeiro, T. S., Da Silva E., Perez M. A., Gealh, A.M. & Takemoto, R. M. Research of the parasite fauna of *Astyanax* aff. *fasciatus*, collected on the Sao Joao river, Parana, Brazil
11:25 – 11:40 Pérez-Ponce de León, G. The search for cryptic species in freshwater fish helminth parasites in Mexico: The classical taxonomy to holistic approach and back to classical taxonomy
11:40 – 11:55 Salgado-Maldonado, G. Central America is an area of endemism for the helminth parasites of freshwater fish
11:55 – 12:10 Bagherpour, A. Prevalence and intensity of internal parasitic helminthes infected of black sole fish, *Brachirus orientalis* (Bloch & Schneider, 1801) in Persian Gulf
12:10 – 12:25 Justine, J-L. How many parasites are there on coral reef fish?

12:40- 13:20 CONFERENCE (Gala Room)

14:30 - 16:30 Poster Session II

THURSDAY 29

GALA ROOM

SESSION ECOLOGY AND BIOGEOGRAPHY OF FISH PARASITES I

PRESIDENT M. GEORGE-NASCIMENTO SECRETARY D.M.P. CANTATORE

08:30 -08:50 Key note Speaker Dr. M. George-Nascimento. George-Nascimento, M., Oliva, M. E. & Carvajal, J. Spatial and temporal variability of parasite infracommunities in marine fish species differing in body mass
08:50 - 09:05 Arnott, S., Dykova, I., Roumillat, W. A. & de Buron, I. Population dynamics of endoparasites of the spotted seatrout, *Cynoscion nebulosus*
09:05 - 09:20 Emde S. Ecological impact of invasive Ponto-Caspian fish and amphipod species on the distribution of Acanthocephala in the river Rhine (Germany)
09:20 - 09:35 Lacerda, A. C. F., Takemoto, R. M., Tavares-Dias, M., Poulin, R. & Pavanelli, G. C. Endoparasites of two invasive fish species, *Cichla piquiti* (Cichlidae) and *Plagioscion squamosissimus* (Sciaenidae), in native and invaded Brazilian basins: testing the enemy release hypothesis
09:35 - 09:50 Muñoz, G., Cortés, Y. & Delorme, N. Parasite communities in fishes from the intertidal rocky zone of central Chile: comparison between temporal and resident fish
09:50 - 10:05 Soler-Jiménez, L. C. & Fajer-Ávila E. J. Microhabitat selection of dactylogyrids (Monogenea: Dactylogyridae) on the gills of wild spotted rose snapper *Lutjanus guttatus* (Lutjanidae) from Mazatlan Bay, Mexico

10:05 - 10:35 Coffee break

SESSION ECOLOGY AND BIOGEOGRAPHY OF FISH PARASITES II

PRESIDENT M.T. GONZALEZ SECRETARY F. SEPULVEDA

10:35 - 10:55 Key note Speaker Dr. M. T. González. Are there latitudinal patterns in fecundity and body size of digenean species in littoral fishes from southeastern Pacific?
10:55 – 11:10 Dick, T. A. & Gallagher, C. Ninespine stickleback *Pungitius pungitius* from southern Baffin island: biogeography, parasites and trophic structure
11:10 – 11:25 Huyse, T., Bristow, G.A., Hellemans, B., Volckaert, F.A.M., Bell, M.A., & Raeymaekers, J.A.M. Monogenean parasites reveal ongoing long-distance migration of their three-spined stickleback host
11:25 – 12:40 Kuhn, T. Zoogeography of zoonotic *Anisakis* spp. (Anisakidae, Nematoda) in different climate zones
12:40 - 12:55 Kuchta, R. & Scholz, T. Geographical distribution and host specificity of the Asian fish tapeworm *Bothriocephalus acheilognathi* Yamaguti, 1934
12:55 – 12:10 Santana-Piñeros, A. M., Pech, D. & Vidal-Martínez, V. M. Quantifying the spatial and environmental variation of the parasite communities of Blackcheek tonguefish (*Symphurus plagiusa*) in the southern Gulf of Mexico

12:30 - 13:10 CONFERENCE: ***ADVANCES AND TRENDS ON ANISAKID NEMATODES AND ANISAKIDOSIS***
Dr. S. Mattiuci and G. Nascetti, Università di Roma "La Sapienza", Italy

SESSION FISH PARASITES: ANOTHER VIEW

PRESIDENT S. KLIMPEL SECRETARY J.T. TIMI

14:30 - 14:50 Key Note Speaker Dr. S. Klimpel, Fish parasites in extreme environment
14:50 - 15:05 Conn, D. B. Global Public Health Implications of Human Sparganosis
15:05 - 15:20 Levsen, A., Mattiucci, S., Paoletti, M. & Nascetti, G. Occurrence and distribution of anisakid nematodes in capelin (*Mallotus villosus*) from the Barents Sea: product quality and food safety considerations
15:20 - 15:35 Avenant-Oldewage A. Pathology caused by the Branchiura in relation to the digestive system morphology
15:35 - 15:50 Timi J.T. & Lanfranchi A. L. Ontogenetic changes in heterogeneity of parasite communities of fish: disentangling the relative role of compositional vs abundance variability

15:50 - 16:20 Coffee Break

16:20 - 18:00 Poster Session III

18:10 - 18:50 CONFERENCE: ***PARASITES AND FISHERIES***
Dr. K. MacKenzie, Department of Zoology, University of Aberdeen, UK

ANTUNEZ ROOM

SESSION FISH PARASITES AND FISHERIES I

PRESIDENT J.T. TIMI SECRETARY V. HENRIQUEZ

08:30 - 08:50 Key Note Speaker. Dr. J. T. Timi, Parasites as biological tags for fish stock assessment: limitations and perspectives
08:50 - 09:05 Cañas L., Sampedro, M. P., Farina, A. C. & Llevot, M. J. Spatial distribution patterns of three anisakid nematode parasites of anglerfish *Lophius piscatorius* and their potential application in stock identification stdudies.
09:05 - 09:20 Espínola-Novelo, J.F., Mackenzie, K., Gonzalez-Salas, C. & Guillén-Hernández.S. Infracomunities of metazoan parasites as a tool for stock identification of *Mycteroperca bonaci* (Poey, 1960) (Epinephelidae) off the coast of Yucatán México
09:20 - 09:35 Henriquez, V., González, M.T., Licandeo,R. & Carvajal, J. Metazoan parasite communities of rock cod, *Eleginops maclovinus*, and their use as biological tags at local and regional scale
09:35 - 09:50 Llarena-Reino, M., Abollo, E., Maroto, J., Sieiro, P. & Pascual, S. Software development for management of parasitized fish stocks and products.
09:50 - 10:05 Moore, B. R. & Lester, R. J. G. Spatial variation in parasites of king threadfin (*Polydactylus macrochir*) and blue threadfin (*Eleutheronema tetradactylum*) in Australian waters; implications for fisheries

10:05 - 10:35 Coffee break

SESSION FISH PARASITES AND FISHERIES II

PRESIDENT J.T. TIMI SECRETARY V. HENRIQUEZ

10:35 - 10:55 Kappalli, S., Aneesh, P.T., Keethadath, A. & Gopinathan, A. Studies on a Parasitic Copepod infesting edible seer fish population (*Scomberomorus guttatus*) of Malabar (Kerala, India)
10:55 - 11:10 Reed, C.C., MacKenzie, K., & van der Lingen, C.D. Parasites as biological tags for South African sardines
11:10 - 11:25 Oliva, M. E. & Cuello, D. *Sprattus fuegensis* a small pelagic fish with a high burden of the nematode *Hysterothylacium* sp.
11:25 - 11:40 Cavaleiro, F. I., Ho, J-S & Santos, M.J. The seasonal infection dynamics of *Octopicola superba* in the common octopus, *Octopus vulgaris*

12:30 - 13:10 CONFERENCE (Gala Room)

FRIDAY 30

GALA ROOM

SESSION LIFE CYCLE I

PRESIDENT G.T.R. SOUZA SECRETARY C GILORDANI

09:05 - 09:20 Halajian, A., Tavakol, S., Mortazavi, P., Shokoofeh, S. & Luus-Powell, W. *Clinostomum complanatum* in birds, a potential pathogen for fishes, Iran

09:20 - 09:35 Hodova, I., Valigurova, A., Koubkova, B. & Gelnar M. *Eudiplozoon nipponicum*: host-parasite interactions in blood-feeding diplozoids

09:35 - 09:50 Kocan, R., Hershberger, P., Hart, L. & LaPatra, S. Early Development of *Ichthyophonus* in Two Fish Hosts; From Circulating Blood Stage to Fully Mature Tissue Schizonts

09:50 - 10:05 Poynton, S. L. & Fard, M. R. S. *Spironucleus salmonis*: adhesive flagella initiate clustering of trophozoites and clusters of cysts – new observations on adaptions for enhanced infectivity

10:05 - 10:35 Coffee break

SESSION LIFE CYCLE II

PRESIDENT G.T.R. SOUZA SECRETARY C GILORDANI

10:35 - 10:55 Repulles-Albelda A., Raga, J.A. & Montero, F.E. The three growth periods of microcotylid

10:55 - 11:10 Souza, G.T.R., Minte-Vera, C. V., Dias, M. L., Yamada, F. H. & Takemoto R. M. Parasites as markers of the trophic position of fish and birds in the floodplain of the high Parana River, Brazil.

11:10 – 11:25 Souza, G. T. R., Dias, M. L., Machado, M. H., Silva, E. S., Takemoto, R.M. Development of metacerariae of *Clinostomum* sp. (Digenea: Clinostomidae) into ovigerous adults using experimental host.

12:30 : Closing Ceremony.

POSTERS

TUESDAY 27

POSTER SESSION I

1.- Jerônimo, G. T., Marchiori, N.C., Tamporoski, B. R. F., Ishikawa, M. M. & Martins, M. L. First report of *Trichodina colisae* (Ciliophora: Trichodinidae) in pacu (*Piaractus mesopotamicus*) cultured in Brazil

2.- Kozlowiski, R., Abdallah, V.D., Da Silva, R. J. & Carvalho, E. D. *Henneguya* spp. parasitizing *Cyphocharax nagelii* (Steindachner, 1881), *Prochilodus lineatus* (Valenciennes, 1837) and *Steindachnerina insculpta* (Fernández-Yépez, 1948) (Characiformes) from the Peixes river, State of Sao Paulo

3.- Reed, C.C., Bartošová, P., Fiala, I. & Dyková, I. Preliminary results of a population study on *Ceratomyxa cottoidii* from South Africa

4.- Zhang, J. & Li, A. Molecular detection of *Myxobolus ampullicapsulatus* in pond-cultured allogynogenetic gibel carp, *Carassius carassius gibelio* in China

5.- Abdallah, V. D., Kozlowiski, R., Da Silva R. J. & Carvalho, E. D. Diversity of monogeneans parasites of fish from the Peixe's river, State of Sao Paulo, with news records for Brazil

6.- Crafford, D., Avenant-Oldewage, A. & Luus-Powell, W. J. Does size matter? The case of the lesser-endowed monogeneans

7.- De Melo, M.F.C., Santos, C, P. & Santos J.N. A new genus and species of monogenean (Dactylogyridae) from the gills of *Satanoperca jurupari* (Heckel) (Cichlidae) in the Guamá River, Amazon delta, Brazil

8.- Ferreira. R. C., Silva, M.B. & Boeger, W.A.P. Can DNA help defining morphological diagnostic characters for generic groups within a polyphyletic *Gyrodactylus* (Gyrodactylidae, Monogenoidea)?

9.- Marcotegui, P., Montes, M. & Martorelli, S. New *Polyclithrum* (Monogenea: Gyrodactylidae) from external surface of *Mugil liza* (Mugilidae) from Samborombón Bay, Argentina

10.- Matla, M.M., Mashego, S. N. & Mokgalong, N. M. Monogenea of the genus *Dactylogyrus* from South Africa

11.- Prikrylova, I., Blazek, R. & Vanhove, M.P.M. The description of five new species of *Gyrodactylus* Nordmann, 1832 (Monogenea: Gyrodactylidae) parasitizing African catfishes

12.- Santos, C. P., Miranda, D.F., Cunha, L.F.G. & Santos, E.G.N. Confocal laser scanning microscopy of *Gotocotyla acanthura* (Monogenea: Gotocotylidae)

13.- Sepúlveda, F., López, Z. & González, M.T. *Neobenedenia* spp. (Monogenea: Capsalidae) in fishes from Chilean coast as a potential pathogen in culture of *Seriola lalandi*.

14.- Sepúlveda F., González M.T. & Oliva M.E. The genus *Encotyllabe* sp. (Capsalidae, Encotyllabinae) in fishes from Chilean coast with proposal of two new species

15.- Vanhove, M.P.M., Van den Broeck, F., Snoeks, J., Volckaert, F.A.M., Pariselle, A. & Huyse, T. Extending knowledge on monogenean fauna of riverine cichlids to the heart of Africa

16.- Mouahid, G., Faliex, E., Allienne, J.F., Cribb, T.H. & Bray, R.A. *Proctophantastes nettastomatis* (Digenea: Zoogonidae) from Vanuatu deep-sea fish: new morphological features, allometric growth and phenotypic plasticity aspects

17.- Fernandes, B. M., Mota, A. M. & Malta, J.C.O. A new genus of Macroderoididae McMullen, 1937, digenean parasite of *Hoplosternum littorale* (Hancock, 1828) (Pisces: Callichthyidae) from Amazonas State, Brazil

18.- Ostrowski de Núñez, M., Arredondo, N. J. & Gil de Pertierra, A. A. Two new species of *Parspina* Pearse, 1920 (Digenea, Cryptogonimidae) from freshwater fishes (Gymnotiformes) of the Paraná River basin in Argentina
19.- Justo, M.C.N., Mendonça, H. S., Cohen, S. C. & Fernandes, B. M. M. New genus of Cryptogonimidae, a digenean parasite of *Rhaphiodon vulpinus* (Pisces: Cynodontidae) from Brazil
20.- Martorelli, S. R., Montes, M,, Alda P, & Marcotegui, P. First record of *Diphterostomum brusinae* (Digenea: Zoogonidae) in juveniles of *Micropogonias furnieri* (Pisces: Scienidae) in Argentina
21.- Pazooki, J., Khosheghbal, M. & Masoumian, M. Digenean parasites from *Otolithes ruber* in north west of Qeshm Island, Iran
22.- Arredondo N. J. & Gil de Pertierra, A. A. New proteocephalidean cestode (Proteoceophalidea: Proteocephalidae), parasite of the Callichthyidae (Pisces: Siluriformes) from the Paraná River basin, Argentina
23.- Gil de Pertierra, A. A., Incorvaia, I. S. & Arredondo, N. J. Two new species of *Clestobothrium* (Cestoda: Bothriocephalidea), parasites of *Merluccius australis* and *M. hubbsi* (Gadiformes: Merlucciidae) from the Patagonian shelf of Argentina
24.- Borges, J.N., Cunha, L.F.G., Santos, H.L.C., Monteiro-Neto, C. & Santos, C. P. Morphological and molecular characterization of *Anisakis* larvae (Nematoda: Anisakidae) in cutlass fish *Trichiurus lepturus* (L.) from Brazilian waters
25.- Braicovich, P.E., Lanfranchi, A.L., Luque, J.L. & Timi JT. About the difficult systematic position of an Acanthocephalan of the round scad, *Decapterus punctatus* (Cuvier 1829) from Brazil
26.- De Melo, M.F.C., Santos, J.N., Giese E.G., Santos, E.G.N. & Santos, C. P. A new species of *Raphidascaris* (Sprentascaris) (Nematoda: Anisakidae) from the fish *Satanoperca jurupari* (Osteichthyes: Cichlidae)
27.- Fernandes, B. M. M., Mota, A. M., Malta, J.C.O. & Cárdenas, M. Q. A new species of *Philometra* Costa, 1845 (Nematoda: Philometridae) from *Pygocentrus nattereri* (Kner, 1858) (Characiformes: Serrasalmidae) a freshwater Amazonian fish, Brazil
28.- Halajian, A., Paoletti, M., Nascetti, G., Tavakol, S., Mattiucci, S. Molecular identification of species of genus *Contracaecum* (Nematoda: Anisakidae) maturing in fish-eating birds of Northern Iran
29.- Lacerda, A.C. F., Takemoto, R. M. & Pavanelli, G. C. New species of *Cucullanus* (Nematoda: Cucullanidae), parasite of the intestine of *Cichla piquiti* (Perciformes: Cichlidae) from Tocantins river, Brazil
30.- Masova, S. & Barus, V. *Procamallanus* (*Spirocamallanus*) *spiralis* (Camallanidae) in new host and locality - SEM and LM observations
31.- Rossin, M.A., Incorvaia, I. S. & Timi, J. T. A new species of *Neoascarophis* (Cystilicolidae), a parasite of *Macrourus carinatus* (Günther) from Patagonian waters.
32.- Timi, J. T., Mattiucci, S., Paoletti, M., Lanfranchi, A. L., Alarcos, A. J., Garbin, L., George-Nascimento, M. & Nascetti, G. Molecular identification of *Pseudoterranova cattani* and *P. decipiens* E (Nematoda: Anisakidae) from fishes of the Austral region: morphological and ecological characterization
33.- Cantatore. D. M. P., Lanfranchi, A. L & Timi, J. T. New species of *Acanthochondria* (Copepoda: Chondracanthidae) parasitizing the longtail southern cod, *Patagonotothen ramsayi* (Perciformes: Nototheniidae) from patagonian waters, Argentina
34.- Gao, Q., Peng, G-X., Luo Y-L. & Nie P. Mitochondrial genes of *Sinergasilus polycolpus* (Copepoda, Ergasilidae) parasitizing the gills of fish
35.- Cavaleiro, F.I., Ho, J-S & Santos, M.J. An updated key to species of *Octopicola* (Crustacea: Copepoda: Octopicolidae)
36.- Hadfield, K.A., Bruce, N. L. & Smit, N. J. *Cymothoa* isopods parasitic on marine fishes in the South Western Indian Ocean, including records of two new species**.**

37.- Alfjorden. A. Swedish investigations of parasitic infections in farmed and wild perch (*Perca fluviatilis*) collected from the northern county of Västerbotten down to the coastal waters of Östergöetland
38.- Antonucci, A.M., Takemoto R.M., Lopes, L.P., Yamada, F.H. & Pavanelli, G.C. Identification of parasites commercialized as ornamental fish in the city of São Paulo, Brazil
39.- Boijink, C. de L., Crescencio, R., Da Silva, E. C. & Inoue. L.A.K.A. Use of mebendazole for monogenea control during transport of Tambaqui (*Colossoma macropomum*)
40.- Chagas, E. C., De Araujo, L. D., Gomes, L.D., Malta, J.C. & Varella, A.M.B. Salt effect on physiological responses and monogenean control in tambaqui (*Colossoma macropomum*)
41.- Civanova, K., Davidova, M.,Visner, R., Flajshans, M. & Simkova, A.V. The effect of fish ploidy level on the structure of metazoan parasite communities of tench (*Tinca tinca* L.)
42.- Franceschini, L., Zago, A. C., Schalch, S.H.C, Garcia, F., Romera, D. M. & da Silva, R. J. Parasitic infections in the production of pacu *Piaractus mesopotamicus* and hybrid patinga from the Northwest of São Paulo State, Brazil
43.- Garcia, F., Romera, D. M., Schalch, S. H. C., Gozi, K. S., Onaka, E. M. & Portella, M. C. Prevalence of *Trichodina* parasite in different stocking densities of Nile tilapia in cages
44.- Jerônimo, G. T., Ventura, A.S., Gonçalves, E. L.T., Tamporoski, B. R. F., Martins, M. L. & Ishikawa, M. M. Parasitic fauna of hybrid siluridae fishes of different hatchery stages in Brazil
45.- Müller, M. I., Carriero, M.M., da Silva, M. R. M., Ceccarelli, P. S., Adriano, E. A. & Ueta, M.T. Ultrastructural and Molecular Analysis of *Henneguya piaractus* (Myxosporea) parasite of gills of cultivated *Piaractus mesopotamicus* (Characidae) in Brazil
46.- Romera, D. M., Schalch, S.H.C., Garcia, F. Gozi, K.S., Fonseca, F.S. & Candeira, P. G. Prevalence of *Trichodina* sp. (Protozoa: Ciliophora: Peritrichia) and monogenean (Helminth: Dactylogyridae: Monogenea) of Nile Tilapia reared in cages placed in hydroelectric reservoirs, São Paulo Brazil
47.- Sahandi,J., Shohreh, P. & Jafariyan, H. *Argulus* (*Argulus pellucidus*) parasite, usual disease of Gold fishes.
48.- Sanchez-Garcia, N., Ahuir-Baraja, A. E., Raga, J. A. & Montero, F. E. Preliminar study of the increased succeptibility of *Sparus aurata* to the monogenean *Furnestinia echeneis* after hydrocortisone administration
49.- Severino, R., Davies, A. J. &, Santos, M. J. Sporogonic stages of an *Eimeria* sp. infecting cultured sea bass (*Dicentrarchus labrax* L.), in South Portugal.
50.- Zago, A. C., Franceschini, L., Garcia, F. & Da Silva, R. J. Ectoparasites of "tilápia-do-Nilo" (*Oreochromis niloticus*) cultivated in fish cage in Grande River, Água Vermelha Reservoir, Brazil

WEDNESDAY 28

POSTER SESSION II

1.- Iannacone, J., Alvariño, L. & Cárdenas-Callirgos, J. Parasite community of cabinza grunt *Isacia conceptionis* (Cuvier and Valenciennes, 1830) (Perciformes: Haemulidae) in the zone of Chorrillos, Lima, Peru

2.- Iannacone, J., Alvariño, L. & Cárdenas-Callirgos, J. Interannual variations of metazoan parasite communities of Peruvian morwong *Chirodactylus variegatus* (Valenciennes, 1833) (Perciformes: Cheilodactylidae) in the zone of Chorrillos, Lima, Peru
3.- Sánchez, L, Suyo, B., Salízar, P. & Ñacari, L. Contributions to knowledge of helminths of *Sphoeroides annulatus* (Jenyns, 1842) (Tetraodontiformes) from mangrove, Tumbes, Peru.
4.- Alarcos, A.J. & Timi, J.T. Parasite communities in three sympatric flounders (Pleuronectiformes: Paralichthyidae): similar ecological filters driving to repeatable assemblages
5.- Braicovich, P.E. & Timi J.T. Multivariate dispersions of composition vs abundance as drivers of beta diversity in parasite assemblages of *Serranus auriga* (Serranidae) along host ontogeny
6.- Cantatore, D. M. P., Tringali, L. S. & Timi, J. T. Parasite infracommunities of *Helicolenus lahillei* Norman, 1937 (Scorpaeniformes. Sebastidae) in Southwest Atlantic Ocean
7.- Cantatore, D. M. P., Braicovich, P. E., Alarcos, A. J., Lanfranchi, A.L., Rossin, M. A. & Timi, J. T. New records of parasitic copepods (Crustacea: Copepoda) from marine fishes in the Argentinean Sea
8.- Silva, A., Castro, R., Cavaleiro, F. & Santos, M. J. Helminths of Atlantic chub mackerel, *Scomber colias* Gmelin 1789, and Atlantic mackerel, *S. scombrus* Linnaeus 1758, useful as biological tags of host feeding ecology
9.- Cohen, S.C., Campos, T. O., Fernandes, B. M. M. & Cárdenas, M. Q. Monogenoidea from *Centropomus* spp.: salinity influences species richness?
10.- Henriquez, V., González, M. T. & Irribarren P. Metazoan parasite assemblages of sea bass *Paralabrax humeralis* (Serranidae) from Northern Chile
11.- Hernández-Orts, J.S., Juan, A., Crespo, E. A., Montero, F. E., Raga, J.A. & Aznar, F. J. Population structure of *Corynosoma australe* (Acanthocephala: Polymorphidae) in paratenic fish hosts from Patagonia, Argentina
12.- Kilian, E. & Avenant-Oldewage, A. Distribution of *Ergasilus* sp. on the gills of *Lamprichthys tanganicanus* collected from Lake Tanganyika
13.- Kuhn, T., García-Márquez, J., Busch, M. W. & Klimpel, S. Zoogeography and genetic variability of zoonotic *Anisakis* spp. (Anisakidae, Nematoda) in different climate zones
14.- López, D. & George-Nascimento, M. An experimental approach to the study of persistence in parasite assemblages of intertidal fish assemblages of Chile
15.- Montes, M., Marcotegui, P. & Martorelli, S. A Bayesian comparison of two helminthes population in juveniles of *Mugil liza* from Samborombon bay, Argentina
16.- Moya-Alcover, C. M., Montero, F.E. & Carrassón, M. Parasites of Gadiform fish species from Western Mediterranean
17.- Pérez-del-Olmo, A, Morand, S., Raga, J.A. & Kostadinova, A. Taylor's power law for marine parasites: the importance of taxonomy and ecology of transmission
18.- Pérez-del-Olmo, A., Dangel, D. R. & Sures, B. Effect of water temperature on parasite communities of brown trout, *Salmo trutta fario*, in Central Europe
19.- Vardic, I., Valic, D., Kapetanovic, D., Gjurcevic, E. & Teskeredzic, E. Distribution and molecular characterization of acanthocephalan parasites from freshwater fish in Croatian rivers
20.- Al-Atiya, S., Williams, C. & Brooks, D. *Pseudodactylogyrus* spp. in wild eel populations of the United Kingdom
21.- Cohen, S. C., Fernandes, B. M.M., Justo, M. C. N., Dos Santos, A. L. & Cárdenas, M. Q. Helminth parasites of *Ctenosciaena gracilicirrhus* (Metzelaar, 1919) (Perciformes: Scianidae) from the coast off Angra dos Reis, Rio de Janeiro State, Brazil

22.- Faliex, E., Amilhat, E., Virag, L., Accou, A., Feunteun, E. & Sasal, P. First european extensive study on silver eels (*Anguilla anguilla*) infected by the pathogenic invasive nematode, *Anguillicoloides crassus*
23.- Irribarren, P., López, Z. & González, M. T. Characterization of *Caligus* species found in fishes from northern Chilean coast
24.- Lemos, M. & Souto-Padron, T. Dynamics of infection of trypanosomes found in *Hypostomus affinis* and *Haementeria* sp.
25.- Lemos, M. & Souto-Padron, T. Developmental forms of trypanosomes from fishes hosts *Hypostomus affinis* and *Hypostomus luetkeni* and of the leech *Haementeria* sp.
26.- Martins, M. L., Dehai, X., Shoemaker, C. & Klesius, P. Coinfection by *Edwardsiella ictaluri* and *Ichthyophthirius multifiliis* affects hematology and survival in channel catfish *Ictalurus punctatus*
27.- Pascual, S., Regueira, M., Bao, M., Vello, C., Outeiriño, L. & González, A.F. Spatial epidemiology of *Anisakis* in Atlantic waters: systematic review and GIS
28.- Sahandi, J., Shohreh, P. & Qolipour, M. Increasing of temperature for *Oodinium* disease treatment in marine fishes
29.- Yactayo-Flores, A. & Sánchez, L. Helminth endoparasites of *Odontesthes regia* (Pisces: Atherinopsidae) from the central coast of Peru
30.- De Azambuja, L. P. & Boeger W.A.P. Using ecological network analysis to test predictions on the limitation of host-switch by oviparous Gyrodactylidae
31.-Valdivia, I.M., Criscione, C., Cárdenas, L. & Oliva, M.E. What factors affect the genetic diversity of a progenetic trematode at local scale? *Proctoeces cf lintoni* as a study model
32.- Barciová, T., Hanzelová, V. & Miklisová, D. Sensing of polychlorinated biphenyls in heavily polluted water reservoir in Eastern Slovakia using fish and their intestinal parasite *Acanthocephalus lucii*
33.- Hanzelova, V., Barsiova, T. & Oros, M. Abnormalities of the strobilar morphology in *Proteocephalus percae* from perch (*Perca fluviatilis*) in degraded aquatic environment.
34.- Luus-Powell, W., Jooste, A. & Addo-Bediako, A. Biomonitoring the fish health and parasites at two impoundments in the Olifants river, Limpopo Province
35.- Luus-Powell, W., Jooste, A., Smit, W., Madanire-Moyo, G. & Addo-Bediako, A. Diversity of metazoan parasites of the silver catfish and mozambique tilapia as indicator of pollution from the Olifants river, South Africa
36.- Mateu, P., Repullés-Albelda, A., Carrassón, M. & Montero, F. E. Parasitofauna of *Bathypterois mediterraneus* (Osteichthyes: Ipnopidae) from western Mediterranean waters
37.- Oda, F. H., Lopes, L. P., Antonucci, A. M. & Takemoto, R. M. Parasites of the kilifish *Rivulus apiamici* Costa, 1989 (Cyprinodontiformes: Rivulidae) as bioindicators of anthropogenic impact in two streams from upper Paraná River basin, Brazil.
38.- Olivier, P.A.S., Madanire-Moyo, G. N. & Luus-Powell, W. J. Monogenean communities of *Clarias gariepinus* and *Oreochromis mossambicus* as bioindicators of pollution
39.- Rodriguez, S. M., D' Elia, G. & George-Nascimento, M. New host and geographical record for *Mooleptus rabuka* (Nematoda: Gnathostomatidae) in the largenose catshark *Apristurus nasutus* (Carchariniformes: Scyliorhinidae) off Juan Fernandez Archipelago, Chile
40.- Aldana M., Garcia-Huidobro M. R, Espinoza, G. & Marquet, P. A. How important is *Sicyases sanguineus* in the life cycle of *Proctoeces lintoni* in the intertidal of central Chile?
41.- Braga, M. P., de Oliveira, R. N. & Boeger, W.A.P. Testing origin of the first "daughter" of viviparous Gyrodactylidae
42.- Gregori, M., González, A.F. & Pascual, S. Intermediate hosts for fish parasites in Galician waters

43.- Busch, M.W., Kuhn, T. & Klimpel, S. Biodiversity of zooplankton off the coast of Namibia and its role as intermediate host of fish parasitic *Hysterothylacium aduncum*
44.- Emde, S., Verweyen, L. & Klimpel, S. Aquatic invasive species of the Rhine River (Germany) and their function as parasite hosts
45.- Repulles-Albelda, A., Raga, J.A & Montero, F.E. Blood or yolk: early post-larval development of the digestive system of *Sparicotyle chrysophrii* (Monogenea, Polyopisthocotylea)
46.- Rossi, G., Mele, S., Addis, P., Cau, A., Rodriguez-Marin, E. & Montero, F.E. Life strategies of adult didymozoids (Trematoda)
47.- Rangel, L. F & Santos, M. J. *Deropristis inflata* (Digenea: Deropristidae), an eel parasite in its prey, *Nereis diversicolor* (Polychaeta: Nereidae) in Aveiro Estuary, Portugal.
48.- Cardenas, L., Valdivia, I.M., Chávez, R., Molina, H. & Oliva, M.E. Preliminary assessment of the factors influencing the spatial genetic differentiation in *Helicometrina nimia*, 1910 (Trematoda, Opecolidae).

THURSDAY 29

POSTER SESSION III

1.- Al-Jufaili, S., Al-Aboodi, N., Al-Busaidi, M., Al-Ghabshi, A., Al-Mazrooei, N. & Gil Ha Yoon. The community of metazoan parasites of commercially important wild marine fish, Whitespotted Rabbitfish *Siganus canaliculatus* in Sultanate of Oman.
2.- Braicovich, P.E., Luque JL. & Timi J.T. Stock composition of the rough scad, *Trachurus lathami* Nichols in South American Atlantic waters: geographical patterns of parasite community structure as discriminating tools.
3.- Cañas, L., Martinez, A., Farina, A. C. & Sampedro, M. P. Morphological and genetic characterization of three anisakid nematode parasites of *Lophius piscatorius* from southwest of Ireland for their use as biological tags in stock identification.
4.- Castro, R., Silva, A., Cavaleiro, F., Costa, G. & Santos, M. J. Can ectoparasites of Atlantic chub mackerel, *Scomber colias*, and Atlantic mackerel, *S. scombrus*, be used as biological tags to distinguish between the two host species?
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ABSTRACTS CONFERENCES

BIODIVERSITY OF FISH PARASITES IN SOUTH AMERICA: LEARNING FROM OUR HISTORY AND SHAPING THE FUTURE

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The 2010 International Year of Biodiversity declared by the United Nations was an important opportunity to understand the vital role that biodiversity plays in sustaining life on Earth and to stop this loss. However, the parasites remain as an underestimated component of the global biodiversity. South America holds more than 30% of the entire planet's freshwater. Also, South American Pacific and Atlantic oceans support important commercial fisheries. These conditions are reflected in the high diversity of the regional ichthyiological fauna. In this context, the study of South American fish parasites increases its relevance to understand key roles in ecosystems, regulating the abundance or density of host populations, stabilizing food webs and structuring host communities. Other relevant topics are the impact of parasitism in the regional pisciculture and the fish-borne parasitic zoonoses. Thus, a good knowledge of South American fish parasite diversity would be a useful tool to environmental management and conservation and consequently to understanding of the global biodiversity. It is very hard estimate the number of fish parasite species in South America and the number of fish species studied for parasites are very low (not more than 10%), however, nematodes appears as the more diverse group of species associated with fishes, e. g. there are approximately 215 species associated with 380 species of fishes from Brazil. The history of the South American fish parasitology was strongly influenced by the contribution of the European researchers which in the 19th century generated the first parasite records as the result of naturalist expeditions into given territories. Today, collaborations with worldwide researchers continuing as an essential characteristic of fish parasitology in the region. Currently, some early problems as the researcher dispersion, absence of interchange, effort duplicity, and the significant volume of not indexed publications are clearly diminished in the region. Contribution of the South American researchers is not restricted to taxonomy but also to relevant parasite ecology aspects: extensive datasets were shaping along the last years generating numerous studies about parasite populations and communities. Increasing of interchange and research network in the context of the globalization allows visualize a promising and productive future for fish parasitology in South America.

FISH PARASITES AND FOOD WEBS

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In most aquatic ecosystems, fishes are hosts to parasites and, sometimes, these parasites can affect fish biology. Some of the most dramatic cases occur when fishes are intermediate hosts for larval parasites. For example, fishes in southern California estuaries are host to many parasites. The most common of these parasites, *Euhaplorchis californiensis*, infects the brain of the killifish *Fundulus parvipinnis* and alters its behaviour, making the fish 10–30 times more susceptible to predation by the birds that serve as its definitive host. Parasites like *E. californiensis* are embedded in food webs because they require trophic transmission. In the Carpinteria Salt Marsh estuarine food web, parasites dominate the links and comprise substantial amount of biomass. Adding parasites to food webs alters important network statistics such as connectance and nestedness. Furthermore, some free-living stages of parasites are food items for free-living species. For instance, fishes feed on trematode cercariae. Being embedded in food webs makes parasites sensitive to changes in the environment. In particular, fishing and environmental disturbance, by reducing fish populations, may reduce parasite populations. Indirect evidence suggests a decrease in parasites in commercially fished species over the past three decades. In addition, environmental degradation can affect fish parasites. For these reasons, parasites in fishes may serve as indicators of environmental impacts.

FISH PARASITES: FROM LINNAEUS TO MOLECULES

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In the 18th century, most written knowledge would fill an entry-level iPad today. However, with no iPads and no 'apps', for those seeking to bring order to the natural world, an extensive library, a global perspective and was required. As the natural world was being 'discovered' and formally described at a remarkable rate, the need for a simple tool for naming and classification was required. It fell to the natural historian Carl Linnaeus (1707-1778) to develop the simple binomial system of classification for taxonomy through the publication of *Systema Naturae* (1735), a short 12-page treatise. In its tenth edition *Systema Naturae* classified 4,400 species of animals and 7,700 species of plants; a comprehensive treatment of life on earth at the time, and one that has been developed using the same basic system, ever since. After three centuries much of the diversity of parasites recognized today would fall, if at all, in Linnaeus' *Paradoxa* or *Vermes*, since many are small (especially microscopic), cryptic, relatively amorphous or were simply not found in Linnaeus' time. There seems little doubt that much of parasite diversity has yet to be discovered, let alone named, and it seems parasitologists must deal with more than their fair share of *Paradoxa* or *Problematica*. Systematists focus on three questions: what is it, where is it found and how is it related? At the heart of answering each satisfactorily and comprehensively, requires the resolution of the Tree of Life, the application of evolutionary principles and

most recently an engagement with the molecular biology revolution. Here I review the progress in bringing order out of chaos in various aspects of fish parasitology that depend on systematics, and consider the challenges and opportunities offered by the on-going molecular and information revolutions. Are there apps for that and are they any good?

PARASITES AND FISHERIES

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Two separate aspects of the relationship between parasites and marine fisheries are discussed: the effects of parasites on fisheries, and the effects of fisheries on parasites. Parasites can have negative effects on fisheries through loss of biomass due to pathogenic parasites, or through highly visible "spoilage" parasites reducing the market value of the product. Examples of pathogenic parasites causing mass mortalities are the fungus-like protistan *Ichthyophonus* and the monogenean *Pseudanthocotyloides* sp. Several species of the coccidian genera *Goussia* and *Eimeria* are also suspected of causing serious mortalities in marine fish, as are parasitic copepods of the genus *Lernaeocera.* Larvae of anisakid nematodes and some metacestodes infecting the musculature of their fish hosts cause serious losses to marine fisheries because of the negative aesthetic appearance of infected fish. While the effects of parasites on fisheries has been fairly well documented, little consideration has been given to date to the effects of overexploitation by marine fisheries on parasite biodiversity. Some examples are given of significant decreases in levels of infection of parasites, with possible local extinctions, thought to be at least partly due to fishing activities. Finally, the value of parasites as biological tags in population studies of commercially important marine fish is assessed.

ADVANCES AND TRENDS ON ANISAKID NEMATODES AND ANISAKIDOSIS.

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Anisakisosis is a diseases caused by human infection with larval (usually L3) nematodes belonging to the family Anisakidae. The species of the two genera *Anisakis* and *Pseudoterranov*a are those often associated with human anisakidosis, even if few cases have been also reported due to the larval stages of the genus *Contracaecum*. Molecular genetic studies have identified in these genera complexes of sibling species and detected new biological species. Among those, only some are so far genetically recognized as causing human anisakidosis. Here, we review recent results achieved on some species of anisakid nematodes, their geographical distribution, host preference, population genetic structure, genetic diversity, phylogeography and co-evolutionary aspects, as based on both nuclear and mithocondrial markers. Further, molecular and immunological diagnosis of some anisakid species and their pathogenic role to humans is discussed.

ARE WE EVER GOING TO FIGURE OUT WHY SOME FISH SPECIES HAVE MORE PARASITE SPECIES THAN OTHERS?

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Certain fish species harbour rich parasite faunas, and others don't; this is a simple fact apparent to anyone who has surveyed the parasites of different fish species. Why is that? After several decades of comparative analyses seeking to explain this variation, we still lack a satisfactory answer. Here, I will first summarise the main factors (host body size, trophic level or diet breadth, geographical range, latitude, etc.) usually predicted to covary with parasite species richness, and provide the evolutionary or ecological rationale for these expectations. Second, I will show how practically all studies to date have found either inconsistent or weak (low r-squared values) relationships between these factors and parasite species richness. Third, I will offer some reasons for these disappointing results, by presenting empirical evidence for widespread measurement error and underestimation of parasite species richness due to the low taxonomic resolution of primary surveys, and to the undetected existence of cryptic parasite species. Finally, I will present a slightly different approach to the question, by applying methods used in conservation biology to identify hotspots of biodiversity, in order to determine whether our failure to identify the drivers of parasite diversity is merely due to inadequate methodology. The search for the processes underpinning variation in parasite species richness among fish species, as this update will show, remains wide open.

KEY NOTE SPEAKER

PERSPECTIVES ON THE TAXONOMY AND SYSTEMATICS OF THE MYXOZOA

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Over the last 20 years a dramatic increase in the number of publications on taxonomy and relationships in the Myxozoa has emerged. During that time almost 100 papers were published resulting in 1,500 secondary citations, a clear demonstration that work in this area is active and relevant. Understandably, there is an emphasis on myxozoan impact upon wild harvest and aquaculture fisheries. Nonetheless, patterns cannot be resolved without information from additional intermediary host/parasite relationships. Thus, data from a broader range of hosts occurring in natural habitats are required to develop strategies for management and diagnosis in commercially-significant hosts. This allows a more balanced exploration of systematic relationships. The whole of evidence approach has become the standard for proposal of new species of myxozoans and as such aligns perfectly with the theme of this conference. Elements of morphology, molecular identity, geography, habitat and host specificity are all key to unambiguous assignment of species. Equally, a reappraisal of familial, generic and specific boundaries in the light of this approach is an obvious and pressing need for species designated prior to the accessibility of molecular characters. Our task has been assisted by recent key reviews that provide a solid foundation for further work. Scope of work is exemplified by our studies on the Australian fish fauna with a recorded 1,610 fish species, of which many occur on Queensland's Great Barrier Reef. Our recent taxonomic studies on myxozoans have revealed a diversity for *Ceratomyxa* alone that is likely to exceed that of their fish hosts. The analysis estimates that Australia's coral reef fish fauna harbours over 1,500 species of this genus, of which only 1% have been described.

FISH PARASITES AND PATHOLOGY

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All parasite taxons contain representatives which significantly injure the host through mechanical and chemical mechanisms comprising ingestion of host tissue or chemical breakdown of tissues through enzymatic activity. These changes of the host and organ integrity may inflict considerable damage to the host. However, host reactions against parasites of all taxons have been described in some detail and these may interfere with the normal physiological functions of the host. Thus, both innate and adaptive responses mounted by the host, aiming at eliminating the parasite, will themselves contribute to severe pathology. Thus immune evasion reactions of parasites will in several cases make at least part of the parasite population able to survive the often intricate host reactions. Some parasites may produce immune-depressing molecules whereby the parasites may continue the tissue destroying activity. Other parasitic organisms will in certain cases elicit a strong

reaction but protect themselves by various protective layers and will eventually be encapsulated by a complex of host cells including lymphocytes, macrophages and fibroblasts. The parasite may survive in these structures for years but the mere presence of these granuloma will disturb the function of the afflicted host organ. Examples comprising protozoans and metazoans using different invasion and evasion strategies will be presented. Gill pathology is mainly observed in association with amoebae, ciliates, flagellates, myxosporeans, monogeneans, digeneans and crustaceans. Severe pathology of internal organs is induced by myxosporeans in muscles or cartilage tissues. Crustaceans such as *Lernaeocera branchialis* may induce serious functional changes in cardio-vascular tissues. Likewise digeneans such as *Sanguinicola* and *Aporocotyle* survive in these organs. Cestodes such as *Triaenophorus* and nematodes such as anisakids are associated with significant dysfunction of liver tissue. Acanthocephalans such as *Pomphorhynchus laevis*, digeneans and nematodes may interfere with the normal structure and function of the intestinal mucosa and serosa. Evolutionary aspects of these pathological reactions will be discussed.

LIFE CYCLES OF DIGENEA PARASITIZING MARINE FISH IN ARGENTINEAN WATERS

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Considering that food webs are used by digeneans to complete their life cycles, their larval stages in intermediate hosts are also positive indicators of trophic relationships in an ecosystem. Taking into account the ecological importance of the mollusk-digenean interactions in coastal environments, and the scarcity of integrated studies on this subject in South America, the aim of the present study is to review the information about digenean life cycles of marine fish in Argentina. Until 1996, only 3 marine digenean larvae were known. At present, a total of 17 larvae are known, 12 from bivalves (3 Bucephalidae in mussels, 2 Sanguinicolidae in Veneridae and Solenidae clams, 5 Monorchiidae in Veneridae (2), Mactridae, Gaimardiidae and Erycinidae clams, 1 Faustulidae in a Psammobidae razor clam, 1 Fellodistodistomidae in a Nuculidae clam), and 5 from snails (1 Hemiuridae in a Siphonaridae, 1 Zoogonidae in a Nassaridae, 1 Fellodistomidae in a Nassaridae snail, and 2 Lepocreadiidae in Calyptreidae and in a Buccinidae). Most of the recorded species are from intertidal environments in Patagonia. The life cycles have been elucidated for only 2 species; 1) the fellodistomid *Monascus filiformis* in which the first intermediate host is the clam *Nucula puelcha*, the second hosts are jelly fish, and the final host is the pelagic fish *Trachurus lathami*, and 2) the monorchiid *Proctotrema bartolii* in which the first and second host is the clam *Darina solenoides* (Mactridae) and the fish *Eleginops maclovinus* and *Odontesthes* spp. being the final hosts. Considering that more than 50 adult forms are known in marine fish in the Argentinean Sea, it is unavoidable to study digenean larvae in subtidal environments. Life cycles should be carried out by experimental infections with the help of molecular tools.

SPATIAL AND TEMPORAL VARIABILITY OF PARASITE INFRACOMMUNITIES IN MARINE FISH SPECIES DIFFERING IN BODY MASS.

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Most studies on the ecology of parasite communities in marine fish have not been replicated neither examined in more than one spatial and temporal scale. We assessed the variability of parasite infracommunities in terms of richness, biomass and abundance in four fish host species selected by their high availability along the coast of Chile and because they spanned a wide spectrum of body sizes. Triplicated samples (ca. 30 fish each) of 4 fish marine host species (hake *Merluccius gayi*, black ling *Genypterus maculatus*, jack mackerel *Trachurus murphyi,* anchovy *Engraulis ringens*) were taken twice per year between 2005 and 2007, in the three major fishing areas along Chile in order to assess the extent to which the variability of aggregated properties of metazoan parasite infracommunities depended on the host body mass, the sampling time, the fishing zone and the host species identity. Results revealed that richness, biomass and abundance in infracommunities increase with the host body mass, while their variability decreases with the host body mass. Examination of residuals of the effect of the host body mass, showed that richness, total parasite biomass and numerical abundance are affected more by the fishing zone, the year of sampling and the host species identity than their variabilities. These results have several implications for the use of parasite infracommunities in fish populations studies, where the amount of sampling effort needed is the most important aspect affected.

ARE THERE LATITUDINAL PATTERNS IN FECUNDITY AND BODY SIZE OF DIGENEAN SPECIES IN LITTORAL FISHES FROM SOUTHEASTERN PACIFIC?.

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Some parasite species are more abundant than others, and they show an extensive geographical (latitudinal) range. However, a given parasite species show geographical variations in abundances (and prevalences) along the geographical host range. These intra-specific parasite variations among host populations could reflect local environmental conditions affecting parasite growth and reproduction (fecundity). In this study, the fecundity and body size of digenean parasites of littoral fish across geographical ranges (24ºS- 45ºS) are determined, and the possible associations between parasite fecundity and infection parameters (prevalence and abundance) in host populations are evaluated. The biological models studied were: *Neolebouria georgenascimentoi, Phyllodistomum* sp., *Pseudopecoelus* sp., and *Helicometra cf. fasciata* present in four fish species (*Prolatilus jugularis, Pinguipes chilensis, Sebastes oculatus, Paralabrax humeralis*) distributed along

the southeastern Pacific coast. For each host, all mature digeneans (with eggs) found into fishes were measured in its total length (mm) and the uterus was extracted. Total eggs were counted, and a fecundity index was estimated. Fecundity of digeneans was correlated with body length. Parasite body sizes and fecundity of *N. georgenascimentoi*, *Phyllodistomum* sp. and *H. fasciata* showed latitudinal variations; but not *Pseudopecoelus* sp. The digeneans with longer latitudinal range showed an abrupt change in their biological characteristics, which is coincident with a known biogeographical break (ca 42ºS) in the southeastern Pacific coast.

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FISH PARASITES IN EXTREME ENVIRONMENT

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The open ocean and the deep-sea are amongst the most fascinating ecosystems on earth. Compared to other aquatic environments such as the coastal zones and the northern continental shelf regions, only a minor part of the open ocean and the deep-sea have been scientifically explored. The deep-sea below 200m water depth is inhabited by a wide variety of metazoan fish parasites. A total of 789 parasite taxa belonging to the Myxozoa (63 species), Digenea (308), Monogenea (74), Cestoda (113), Nematoda (51), Acanthocephala (40), Hirudinea (5) and Crustacea (135) have been reported so far from 511 different fish species, resulting in an average of 1.5 parasite species in each studied deep-sea fish. Most parasite records originate from the commercially important macrourids, while other families such as the Melamphaidae, Ipnopidae, Bathylagidae, Oneirodidae, Platytroctidae and Chiasmodontidae have been widely neglected in parasitological research. The onion-eye grenadier *Macrourus berglax* can be considered the most parasite rich deep-sea fish, with records of more than 54 metazoan species. Digeneans, cestodes and crustaceans followed by nematodes are the predominant parasites of the deep-sea, being most diverse close to the sea floor and less abundant as well as species rich in the free water column. This is related to a general scarcity of food in the meso- and bathypelagic realm. The parasite fauna of deep-sea fish is dependent on food availability, the feeding and migratory behaviour of their potential intermediate and final hosts and the distance to the epipelagic zone and the sea floor. The most species rich parasite fauna occurs between 200 and 1.000m, decreasing in diversity and abundance from 1.000 to 3.000m. Only few parasite records exist below 3.000m, but the diversity of all metazoans except the digeneans appears to decrease. Host specificity of many deep-sea fish parasites is low, indicating a high level of generalism within this aquatic environment.

WHAT'S NEEDED FOR A COMPREHENSIVE MOLECULAR PHYLOGENY OF THE DIGENEA?

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The most comprehensive phylogeny for the Digenea relies on an analysis of two nuclear ribosomal genes. So far, this has remained largely unchallenged or ignored, although smaller-scale studies have refined or added resolution to some of the branches on the digenean tree, and many new species have been sequenced for a diversity of markers. If accepted it requires significant changes to the classification system in place for decades. However, for a molecular phylogeny to achieve its full potential, as the basis for classification, evolutionary inference, and as a tool for understanding comparative biology, it must be robust, densely sampled (both taxa and genes), provide congruent solutions (between its constituent gene trees and with other lines of evidence) and be believable when its biological implications are considered. How do we achieve this? Two avenues to pursue include (i) a supermatrix approach to incorporating all available phylogenetic information, and (ii) a supertree approach to incorporating all available phylogenies. However, both have their limitations and both rely on a relatively passive, *post hoc*, approach to engaging with the wider user-community. We argue for a planned, dirigible, community-based approach in collecting, storing and sharing tissue samples amenable for molecular analysis, and a suite of standardized markers to be provided in association with new species descriptions and revisionary work. We investigate the scope and utility of a diversity of markers available in achieving a comprehensive digenean Tree of Life, whilst mindful of the needs of other molecular-based studies, not least those involving species identification. Finally, we view the tree in the light of fish digeneans and demonstrate the important role that fish parasitologists need to play in achieving the broader goal.

ACHIEVEMENTS OF RECENT STUDIES ON PHILOMETRID NEMATODES (Philometridae), IMPORTANT PARASITES OF FISHES

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Philometrids (Philometridae) represent the most important group of dracunculoid nematodes parasitizing fishes. In his monograph treating Dracunculoidea, Moravec (2006) reported a total of 11 genera and 105 species of philometrids parasitizing freshwater, brackish-water and marine fishes. However, during the last five years (2007-2011), an additional 37 new species of Philometridae have been described, representing a 35% increase of the number of nominal species. Most of them (28) belong to *Philometra* (a 41% increase of species in this genus), mainly represented by parasites of marine fishes, a few species to *Philometroides* (5), and a single species to each *Caranginema* (1), *Dentiphilometra* (1) and *Spirophilometra* (1). Moreover, 2 new genera, *Afrophilometra* and

Caranginema, were erected. For the first time, representatives of 6 genera, *Afrophilometra*, *Buckleyella*, *Caranginema*, *Dentiphilometra*, *Paraphilometroides* and *Rumai*, were studied using scanning electron microscopy (SEM). Thirteen already known but poorly described philometrid species were redescribed and, in some of them (species of *Caranginema* and *Philometra*), previously unknown conspecific males were discovered and described. The male surface ultrastructure studied by SEM provided new taxonomically important features for species distinction. Phylogenetic interrelationships among representatives of 7 genera, *Afrophilometra*, *Alinema*, *Caranginema*, *Nilonema*, *Philometra*, *Philometroides* and *Rumai*, were studied by molecular methods. New important data have recently been obtained on the biology and pathogenicity of several species of *Philometra*, *Philometroides*, *Nilonema* and *Rumai*. Further detailed studies on philometrids are significant not only from the theoretical viewpoint, but they may also have practical implications.

EPIDEMIOLOGY OF PARASITIC DISEASES IN FISHES

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Aquaculture production has been increasing globally. Emergence of new parasitic diseases has been reported in farmed fish, particularly those farmed in marine cages. Some of these diseases are caused by facultative parasites which live free in the environment but under certain, often not fully understood, conditions can parasitise fish. These include marine amoeba *Neoparamoeba perurans*, the causative agent of Amoebic Gill Disease in various fish species farmed in marine environment and marine scuticociliate *Uronema nigricans*, the causative agent of swimmer syndrome in Southern Bluefin Tuna. With the detection limits and quantification improvements due to the development of molecular methods, relationships between presence of these organisms in the environment and disease outbreaks can be now investigated with a greater resolution. Other fish diseases are caused by parasites which are obligate parasites and infect wild fish but their infections are often more severe in farmed fish, for example sealice in salmonids or Southern Bluefin Tuna and blood fluke *Cardicola forsteri* in Southern Bluefin Tuna. Knowledge of reservoirs of these parasites and of their life cycles is important for understanding these disease outbreaks. Wild fish can be a reservoir of infection for some of these parasites. Epidemiology is a study of patterns and causes of diseases in populations, which is directly applicable to aquaculture where an individual animal is rarely the unit of interest. Epidemiological studies include observational studies (descriptive, cross-sectional, case-control or cohort), intervention studies or theoretical studies (modelling). Patterns of outbreaks can suggest risk factors and mitigation strategies. For example outbreaks of Amoebic Gill Disease are usually associated with high salinity and increased water temperature. However, the interpretation of epidemiological studies can be challenging due to a lot of variation at different levels (individual, cage, site, company). Additionally, production pressures may limit fish sampling or adversely affect experimental design. This can have detrimental effects on the study. Choice of appropriate diagnostic methods and precise case definition are critical for a successful study. Potential co-infections need to be taken into account when interpreting results of an epidemiological study. Laboratory experiments can be used

to improve interpretation of epidemiological studies or provide additional information needed for modelling.

CONTROL OF PARASITIC DISEASES OF FISH IN JAPANESE AQUACULTURE

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About 50 species of marine and freshwater fish are cultured in Japan. From 25 major cultured fish, more than 200 species of parasites have been recorded, many of which are known to be pathogenic. However, options for chemical treatment of parasite-infected fish are limited. In many parasitic infections, immunity is not at all or poorly acquired in infected fish and/or no preventive measures can be taken due to the lack of knowledge on the life cycle of causative parasites or such knowledge is not applicable to open culture environments. All these suggest that the losses due to parasitic infections may become equivalent to or exceed those caused by viral and bacterial infections. Interruption of parasite life cycle is a still major goal for establishing control measures of parasitic diseases. Besides, production of resistant fish strains against particular parasites should be pursued as another realistic approach. Conventional selective breeding may require long years of practice, but molecular techniques will effectively shorten the period by selecting fish with particular genes involved in the resistance.

PUTTING SOME ECOLOGY BACK INTO HOST-PARASITE COPHYLOGENETIC STUDIES: INTERACTION FREQUENCY IN GEOGRAPHIC SPACE

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Advances in phylogenetic analyses over the last twenty years have seen a rise in the number of studies of host-parasite cophylogenetics. Essentially, these consist in rigorous attempts to compare the topologies of host and parasite phylogenetic trees, in order to infer evolutionary events such as cospeciation or host-switching. In all those studies, however, host-parasite associations are treated not as continuous variables, but as all-or-nothing, i.e. parasite A infects host B, or it does not. In reality, however, if one samples a particular host species in several different localities, it is likely that some parasite species will occur on that host in most or all localities, whereas other parasite species will only infect the host in a few localities. Using data on metazoan parasites of sticklebacks, I will show that host-parasite associations cannot be considered as all-or-nothing on a geographical scale: interaction frequency (i.e. the proportion of host populations in which a particular parasite occurs) varies widely among parasite species. I will then argue that integrating spatial co-occurrence data into cophylogenetic studies might provide much clearer insights into the circumstances under which certain coevolutionary scenarios, such as cospeciation or host-switching, are favoured over others. The uncoupling of ecological data from phylogenetic data must come to an end.

MONOGENEAN CONTRIBUTIONS TO THE INTERNATIONAL SYMPOSIA ON FISH PARASITES

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The first international meeting of people working on monogeneans was realized within the symposium "Parasitic Worms and Aquatic Conditions" held in Prague during 1962. Later, the first meeting in the ISFP series was held in 1983 at České Budějovice (then Czechoslovakia), when less than 10% of the 103 presentations were on the Monogenea. These were on numerous topics but predominantly taxonomic, and presented by workers restricted to Czechoslovakia, West Germany, China, Malaysia, Japan and Poland. At II ISFP, held at Tihany, Hungary, in 1987, there were a similar number of papers, with *c*.8% being on monogeneans in the areas of taxonomy, ecology and general biology, again coming from workers in Europe and Asia. Due to these meetings, in 1988 the first International Symposium on Monogenea was organized in České Budějovice, aiming to alternate with the ISFP meetings. The year 1989 was significant with the independence of the countries of Central and Eastern Europe from the Soviet Union and two years later, apart from political circumstances, the III ISFP occurred in Karelia (former USSR) in 1991. Again 10% of the 100 papers presented were on monogeneans, with ecology and papers from the USSR dominating. The turning point for the series was IV ISFP at Munich, Germany, in 1995, with 31 monogenean presentations (18%) from 18 different countries, mainly on ecological topics. This was the first meeting to be world-wide in its attendance. In 1999, the V ISFP returned to České Budějovice for a meeting with almost 200 presentations, 13% of which were on monogeneans. There it was decided that the next meeting (VI ISFP, 2003) would be outside Europe, and Bloemfontein, South Africa was chosen. Despite the great distance, it still attracted 112 presentations, of which 25% were on Monogenea, mainly on taxonomy and ecology, and with numerous contributions from the Czech Republic and Australia. In 2007, the VII ISFP returned to Europe (Viterbo, Italy) for the largest meeting in the series, with 362 contributions and *c.*80 (22%) on monogenean topics. For the first time in South America, Viña del Mar, Chile, was chosen as the venue for ISFP VIII where a large meeting, with *c.* 230 presentations will include 15% on monogeneans (taxonomy, ecology, aquaculture, evolution and biogeography). Consequently, over the years, the ISFP series throughout the continents allowed the spread of knowledge and opened possibilities for researchers and students of different countries to share their work on Monogenea.

HOT SPOTS OF CESTODE DIVERSITY IN TELEOST FISH: A BRIEF SUMMARY OF THE SYSTEMATIC STUDIES ON FISH TAPEWORMS

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Teleost fish serve as hosts for larval stages (metacestodes) and adults of several major groups (orders) of tapeworms (Cestoda). Current knowledge of the diversity and geographical distribution of individual major groups of fish cestodes are briefly overviewed and areas of possibly undescribed species richness are discussed. Regions with a potential radiation of fish cestodes include the Neotropical Region, especially the Amazon River basin (Proteocephalidea) and South East Asia (India), in which critical revisions of described taxa have revealed numerous invalid taxa (species and genera). Surprisingly, very little is known about the North American (Nearctic) fauna of tapeworms found in freshwater fish. Some groups, in particular the corallobothriine tapeworms (Proteocephalidea), which are parasitic in channel catfish (Ictaluridae), should be revised based on the morphological and molecular evaluation of newly collected and properly processed material. Current cytogenetic and molecular studies indicate possible existence of cryptic species even in Europe, such as in the group of the oldest cestode described from a teleost fish, *Caryophyllaeus laticeps* (Pallas, 1781). Recent studies on the cestode fauna of freshwater fish in Africa indicate a rather low species diversity, but narrow host specificity and wide geographical distribution of fish tapeworms in this biogeographical realm. The diversity of cestodes in marine teleosts, in particular those in bathypelagic and abyssal fish (Bothriocephalidea), is poorly known.

PARASITES AS BIOLOGICAL TAGS FOR FISH STOCK ASSESSMENT: LIMITATIONS AND PERSPECTIVES

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The use of parasites as biological tags for fish stock discrimination has become increasingly popular during last years. This methodology has evolved from using single parasite species as discriminators to comparing entire parasite assemblages by mean of sophisticated multivariate analyses. The growing background of parasite ecology and the increasing number of studies on stock discrimination have evidenced, however that some problems constrain their utility: the disadvantages of using short lived parasites and the lack of replication at short local and temporal scales, both of them providing only snapshots of the actual situation, with no possibilities of inferring about future comparisons. Intrinsic host population traits can also cloud the results; among them host size being one of the most important, especially for long-lived parasites which tend to accumulate with fish size or age and whose influence must be taken into account in case of samples being not homogeneous in terms of host size. Fish size is a source of variability in parasite assemblages, with

younger/smaller fish displaying more stochastic communities than older/larger ones, making difficult the interpretation of results. On the other hand, differences between size classes in the relative contribution to within/between samples of both species composition and abundance can be used for making inferences regarding discrimination of stocks by multivariate procedures. These problematic situations are exemplified based in our own results on fish stock assessment in South Western Atlantic waters, a particular region where parasites can be used not only for identifying the boundaries among fish populations, but also among fish assemblages.

FISH PARASITES IN THE NEOTROPICS

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Why do we need to study fish parasites in the neotropics? Because there are 189 million poor people living in this region. An affordable protein alternative for these people is fish aquaculture. However, with increase in the intensity of fish aquaculture, there is an increase in the number of parasites causing diseases. For this paper, nine diseases (= parasites) listed for fish by the World Organization for Animal Health (OIE) were considered. Since they affect trading, an important challenge in the neotropics is to build capacity to diagnose and report these diseases. The objective of this study was to determine the capacity of the neotropics for reporting OIE- listed diseases of fish. An analysis was made of the information available on OIE-listed fish diseases for the neotropics in the OIE Handistatus II and WAHID databases between 1996 and 2010. The neotropics were divided into three sub regions: South America from Colombia to Argentina; Central America from Panama to Mexico, and the Caribbean including the Greater and Lesser Antilles. The data were interpreted in terms of the number of years that a sub region had the capacity to report an OIE-listed diseases of fish. In South America, five countries maintained disease reporting for periods of 11 – 15 years but seven countries provided no information at all. In Central America, four countries maintained disease reporting for 6–10 years and three provided no disease reports. In the Caribbean, only one country maintained disease reporting for 11–15 years, whereas eight countries had zero participation. The differences in performance are best explained by the small number of professionals trained and engaged in diagnosis of aquatic animal diseases, as well as the lack of reliable laboratories. The potential consequences for biosecurity and trading are emphasized.

ORAL PRESENTATIONS

MONITORING *ANGUILLICOLOIDES CRASSUS* INFECTIONS IN THE EUROPEAN EL, *ANGUILLA ANGUILLA*, WITHIN UK RIVER SYSTEMS

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The European eel, *Anguilla anguilla*, is an economically important species that contributes to biodiversity within UK and European inland and coastal waters. The numbers of *A. anguilla* have suffered serious decline in recent years and the species is now viewed as threatened. One contributory factor to this decline is believed to the pathological impact of infectious agents such as parasites and viruses. To assist understanding of the role(s) of parasites in the species decline, we have focused upon the swimbladder nematode *Anguillicoloides crassus.* This parasite is naturally present in the Pacific eel *A. japonica*, causing no deleterious health effects. However, due to the worldwide eel trade, *A. crassus* was accidentally introduced into European habitats in the 1980s and within *A. anguilla*, it causes a striking pathology of the host swimbladder. The primary aim of this study was to clarify the status of *A. crassus* within UK eel populations. To this end, we have examined > 500 eels from twenty-seven river systems across England and Wales. Our data confirm that *A. crassus* infection is widespread; for example, prevalence of infection is 83%, 70% and 36% from specimens isolated from the river Piddle (Dorset), the river Cadoxton (South Wales) and the river Leven (Cumbria) respectively. We have also initiated parasite genotyping to establish the extent of *A. crassus* genetic diversity in the UK. Such information is necessary as a foundation for controlling the spread of A. crassus and hence assisting improvements to the management of European eel stocks in the United Kingdom.

CHECKLISTS OF MONOGENEANS PARASITIZING FRESHWATER FISHES OF KURDISTAN REGION, IRAQ

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Through a comprehensive review of the studies made on different aspects of the fish parasites of Kurdistan region, north of Iraq, a total of 49 species of monogenetic trematodes belonging to eight genera (*Dactylogyrus, Dogielius, Diplozoon, Gyrodactylus, Mastacembelocleidus, Mazocraes, Paradiplozoon* and *Silurodiscoides*) were so far recorded from 24 species of freshwater fishes. The genus *Dactylogyrus* was the most abundant (33 species) in the monogenean group. The highest number of monogenean species was recorded from the cyprinid fish *Cyprinus carpio* (12 species), followed by *Cyprinion macrostomum* (9 species) and *Barbus barbulus*, *B. luteus* and *B. xanthopterus* (6 species each). In connection with the distribution of monogeneans among the freshwater fishes, *Dactylogyrus vastator* was reported from 11 fish host species and both *Dactylogyrus carpathicus* and *Diplozoon barbi* were reported from four fish host species. In this study,

detailed lists of parasite-host and host-parasite are provided. Also, a key to the genera of monogeneans from Kurdistan region was constructed.

DIGENEAN FAUNA DIVERSITY IN TELEOST FISH FROM BIZERTE LAGOON IN THE NORTH EAST OFF TUNISIA

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The coastal lagoons are confined ecosystems characterized by an abundant food and high faunistic density. This made these environments favourable for the circulation of the parasites and the completion of their life cycles. Despite the importance of parasitism in these biotopes, the lagoonal digenean fauna remains poorly known. In order to remedy this deficiency, we examinated 3351 teleost fish coming from the Bizerte Lagoon. After this examination, 46 digenean species belonging to 20 families are reported for the first time in Tunisia. Among the collected trematodes, *Prodistomum polonii*, is indicated, for the first time in the Mediterranean from Sparid fish (*Diplodus annularis* and *Sarpa salpa*); this species seems to be predominantly reported in carangid fish of the genus *Trachurus*. Furthermore, news hosts are reported for some digenean species in this biotope. Majority of recorded digeneans colonize two or more parts of the digestive tract of the host. However, *Hemiuris communis, Bacciger israelensis, Diphterostomum brusinae, Magnibusatus bartolii* and *Zoogonus rubellus* seem to show clear ecological preferences and limit their distribution to only one niche. The analysis of parasite infracommunities shows that the majority of host species harbour only one species of parasite and the occurrence of two or three is much less frequent. However, we have noted the presence of 4 species of parasites in *Sarpa salpa*. Two life cycles of parasite of *Bucephalus* genus (*Bucephalus labracis* and *B. anguillae*) were elucidated in this lagoonal environment.

POPULATION DYNAMICS OF ENDOPARASITES OF THE SPOTTED SEATROUT, *CYNOSCION NEBULOSUS*

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The sciaenid *Cynoscion nebulosus* is a species of great ecological and economic importance in southeastern US coastal waters. In South Carolina estuarine systems, it was recently discovered to be infected with several pathogenic endoparasites including three separate species of myxozoans in the skeletal muscle, bulbus arteriosus, and urinary system, one blood fluke in the heart ventricle, one Ichthyophonus-like parasite in the posterior kidney, and an unidentified microsporidian in the liver. We determined infection by these parasites in a histological study carried out from March 2009 through May 2010 in 238 fish ranging

from 15 to 663 mm in total length and 0-7 years in age. Mean prevalence ranged between 2.9% and 49.6% for the different parasite species. Some of the species were affected by season, with highest prevalences occurring in the winter. In most cases, prevalence increased with fish size and age, and males of a given size were more often infected than females. The total number of parasite species per fish varied between 0 and 6, and was similarly affected by total length, age and sex. The effects of these endoparasites on the health of the fish are currently being investigated.

PATHOLOGY CAUSED BY THE BRANCHIURA IN RELATION TO THE DIGESTIVE SYSTEM MORPHOLOGY

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Three genera were studied. In *Argulus* an extended proboscis and pre-oral spine occur. Digestive enzymes are released via the pre-oral and the labial spines from glands situated in the carapace. A blood meal is taken when blood vessels are broken. In *Dolops* and *Chonopeltis* the proboscis is very short and both the pre-oral spine and buccal spines are absent. *Dolops* feed on blood released from the wounds created by the hooks on the maxillulae. In *Chonopeltis* attachment is effected by suckers and mucous forms the main component of the diet. In all three genera the esophagus is surrounded by circular muscle bundles which extend the esophagus to create a vacuum presumably to assist ingestion. The esophagus opens into the midgut via a funnel. Superficially the anterior and posterior midgut in all three genera bears resemblance. In *Argulus* and *Dolops* the ultra structure is similar to that of free living copepods. The anterior midgut consists of resorptive cells and the enteral diverticules contain both F (fibril) and R cells. The R cells contain oil droplets and the F cells contain rough endoplasmic reticulum indicating that absorption takes place in the anterior midgut and enteral diverticula. Blister cells occur in the posterior midgut and they are involved in processing of digestive waste. In *Chonopeltis* R/F cells occur with both absorption and digestive waste involvement. The cells contain few lipid droplets but instead have crystaline protein structures. The difference in diet is probably related to the structure of feeding appendages and the ultra structure of the digestive system and this impact on the pathology exhibited by the parasites.

PREVALENCE AND INTENSITY OF INTERNAL PARASITIC HELMINTHES INFECTED OF BLACK SOLE FISH, *BRACHIRUS ORIENTALIS* (BLOCH & SCHNEIDER, 1801) IN PERSIAN GULF

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This study was conducted to identify intestinal helminthes parasites. The helminthes fauna is collected from body cavity and intestine of 108 specimens, *Brachirus orientalis* obtained from Abadan port (waterfront) were investigated during the year 2009-2010 .A lot of 4 species of helminthes were found in intestine and body cavity of examined fishes. The

helminthes found was composed by 2 digenetic Trematodes (*Lepocreadioides zebrine*, *Allocreadium brachirusii*) all in adult state in intestine. General prevalence of *Lepocreadioides zebrini* and *Allocreadium sp.* were in intestine 58% and 73% respectively, one nematode *Hysterothylacium aduncum* that the prevalence was 23% the only Cestod *Proteocephalus* sp. with 16%. Often parasites species found in this study are reported for the first time from Iran and *Allocreadium* sp is introduced as a new species and described here.

OPTIMALITY, MICROEVOLUTIONARY, AND MACROEVOLUTIONARY PERSPECTIVES ON THE LIFE CYCLE OF *SCHISTOCEPHALUS SOLIDUS*

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Transmission from one host to the next is a critical life history transition in complex life cycle parasites. The optimal size and age at transmission is thought to be shaped by growth and mortality rates experienced in the different hosts. I provide one of the few estimates of these rates for a parasite species, the trophically-transmitted tapeworm *Schistocephalus solidus*, and explore their consequences at both micro - and macroevolutionary levels. I focused on the transmission of the worm from its copepod first host to its stickleback second host. The parasite experiences far higher growth rates and far lower mortality rates in fish, suggesting any growth in the first host is wasted time. Artificial selection for rapid development in the first host produced little response, indicating that there is low potential for evolutionary change in the direction of higher fitness. Such constraints on change seem quite persistent, as other parasite species with comparable life cycles exhibit very similar growth and developmental rates. Even parasite taxa that have independently evolved a copepod-fish life cycle converge on this life history strategy. Thus, using inferences from optimality models, quantitative genetics, and cross-species comparisons, I conclude that particular life history strategies are universally associated with certain life cycles, which implies highly conserved selection pressures and/or functional constraints.

SITE-SPECIFIC DEFENSE RESPONSES IN SALMON SKIN ELICITED BY THE ECTOPARASITE *LEPEOPHTHEIRUS SALMONIS*

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The site-specific response of infection with the ectoparasite *Lepeophtheirus salmonis* differs among host salmonid species: Atlantic salmon (*S. salar*) are unlikely to mount an inflammatory response whereas the more resistant pink salmon (*Oncorhynchus gorbuscha*) exhibit a strong inflammatory reaction. Given the ecological and economic importance *of L.*

salmonis, understanding this interaction at the molecular level is critical and is the focus of this research. Pink, Atlantic and chum (*O. keta*) salmon were infected with adult *L. salmonis* and the response of select immune-related genes at the louse-skin interface after 24 and 48hrs was measured by real-time quantitative PCR (qPCR). Genetic expression in the skin at louse-infected sites and non-infected sites were normalized to expression in skin from non-treated fish. Louse-site up-regulation was observed independent of species in a number of genes including CCAAT/enhancer binding protein beta; (C/EBP-beta), interleukin (IL)-6 (at 24hrs), IL-8, IL-1beta;, tumor necrosis factor-alpha;, cyclooxygenase-2, and matrix metalloproteinase 13. Up-regulation of genes at non-infected sites on infected fish but not at louse-attached sites suggests a louse-derived suppression, and was observed in C-reactive protein, major histocompatibility factor II, prostaglandin D synthase, Nuclear factor kappa-B, serum amyloid P, and C/EBP beta;. Major differences within species were observed in several genes with pronounced expression at louse-infected sites predominant in pinks. Evidence of louse-derived suppression in species known to be more prone to infection (Atlantic, chum) suggests biomarkers of susceptibility. Conversely, exaggerated responses of particular genes (MHCII, C/EBP-beta, CRP, MMP13, COX-2, NF kappa-B) in resistant species (pink) may implicate certain immunological pathways associated with protective effects in *L. salmonis* infections.

PRINCIPLE PARASITES AFFECTING SALMONIDS FARMED IN FRESHWATER IN SOUTHERN CHILE

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As salmonids are not native species in the southern hemisphere parasite infection in freshwater in Chile have mainly been caused by widely distributed parasites in the wild fish species that inhabit rivers and lakes. Parasites are horizontally transmitted to salmonids species reared intensively in the south of Chile. Most of the parasites recorded for farmed salmonids correspond to ectoparasites with a direct life cycle. The parasites recorded in salmonids in freshwater include the protozoans *Ichthiophtirius multifilis*; *Trichodina* sp.; *Chilodonella* sp.; *Ichthyobodo necatrix*; *Hexamita* sp. and the intracellular *Nucleospora salmonis*, the last one introduced from the United States through the infected eggs of Atlantic salmon. The crustaceans *Argulus* sp. and *Ergasilus* sp., and the glochidia of the mussel *Diplodon chilensis* have also been recorded as parasites of salmonids species reared in netpen in the lakes.

SPATIAL DISTRIBUTION PATTERNS OF THREE ANISAKID NEMATODE PARASITES OF ANGLERFISH *LOPHIUS PISCATORIUS* AND THEIR POTENTIAL APPLICATION IN STOCK IDENTIFICATION STUDIES

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Anisakis type I, *Pseudoterranova decipiens* (s.l.) and *Hysterothylacium rigidum* are parasites of anglerfish, L. piscatorius, a fishing species managed under two stocks consideration (Northern and Southern stock) in the Southern Shelf of the Northeast Atlantic. A key aspect of fisheries management is the accurate identification of the stock boundaries. In this study the abundance and distribution patterns of those parasites in that area were examined aiming to a biological tool for anglerfish stock identification. Generalized linear models, generalized additive models and non parametric test were used to analyze the variability of parasitic prevalence and intensity with host and spatio-temporal variables. Year, depth, latitude and longitude were no significant factors on the infestation levels of the studied parasite. Host sex (examined in the cases of *P. decipiens* (s.l.) and *H. rigidum*), was not either significant. Anglerfish size was a significant covariate on the infestation levels of *Anisakis* type I and *P. decipiens* (s.l.), which increased with the host size. The geographical variables (stock and area) also showed a significant effect. *Anisakis* type I was found more abundant in southern area and prevalence of *P. decipiens* (s.l.) was higher in the northern one (43% in northern areas and 5 % in southern). Presence of *H. rigidum* was higher in the Southern stock (15%) than in the Northern stock (8%). Infestation levels of the three nematodes and factors related variability between stocks resulted still poor for categoric anglerfish stock identification, although represented a useful step forward to the holistic approach purpose.

A NEW DIPLOSTOMID METACERCARIAL GENOTYPE FROM THE EYE LENSES OF THE EUROPEAN FLOUNDER, *PLATICHTHYS FLESUS* (L.) (TELEOSTEI: PLEURONECTIDAE)

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Despite the numerous parasitological studies which have been conducted on the European flounder, *Platichthys flesus* (Linnaeus, 1758), little attention has been devoted to its

diplostomid eye fluke infections. These were recently detected in the eye lenses of flounders off the Portuguese coast, but there has been no serious attempt to identify isolated metacercarial specimens to the species level. This study addresses the issue of species identification by considering morphometric and genetic data. Metacercariae of *Diplostomum* sp. were isolated from flounders caught off Matosinhos on the northwest Portuguese coast. Two different morphotypes, 'round' and 'long', were recognized during initial morphometric analyses, but these proved to have 100% genetic homology with regard to the 18S + ITS1 + 5.8S region of the rDNA. The sequenced region proved to represent an unknown genotype, which is now referenced in GenBank as GQ370809. In addition, the molecular phylogenetic analyses, along with the principal components and cluster analyses performed on the morphometric data, show that the isolated species of *Diplostomum* corresponds with neither *D. spathaceum* nor *D. mergi*, two species previously reported to infect the flounder. Although there is the possibility that these marine specimens represent a new species, it seems more likely that they belong to a known species which has yet to be characterized genetically.
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THE SEASONAL INFECTION DYNAMICS OF *OCTOPICOLA SUPERBA* IN THE COMMON OCTOPUS, *OCTOPUS VULGARIS*

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In European waters, the common octopus, *Octopus vulgaris* Cuvier, 1797, is commonly found infected with the octopicolid copepod *Octopicola superba* Humes, 1957. Notwithstanding, the infection dynamics of this parasite has so far been poorly investigated. This study intends to evaluate the occurrence of seasonality of infection in *O. vulgaris* from the northwest Portuguese coast. Thirty octopus were examined per each season for one year: total length [(mean±standard deviation) = 69.8±8.2 cm (winter), 68.3±10.9 cm (spring), 65.8±10.8 cm (summer) and 66.9±7.9 cm (autumn)]; sex composition [13♀♀+17♂♂ (winter), 15♀♀+15♂♂ (spring), 17♀♀+13♂♂ (summer) and 11♀♀+19♂♂ (autumn)]. Prevalence (in %) and intensity [mean±standard deviation (range)] levels of *O. superba* were determined. The existence of a significant difference in intensity among the 4 seasons of the year was evaluated by the Kruskal-Wallis test. No seasonality trend was recorded for prevalence, once this was at its highest possible level, i.e. 100%, in all seasons of the year. On the contrary, the recorded intensity levels suggest the existence of seasonality in the studied parasitism, with the maximum level recorded for summer [100.8±72.8 (7-235) parasites] and the minimum for autumn [8.5±9.7 (1-38) parasites] (Kruskal-Wallis test: χ^2=47.401, D.F.=3, *P*=0.000). This trend agrees with those previously recorded for other species of parasitic copepods present at the study area, e.g. *Lepeophtheirus pectoralis* (Müller, 1777) and *Acanthochondria cornuta* (Müller, 1776).

The summer seems to be the season more favourable for epizootic outbreaks of *O. superba*. In aquaculture systems, the infection might become problematic since: (i) the animals are kept in restricted spaces; and (ii) the parasite has, presumably, a single-host life cycle.

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MORPHOLOGICAL VARIATION OF *CHARACITHECIUM COSTARICENSIS* (MONOGENOIDEA: DACTYLOGYRIDAE): IS AN EVIDENCE OF INITIAL STEPS OF SPECIATION?

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In the present study, we provided new morphometrical data for 7 dactylogyrid species (*Urocleidoides trinidadensis* [=*Diaphorocleidus trinidadensis* new comb.], *D. kabatai*, 2 species of *Diaphorocleidus*, *Ch. costaricensis*, *Jainus hexops*, and Dactylogyridae gen. sp.) infecting the gill lamellae of 3 species of *Astyanax* (*Astyanax fasciatus*, *A. altiparanae*, and *A. bimaculatus*) from Southeast Region of Brazil. Among these monogenoideans, only *Ch. costaricensis* exhibits notable variation in size and shape of its sclerotized structures infecting these 3 host species above mentioned from Mogi Guaçu River, São Paulo, Brazil. As previously noted in *Ch. costaricensis* from Central America, present specimens showed a similar pattern of variation. That variation might suggest initial steps of speciation of *Ch. costaricensis* as result of their colonization on dissimilar environments (i.e., host and/or environmental effect) in which this species occurs along with their hosts in the tropics. This hypothesis is supported by variation based on previous molecular data obtained from *Ch. costaricensis* on *Astyanax* spp. from Central America (unpublished data).

THE VARIABILITY OF MHC GENES AND PARASITE DIVERSITY IN TWO CYPRINID SPECIES, *C. TOXOSTOMA* AND *C. NASUS*, IN HYBRID ZONE

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Hybridization is a common phenomenon in fish, especially in cyprinids resulting from the past introduction of new species and/or endangerment of native species. The differences in parasite infection between hybrids and their parental species seem to be tangible in different plant and animal hybrid systems. Two congeneric cyprinids, the introduced *Chondrostoma nasus* and native, protected and endemic *C. toxostoma* live in sympatry and form a hybrid zone in the Durance River (South France, Mediterranean Sea drainage). The bidirectional gene introgression was demonstrated between two *Chondrostoma* species. The aims of this study were to investigate the composition of metazoan parasite communities in two pure species, *C. nasus* and *C. toxostoma*, and their respective hybrids. All individuals were genotyped for mtDNA (cyt b), 41 microsatellite loci and DAB1 and DAB3 genes (MHC IIB class). Two allopatric and four sympatric populations were analyzed. A total of 7 Monogenea, 8 Trematoda, 3 Crustacea, 1 Acantohocephala species and larval stages of Mollusca were determined on investigated *Chondrostoma*. Monogenea and Trematoda were the most abundant parasite group. Among them, *Dactylogyrus* was the most abundant parasite genus. The sympatric populations differ in the proportion of two pure species and show a very low frequency of hybrids. When comparing two allopatric localities with the presence of solely *C. toxostoma* or the presence of solely *C. nasus*, low similarity in the presence of parasite species was observed. Higher similarity in parasite species richness was observed between sympatric localities. The individuals differ in DAB genes expression, some of them express only DAB1 or DAB3 gene, and others express the genes of both loci.

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NINE NEW SPECIES OF DACTYLOGYRIDAE PARASITES OF *SALMINUS BRASILIENSIS* FROM PARANÁ RIVER, STATE OF PARANÁ, BRAZIL

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Salminus brasiliensis (Cuvier), "dourado", formerly known as *Salminus maxillosus* (Valenciennes), is a freshwater Characidae fish that occurs in rivers of the Paraná-Paraguay river basin. *Salminusspp* are important target species of both commercial and, in special, sport fisheries in the Paraná-Paraguay and São Francisco river basins. Fish were captured from the Paraná River both below and above the reservoir of the Itaipu Hydroelectric Powerplant, State of Paraná, Brazil. The gills were removed and examined for Monogenoidea, which were processed according to tecniques used for the group. During a long-term study of parasites of this fish species, several new species of Dactylogyridae of distinct genera were collected (*Anacanthorus, Annulotrematoides, Jainus* and *Tereancistrum*). The only monogenoidean species described from this host was *Rhinoxenus bulbovaginatus* Domingues, Boeger and Pavanelli, 1995, collected from the nasal cavities.

Up to now, *Anacanthorus* comprises 65 known species from characiform fishes and five new species of are proposed herein, which differs from all other of the genus mainly by the comparative morphology of the copulatory complex. *Tereancistrum* contains five species, four of them described from Brazil and one from Colombia; The new species proposed herein can be easily distinguished from the others by the copulatory organ. Three species of *Annulotrematoides* were found in *S. brasiliensis,* A. *bryconi* and 2 new ones, which differ from the two previously described species mainly by the shape of accessory piece. Five species of *Jainus* have been already described, one from Costa Rica and four from Brazil, from which the new species differs by the morphology of the copulatory complex.

GLOBAL PUBLIC HEALTH IMPLICATIONS OF HUMAN SPARGANOSIS

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Human sparganosis is a globally occurring disease caused by invasion of human tissues by diphyllobothriidean plerocercoid metacestodes that are primarily parasites of fish. Most belong to the genus *Spirometra*, but precise identification is not always possible. In cases where the identity is undetermined, they are often referred to as "spargana" or *Sparganum* sp. In all cases, humans are considered to be accidental hosts, occupying the position of normal paratenic hosts in the environment, but a life cycle dead-end for the parasite because humans are not typical prey of the regular mammalian definitive hosts. It is usually assumed that humans become infected by ingesting plerocercoids in improperly cooked fish intermediate hosts, or drinking water containing copepod microcrustaceans containing the earlier procercoid stage. Though fish have been regarded as infection sources in most areas, at least 1000 human cases were reported from China alone, with most thought to have been acquired from consumption of infected snakes or frogs. Sites of infection in patients vary, but the most common are the central nervous system, eyes, musculature, and subcutaneous regions. Infections of the breast are emerging as special concerns to women's health, because of their pathology and the fact that they may confound diagnoses of breast cancer. Another emerging aspect involves an increase in reports of proliferative forms, which often lack scoleces, possess aberrant musculature, tegument, and excretory ducts, and usually are fatal to human and animal hosts. Here, we report new animal cases and review human cases, including examination of morphological and histological aberrancies. We propose that these constitute an old but neglected zoonotic threat that warrants more attention from both epidemiological and clinical perspectives.

HISTOPATHOLOGICAL DAMAGE PRODUCED BY PARASITIC HELMINTHS IN BLACKCHEEK TONGUEFISH *SYMPHURUS PLAGIUSA* FROM THE CAMPECHE BANK, MEXICO

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Histopathology is a powerful tool for determining the damage produced by parasites on their host. However, its inclusion is rarely considered in ecological studies. During the study of the parasite community ecology of the blackcheek tonguefish *Symphurus plagiusa* in the Campeche Sound (Gulf of Mexico), we collected 36 individuals to determine the histopathological damage produced by parasitic helminths. The liver, spleen, kidney, intestine, gills, muscle and heart of each individual were fixed in 10% buffered formalin, and processed by routine histological methods, producing 5 µm sections that were stained with Harris hematoxylin and eosin (H&E). *Acanthocephalus* sp. produced mucosal erosion and inflammation in the intestine. The metacercarie of *Bucephalus* sp. and *Stephanostomum* sp. produced fibrosis and chronic inflammation in heart, spleen, and kidney. Both metacercariae produced inflammatory response, migration of eosinophilic leukocytes and focal necrosis in gills. The larval cestode *Kotorella pronosoma* and the nematode *Hysterothylacium* produced local inflammation in the gut wall and in the liver respectively. In all cases, the extent of the structural damage was related to the number of parasites present.

MORPHOMOLECULAR CHARACTERIZATION OF *ANISAKIS TYPICA* PARASITE OF BLUEFISH *POMATOMUS SALTATRIX* OFF RIO DE JANEIRO COAST

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Species of *Anisakis* Dujardin 1845 are common parasites of aquatic organisms worldwide, but there is an increase in reported diseases through exposure to contaminated seafood products. Their life cycles involve crustaceans, fishes, cephalopods, and aquatic mammals acting as intermediate, paratenic and definitive hosts, respectively. The bluefish, *Pomatomus saltatrix* (L.), is one of many fish species along the Brazilian coast which have been assigned as host of *Anisakis* larvae based only on morphological data. This is the first attempt to identify the larvae of *P. saltatrix* off Rio de Janeiro, to species level using genetic analysis. The anterior and posterior regions of the nematodes were fixed in 70% alcohol, cleared in glycerine and mounted on semipermanent slides. The specimens were measured with ocular micrometer and drawings were made using a camara clara of an Olympus CX31 microscope. The middle region of individual larva was used for genomic DNA extraction using the gDNA Micro Tissue ChargeSwitch® Kit according to manufacturer's instructions. PCR followed by DNA sequencing was carried out using primers NC5/NC2 designed to amplify a fragment of internal transcribed spacer ITS-1, 5.8S, and ITS-2 of nuclear ribosomal of anisakids. After morphological characterization of

the anterior and posterior regions of *Anisakis* larvae, the results of the sequencing compared to GenBank data confirmed the identification to species level as *Anisakis typica*. This result shows the presence of anisakid nematodes with zoonotic potential in bluefishes sold in Rio de Janeiro.

NINESPINE STICKLEBACK *PUNGITIUS PUNGITIUS* FROM SOUTHERN BAFFIN ISLAND: BIOGEOGRAPHY, PARASITES AND TROPHIC STRUCTURE.

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This research on ninespine stickleback is part of ongoing studies on the trophic structuring of fish communities in small Arctic lakes using diet, parasites and stable isotopes. Ninespine stickleback collected from Iqalugaajuruluit Lake, Baffin Island, Canada were identified as the Bering *P. pungitius* and those collected from Chitty lake, Northwest Territories, and were identified as Mississippi *P.* pungitius based on McPhail (1963) and Foster (1976). The parasite community differed between the two populations with *Neoechinorhynchus pungitii* present in the Baffin Island stickleback population only. We speculate how this geographical distribution may have occurred as *N. pungitii* was first described from stickleback collected from the Great Lakes. Stable $\delta^{13}C$ and $\delta^{15}N$ isotopes, diet and parasites demonstrated that the prey consumed by ninespine stickleback *Pungitius pungitius* in Iqalugaajuruluit Lake changed during the summer and also revealed intraspecific variation in their ecological niche. In July, there were differences in the diets of male and female ninespine stickleback as indicated by the stable isotopes and was corroborated by the data on diet composition and the parasite fauna. This data suggests the sexes occupied different habitats during spawning. During July, females utilize the shallower littoral areas consuming zooplankton and benthic organisms, while males occupy deeper areas of the littoral zone feeding mainly on pelagic zooplankton. Parasite data support these observations as males had higher infections of copepod-transmitted parasites than females. There appeared to be no segregation of resources between males and females in late August, although the diet of both male and female ninespine stickleback shifted towards more benthic organisms compared to July. Differences in $\delta^{13}C$ isotope, diet composition and infections of co-occurring parasites demonstrated that sympatric ninespine stickleback and Arctic char *Salvelinus alpinus* captured in the littoral zone occupied separate niches. Ninespine stickleback preyed mainly on zooplankton and chironomids while Arctic char consumed a greater variety of prey items, including zooplankton and larger sized prey such as insects and ninespine stickleback. Trophic structure differed between Iqalugaajuruluit and Chitty lakes suggesting that generalizing trophic structuring of ninespine stickleback across Arctic lakes may be a problem owing to different food webs and/or spatial variation in $\delta^{13}C$ and $\delta^{15}N$.

MONOGENOIDS (DIPLECTANIDAE, POLYONCHOINEA) FROM THE GILLS OF MOJARRAS (PERCIFORMES, GERREIDAE) WITH THE RESURRECTION OF *NEODIPLECTANUM* MIZELLE & BLATZ, 1941 AND THE PROPOSAL OF A NEW GENUS.

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Four species of *Neodiplectanum* and three new species of new genus are described and/or reported from the gills of gerreid hosts from the Eastern and/or Western Atlantic: *Neodiplectanum wenningeri* from *Eucinostomus gula* (Quoy & Gaimard,1824) [type-host] and *Gerres cireneus* (Walbaum, 1792); *N. magnodiscatum* (Fuentes Zambrano, 1997) n. comb. (syn. *Diplectanum magnodiscatum* Fuentes Zambrano, 1997) from *Eugerres plumieri* (Cuvier, 1830); *Neodiplectanum gatunense* (Mendoza Franco,Roche & Torchin, 2008) n. comb. (syn. *D. gatunense* Mendoza Franco, Roche & Torchin, 2008) from *Eugerres brasilianus* (Cuvier, 1830); *N. mexicanum* (Mendoza Franco, Roche & Torchin, 2008) n. comb. (syn. *D. mexicanum* Mendoza Franco, Roche & Torchin, 2008) from *Diapterus rhombeus* (Cuvier, 1829); new genus n. sp. A [type species] from *Eucinostomus argenteus* Baird & Girard, 1855; new genus n. sp. B from *Eucinostomus melanopterus* (Bleecker, 1863) [Type-host] from Africa, and *E. argenteus* from Brazil;and new genus n. sp. C from *G. cireneus*. *Neodiplectanum* Mizelle & Blatz, 1941, is emended by diplectanids with male copulatory organ and accessory piece non-articulated, heavily sclerotised vaginal atrium, ventral anchors with deep root twice as long as superficial root, dorsal anchors with conspicuous superficial and deep roots and squamodiscs with spinelike rodlets in the posterior rows. new genus is proposed for species with male copulatory organ articulated to the accessory piece, vaginal opening marginal or submarginal, non-sclerotised vagina atrium, and egg ovate with short filament.

ECOLOGICAL IMPACT OF INVASIVE PONTO-CASPIAN FISH AND AMPHIPOD SPECIES ON THE DISTRIBUTION OF ACANTHOCEPHALA IN THE RIVER RHINE (GERMANY)

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Climate change in combination with habitat fragmentation, canalization, pollution, biodiversity loss and the distribution of parasites and pathogens due to global movement of organisms will enhance the danger of disease outbreaks. Alien or non-indigenous species that become invasive are one of the main drivers of biodiversity loss worldwide. In various freshwater systems in Europe, populations of e.g. native amphipods and fish species are progressively displaced by introduced species that can show explosive range extension. The amphipods *Corophium curvispinum*, *Dikerogammarus villosus* and *Echinogammarus*

trichiatus and the gobiid fish species *Neogobius fluviatilis*, *N. kessleri*, *N. melanostumus* and *Proterorhinus semilunaris* (*marmoratus*) are typical invader in Central Europe including Germany. All these invasive species originate from the Ponto-Caspian basin and spread very quickly to Europe countries via the so called "central and southern corridor". In the present study the metazoan parasite fauna and feeding ecology of the invasive round goby *N. melanostomus* from the Rhine River near Duesseldorf in North Rhine-Westfalia, Germany was investigated. In addition 10.032 specimens of amphipods including four invasive species, which represent the main prey of the gobies in this area, were also analyzed. We detected that the amphipod *D. villosus* and the goby *N. melanostomus* play a decisive role in the life cycle of parasites, especially of the non-native acanthocephalan *Pomphorhynchus tereticollis*.

INFRACOMUNITIES OF METAZOAN PARASITES AS A TOOL FOR STOCK IDENTIFICATION OF *MYCTEROPERCA BONACI* (POEY, 1960) (EPINEPHELIDAE) OFF THE COAST OF YUCATÁN MÉXICO.

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The black grouper *Mycteroperca bonaci* is one of the most important species for commercial fisheries exploited as a single stock in the Yucatán Peninsula, México. During 2010 and 2011, 60 individuals of *M. bonaci* were collected from two marine areas: the Alacranes Reef National Park and the Ría Celestún biosphere reserve. Before examination for parasites, each specimen was weighed (g) and measured (mm) and two age groups were estimated from total length data (Crabtree and Bullock 1998). Prevalence and mean abundance values were calculated for each parasite species at each locality following Bush et al. (1997). Communities were described at component (richness, mean abundance, Shannon-Wiener diversity and evenness Index and dominance of Berger-Parker) and infracommunity levels (richness, abundance, diversity and evenness of Brillouin). Comparisons between index values at the infracommunity level were compared by a PERMANOVA, later assessing the influence of length-age including length as (ANCOVA) covariate. The same procedure was followed using a multivariate method to compare the structure and composition of the infracomunities using Bray-Curtis similarity and Jaccard similarity indices. Differences between samples were analyzed with a canonical discriminant analysis of principal coordinates which identified six parasite taxa as responsible for these differences. Results showed that *Dollfustrema* sp. metacercariae best meet the criteria to be considered as a marker (MacKenzie and Abaunza, 2005), since significant differences in infection levels were observed between localities and the metacercariae have a long life span in this host.

DIGENEAN SPECIES DIVERSITY IN LABRID AND SPARID FISH FROM TUNISIAN COASTS

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A total of 43 species of trematodes belonging to 12 distinct families (Accacoeliidae Cryptogonimidae, Derogenidae, Faustulidae, Fellodistomidae, Gyliauchenidae, Hemiuridae, Lepocreadiidae, Mesometridae, Monorchiidae, Opecoelidae and Zoogonidae) are reported for the first time in 1352 labrid and sparid fish from the Tunisian coasts (Bay of Bizerte and gulf of Tunis). The digenean species diversity fauna of these fish, more important than that of the Lebanese coasts, is very comparable with that of the Scandola Nature Reserve of Corsica. Among harvested parasites, *Magnibursatus bartolii* in *Oblada melanura* is reported for the first time in the Mediterranean. We also document the presence of parasites species in new hosts in fish from the Tunisian coasts. Generally, measures of prevalence, abundance and mean intensity are lower in fish from the Tunisian coasts compared with those from Scandola Nature Reserve of Corsica.

DIGENEANS PARASITIZING INTERTIDAL SNAILS THAT USE FISH AS FINAL HOSTS ON PATAGONIAN COASTS, ARGENTINA

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The goal of this work is to determinate the species of larval digeneans parasitizing the more abundant intertidal snails that use fish as final host on Patagonian coasts, Argentina. Seasonally, we collected 100 individuals of each species of gastropod from July 2008 to August 2010 at 3 sites: Playa Fracasso (42.42ºS, 64ºW) in San José Gulf, Puerto Madryn (42.77°S, 65ºW) in Nuevo Gulf and Puerto Deseado (47.77ºS, 66ºW). The snails were transported to the laboratory, placed in small flasks to get cercarial emission and dissected. Larval stages were identified. Species richness, proportion of digenenean of fish and birds and prevalence for the three sites were calculated. Four from 11 species of parasites found correspond to fish parasites. Only one species was present in the 3 sites: sporocysts and cercariae of Hemiuridae family in the pulmonated snail *Siphonaria lessoni*. Sporocysts with cercariae and metarcercariae of *Diphterostomum* sp. (Zoogonidae) were found in Playa Fracasso and Puerto Madryn in *Buccinanops globulosus*. Two species of Lepocreadidae, with rediae and cercariae were registered in Puerto Deseado in the gastropod *Crepidula dilatata* and *Pareuthria plumbea*. The proportion of parasites that finish the life cycle on fish is lower (~30%) regarding to those that finish the life cycle in birds for the 3 sites. Fish species also show lower overall prevelences (6.38%) in comparison with birds species (93.62%). The low prevalences and species richness of fish parasites could be explained because the gastropods are from the intertidal, and in those environments, the life cycles are promoted mainly by sea birds. However, the larvae of fish digeneans in the gastropods are indicating the presence of coastal fish feeding in the intertidal zones.

USE OF DEGREE-DAY MODEL TO ESTIMATE THE DEVELOPMENT TIME OF *CALIGUS ROGERCRESSEYI* SEA LOUSE AND HISTORY OF ITS CONTROL STRATEGY IN CHILEAN SALMON AQUACULTURE

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The ectoparasite copepod *Caligus rogercresseyi* causes economically significant impacts on the salmon aquaculture industry in Chile. This study assessed the development time of life cycle stages at different temperatures *in vivo* and the survival of planktonic larvae *in vitro*. These results, useful to determine the life cycle span of the parasite on each farm lease, enabled the development of husbandry strategies to avoid the reproduction and dissemination of the parasite. The generation time of a *C. rogercresseyi* population was assessed in experimental infections of rainbow trout, during each season of the year with natural temperature and photoperiod. Its development rate, directly proportional to water temperature, was estimated using the Degree-Day Model that allowed determining the lower temperature limit and the incubation time in a temperature-independent unit. The results of the experiment showed that the time required to reach chalimus 4 from copepodid settlement was 94 (88-100) degree-days and to females with mature eggs, 192 (176-211) degree-days. The culture of the planktonic larvae showed that the relationship of their development rate is logarithmic to water temperature. The settled copepodid occurred 11 days after egg hatching at 10°C and 7 days at 14°C. The *in vitro* survival of larvae was 14 days at 10.8°C and 29-31 gL^{-1} seawater. Based on the results of this study a systematic survey of water temperature and population of C. *rogercresseyi* in farms was proposed a basis for management programs to control parasitosis, particularly the coordination of treatments and fallowing periods between farms in areas with mutual oceanographic influences. In response to the parasitic problem in farms and developed knowledge on *C. rogercresseyi* Monitoring Programs and Control strategies were implemented in most farms in 1999 and in all farms in 2008. Nevertheless, at present these strategies remain ineffective in reducing the parasite impact on salmon aquaculture. The absence of a treatment or a suitable management strategy to completely eradicate the copepod in the particular oceanographic system of the inner sea in the South of Chile signal the fallowing period and reduction in farms densities as an essential component of control strategies in Chile.

CLINOSTOMUM COMPLANATUM IN BIRDS, A POTENTIAL PATHOGEN FOR FISHES, IRAN

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The life cycle of the digenetic trematode *Clinostomum complanatum* has been studied at the level of first and second intermediate hosts in Iran previously, but this is the first study for identification of the definitive hosts of this trematode in Iran. The metacercaria of this digenean have been reported in several fish species of Iran (e.g. *Capoeta* sp., *Alburnoides* sp., *Cobitis* sp.). In this study seventeen species of piscivorous birds including *Anas crecca, Ardea purpurea*, *Bobulcus ibis, Botaurus stellaris*, *Egretta alba*, *E. garzetta*, *Gavia arctica*, *Ixobrychus minutus, Larus fuscus*, *L. genei*, *L. cachinnans*, *L. marinus*, *L. ribibundus*, *Nycticorax nycticorax*, *Phalacrocorax carbo sinensis*, *Podiceps cristatus and Porzana parva* (n=123) were studied. Adult worms were found in four species of the birds including *Ardea purpurea*, *Egretta alba*, *E. garzetta, Nycticorax nycticorax*. The intensity of 1218 worms in a bird is reported for the first time in night heron (*Nycticorax nycticorax*).The pathology of the worms was studied, and it shows a direct relationship between the intensity and the severity of the injuries in infected birds. It is concluded that piscivorous birds are definitive hosts for this trematode in north of Iran. Given the infection of several native fish with larval stage of this parasite and the popularity of these fishes for human consumption, investigating the aspects related to human health of this parasite is among potential future studies.

NO HATCHERY EFFECT ON DISEASE RESISTANCE IN *ONCORHYNCHUS MYKISS*

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Supplementing wild salmonid populations with hatchery-reared fish for commercial and recreational purposes is common practice in the Pacific Northwest of North America. Salmonids of hatchery origin are now the dominant type of fish in many watersheds and the interactions between hatchery and wild fish and their comparative fitness have been questioned. Life history theory posits that there are tradeoffs between different traits: growth, reproduction and maintenance (which include disease resistance). There is speculation that hatchery conditions tend to select for fast growth rates, which may detract from other functions such as disease resistance. Most salmonids in Oregon hatchery programs have a long history of domestication, but some 20% of hatcheries use wild fish as brood stock. To determine if susceptibility differed between first generation (wild x wild parent crosses) and second generation (hatchery x hatchery parents) hatchery steelhead, we conducted exposure challenges with two pathogens relevant to regional salmonids, a myxozoan parasite, *Ceratomyxa shasta* and a bacterium, *Vibrio anguillarum.* We also

investigated whether the induction of triploidy in rainbow trout may affect disease resistance. The procedure renders fish sexually sterile, minimizing their genetic interactions with wild stocks; it also reallocates energy from reproduction to growth. To determine if susceptibility differed between triploid fish and their diploid progenitor stocks, we conducted exposure challenges with *Ceratomyxa shasta* and the bacterium *Aeromonas salmonicida*. Statistical analyses using Cox Proportional Hazards Regression, which takes into account time to death and total mortality, indicated that there was no significant difference in susceptibility between wild and hatchery steelhead or between triploid and diploid rainbow trout.

LINKING DENSITY OF WATERBORNE *CERATOMYXA SHASTA* WITH SALMON MORTALITY

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The myxozoan parasite *Ceratomyxa shasta* causes losses among both wild and hatchery-reared juvenile salmonids in the Pacific Northwest of North America. It is a significant pathogen in the Klamath River (Oregon/California, USA) where it has been identified as a key factor limiting salmon recovery. Long term monitoring studies in that system, involving sentinel fish exposures, polychaete sampling and water analysis, have increased our understanding of the temporal and spatial distribution of the parasite and moved us closer to reaching management goals of reducing mortality to below 40% in native stocks. Water sampling in particular, has proven to be a simple, high-resolution tool to determine and map total parasite density (number of spores per liter of river water). We are now comparing water sampling and fish exposure data to assess how parasite density relates to population effects in Chinook salmon, *Oncorhynchus tshawytscha*, and coho salmon, *O. kisutch*, and identify threshold dose levels. Both salmon species were exposed in cages at four lower Klamath River index sites in April, May, June, September and October from 2006 through 2010 (both species were not exposed at every time point). In parallel, we collected triplicate 1L water samples on the first and final days of the three-day exposures. Fish were held at the Salmon Disease Laboratory (OSU) for up to 90 days and mortality due to *C. shasta* and mean day to death recorded. Water samples were filtered, the captured DNA extracted and *C. shasta* quantified by a TaqMan qPCR. The ITS1 region of positive samples was sequenced to determine the relative abundance of the four main genotypes of *C. shasta*, which differ in their pathogenicity for salmonids. We are now correlating the two data sets to discover patterns of fish mortality, parasite density, parasite genotype, water temperature and flow.

HIGH PREVALENCE AND INTENSITY OF *KUDO*A SP. (MYXOSPOREA) FROM THE PERICARDIAL CHAMBER OF APOGONID FISHES FROM THE GREAT BARRIER REEF, AUSTRALIA

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Species of the myxosporean genus *Kudoa* are microscopic, spore-forming parasites that infect a wide range of fishes. They are mainly histozoic, often forming intracellular cysts in the skeletal muscle of their hosts and can impact on palatability and marketability of fish. A species of *Kudoa* was identified within the pericardial chambers of two apogonid species, *Zoramia leptacantha* and *Archamia zosterophora*, from waters off Lizard Island on Australia's Great Barrier Reef. The infection was found at remarkably high prevalences (73% - 79%, Total n = 271) within the two host species and shows a close taxonomic affinity, both morphologically and genetically, with *Kudoa shiomitsui* from *Takifugu rubripes*, *Thunnus orientalis* and *Paralichthys olivaceus* from Japan. Different sporogonic stages (developing and fully-developed) were observed in pseudocysts within the pericardium of the hosts. The Apogonidae is one of the most species-rich teleost families on the Great Barrier Reef and one of the few fish families that provides extended parental care to their young. Both of these apogonid species form large aggregations, are site attached and are habitat specialists on live (rarely dead) *Porites cylindrica* coral. Several elements were explored to investigate the host/parasite relationship of this species of *Kudoa*: a) whether the prevalence of *Kudoa* infections in these two species of apogonid varied seasonally; b) whether infection occurs when fish are young and then persists; c) whether the fitness of infected fish is compromised by the presence of the parasite; and d) what mechanisms explain high prevalence and whether they are a linked through a local origin (self-recruitment) of these apogonids.

METAZOAN PARASITE COMMUNITIES OF ROCK COD, *ELEGINOPS MACLOVINUS*, AND THEIR USE AS BIOLOGICAL TAGS AT LOCAL AND REGIONAL SCALE.

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The composition of metazoan parasites of *Eleginops maclovinus* from 3 close localities, but with different environmental characteristics, in southern Chile, were firstly compared between them, and secondly compared with published data of parasite communities of *E. maclovinus* from the Falkland Islands to assess the local and regional spatial variations of the parasites at component community (CC) level. A total of 13108 parasites belonging to 34 taxa were collected from 268 fish. 97.4% of the fish were infested with at least 1 parasite . The most prevalent species were: *Hypoechinorhynchus magellanicus, Caligus rogercresseyi, Lepeophtheirus mugiloides, Clavella adunca* and *Similascarophis* sp. Five

species are new records: *Argulus araucanus*, Hirudinea gen. sp1., Hirudinea gen. sp2., *Benedenia* sp. and Camallanidae gen. sp. A Linear discriminant analysis showed that parasites of *E.maclovinus* qualitatively and quantitatively varied among close localities, with 89.7 % of fish being correctly assigned to its respective locality. These results suggest that parasites could be a good tool to discriminate individual fish from close localities. There was a weak relationship between parasite abundances and fish size, and there were no accumulations of parasites in the host over time, which could be associated to ontogenetic changes of diet associated to different use of habitat. The multivariate analyses showed an important separation between the fish from the Atlantic and Southeastern Pacific coast ($p<0.05$). This last result suggest that the parasites of *E. maclovinus* present different distributional patterns between Southern Pacific Ocean and Falkland Island, and probably the fish from these two geographical areas are not mixed populations, and might correspond to different stocks.

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EUDIPLOZOON NIPPONICUM: HOST-PARASITE INTERACTIONS IN BLOOD-FEEDING DIPLOZOIDS

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Eudiplozoon nipponicum (Monogenea) is a blood-feeding parasite from the gills of carp, which due to its unique biological properties, represents an ideal model for studies on diverse biological interactions. Parasite's developmental stages (oncomiracidium, diporpa, juvenile, adult) were investigated using combined microscopic approach to identify explicit adaptations to the ectoparasitic life. Diplozoids have evolved a complex mechanism dedicated to attachment to the host and localization on host body that is advantageous for feeding and reproduction. The main attachment system comprises prominent buccal suckers at the ventral site of the parasite's forebody along with the two well-developed muscular haptors, each with four pairs of clamps in two rows and two central hooks, located on the hindbody. Complicated structure of parasite's tegument, including folds and lobular extensions in the middle part of hindbody, supports its firm fixation to the host gills by locking to the gill lamellae. The complex digestive tract is well-equipped for the hematophagous feeding and consists of a mouth opening, eversible pharynx with adjacent glandular structures and a blind-ending gut with caecal lining. The buccal suckers seem to assist in the parasite's translocation while searching for an optimal niche and we speculate about their temporary attachment function during feeding as well. They appear to be located in a buccal capsule and probably evert when needed (e.g. while feeding). Structures of unknown function, so called the glandulo-muscular organs, which are located apically and opened into the mouth corner, are considered to be a part of digestive tract. These structures seem to be specific for this species. The possibility of extracorporeal digestion of this parasite is discussed.

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MONOGENEAN PARASITES REVEAL ONGOING LONG-DISTANCE MIGRATION OF THEIR THREE-SPINED STICKLEBACK HOST.

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Sticklebacks (Teleostei) have been used as model organism to study speciation and adaptive radiation processes but its phylogeographic history is still not fully understood, partially due to the lack of variable molecular markers. Here we want to use Monogenean flatworm parasites to reconstruct the complex colonization history of sticklebacks. We sequenced the complete ITS rDNA region and a partial cox2 mitochondrial DNA fragment of 165 parasites collected in British Columbia (BC), Alaska, Japan and Iceland (both resident and anadromous sticklebacks). The genetic variation found in the mtDNA of the parasites was 7 times higher than that found in the stickleback host, confirming our ¿magnifying glass? hypothesis. The genetic variation and differentiation among *Gyrodactylus alexanderi* from a single host in Alaskan freshwater lakes was higher than the genetic differentiation between specimens from Alaska and Japan. The phylogeographic reconstruction reveals a secondary admixture between two vicariant *Gyrodactylus* populations in Alaska and BC, suggesting recent and repeated marine colonization events of three-spined stickleback populations.

HOW TO GET PARASITES FROM MORAY EELS?

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Moray eels (family Muraenidae) are hard to catch. Most species will not bite baited lines and will escape nets because of their elongate morphology; to spear them underwater can be extremely time consuming or unsuccessful, because moray eels are shy and hide in crevices in coral. There are many species of moray eels associated with coral reefs and most are small, making their capture even more difficult. However, natural predators of moray eels are easy to catch and kindly yield their prey, including their preys's parasites in a good state of preservation. With some practice, this can even been done without killing the predator, which can be returned unscathed back into sea to chase more eels. A simplified method has been designed to collect parasites in places without laboratory facilities. We will show images and movies of our collection methods, including manipulation of the predator, taken on a deserted islet off Noumea, New Caledonia, South Pacific. Parasites of moray eels are scarcely known, and a survey of the literature revealed only a small number of papers, with parasites occasionally described from a single fish examined. However, several species of moray eel (*Gymnothorax* spp.) from coral reefs

which we examined harbour a rich fauna of parasites, including digeneans, nematodes and copepods. We expect that our collection will significantly enhance the knowledge of moray eel parasites and thus contribute to the general understanding of coral reef fish parasites.

HOW MANY PARASITES ARE THERE ON CORAL REEF FISH?

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The coral reefs of warm seas are the marine equivalents of tropical rain forests in term of biodiversity. However, only the most obvious components of biodiversity, the vertebrates (fish in reefs, mammals and birds in forests) are usually considered. But as parasitologists, we know that each vertebrate species harbours parasites, at least one species, often dozens. A major problem in evaluating biodiversity is of course to recognize how many species are present. For parasites, which are small and require complex methods of preparation and observation, the ¿taxonomic impediment? and the limitation of scientist-hours strike even harder than for hosts. We evaluated the number of parasites in several families of fish caught in the coral lagoon off New Caledonia, South Pacific. Fish sampled in an 8-year program included, among others, groupers (Serranidae), emperors (Lethrinidae), snappers (Lutjanidae) and breams (Nemipteridae). Parasites included helminths (digeneans, monogeneans, cestodes, nematodes) and crustaceans (isopods and copepods). More than 500 host-parasite combinations were encountered, including more than 250 parasites identified at the species level. One relatively small species of nemipterid displayed an encyclopedic array of parasites, with 25 parasite species belonging to all groups. Large groupers or emperors displayed 25-35 parasite species. An additional problem for evaluating parasite biodiversity is the non-specific parasites, which might artificially increase the apparent number of species per fish. Minimalist calculations finally suggest a mean number of 10 parasite species and 30 host-parasite combinations per fish. Consequently, parasite biodiversity exceeds the visible diversity of hosts by one degree of magnitude: coral reefs with 2,000 species of fish might harbour 20,000 species of parasites.

STUDIES ON A PARASITIC COPEPOD INFESTING EDIBLE SEER FISH POPULATION (*SCOMBEROMORUS GUTTATUS*) OF MALABAR (KERALA, INDIA)

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Scomberomorus guttatus is of great demand globally and is largely available along the Malabar coast (Kerala, India). The present study reveals that this fish variety is heavily infested by the parasitic copepod *Pseudocycnus armatus*. A total of 337 fish samples were surveyed during the period from January 2010-January 2011; 328 of them were found to be infested with the parasitic copepod, signifying the existence of heavy parasitisation. The number of copepods recovered from a single fish sample was found to range between 3 and 52. No seasonal fluctuation in the rate of infestation could be observed; our survey reveals a uniform degree of infestation of this parasite throughout the year. Significantly, all the

3479 specimens of parasitic copepods (*P. armatus*) collected round the year from the fish population (*S. guttatus*) were females bearing a pair of egg sacs, each containing 180-200 eggs. In order to assess the host specificity, if any, fish samples belonging to 22 families, collected from the Malabar coast were subjected to thorough observation throughout the year. Interestingly, *P. armatus* could not be recovered from any of the fishes other than *S. guttatus*, suggesting that the parasite is highly host-specific.

Mortality of coho salmon (*Oncorhynchus kisutch*) associated with multiple parasite species

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We evaluated the impact of multiple parasite species on the mortality of threatened juvenile coho salmon (*Oncorhynchus kisutch*) from the West Fork Smith River, Oregon, using multiple analytical techniques. We found heavy parasite infections of *Myxobolus insidiosus* (Myxozoa) and metacercariae of *Nanophyetus salmincola* and *Apophallus* sp. in parr (underyearlings) from the lower mainstem of this river collected in 2007 and 2008. Smolts (yearlings) collected in 2006-2009 always harbored many fewer *Apophallus* sp. and our analyses showed that host mortality was a function of burden by this parasite. Mean intensity of *Apophallus* sp. in lower mainstem parr was 753/fish in 2007 and 856/fish in 2008, while parr from the tributaries had only 37 or 13 parasites/fish, respectively. Smolt infections ranged between 47-191 parasites/fish. Overdispersion (variance to mean ratios) of *Apophallus* sp. was always lowest in smolts. Retrospective analysis based on smolt data using the Crofton binomial truncation technique and our new parsimonious mathematical representation of macroparasite distribution showed similar results. The estimated threshold level for mortality involving *Apophallus* sp. was about 200 or 500 parasites/fish, depending on the analytical method employed. We documented the actual existence of these heavy infections prior to the predicted mortality as most of the lower mainstem parr (60-95%) had infections above this level. Our study indicates that heavy infections of *Apophallus* sp. metacercariae may be an important contributing factor to the high overwintering mortality previously reported for these fish rearing in this section of the river. Analyses using the same methods for *M. insidiosus* and *N. salmincola* generally showed minimal parasite associated mortality.

CHARACTERISTIC OF PARASITIC LEECH, *LIMNOTRACHELOBDELLA SINENSIS* AND HOST REACTION IN CRUCIAN CARP, *CARASSIUS AURATUS*

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In March to May 2010, mass mortality in a population of crucian carp, *Carassius auratus* occurred in Miho and Byeongcheon river, Korea. Many leeches were isolated on the surface of operculum in the sampled fish. The morphology of leech and host reaction by leech were studied by means of light and electron microscopy. On the inner side of each operculum of *C. auratus* (n=10), the leeches, *Limnotrachelobdella sinensis* of 1-4 individuals were parasitic. The leeches had approximately 41.0 mm in total length and 11 mm in width. This body was composed with anterior sucker, neck, trunk and posterior sucker and respectively average length they were 2.3 mm, 7.2 mm, 23.3 mm and 8.7 mm. To both sides of the trunk lateral vesicle of 11 pair existed. When observed by SEM, anterior sucker was hemisphere shape and the mouth where proboscis comes out existed with the its center. Proboscis was connected the esophagus directly. Under light microscopy, bloodsucking gill of *C. auratus* observed lamella fusion, hyperplasia the epithelial cell of the filament and lamella, increased mucocytes and blood congestion. On the other hand, necrotic and edema epithelial cell of the lamella, and appearance of the macrophages from some individuals were thought the secondary infection with the bacteria or virus after bloodsucking activity of the leech.

EARLY DEVELOPMENT OF *ICHTHYOPHONUS* IN TWO FISH HOSTS; FROM CIRCULATING BLOOD STAGE TO FULLY MATURE TISSUE SCHIZONTS

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A circulating blood stage of *Ichthyophonus* was identified, along with the growth and development of the tissue schizont in two fish hosts experimentally exposed to infected fish tissues. Sculpins (*Leptocottus armatus*) were infected with a single feeding of *Ichthyophonus*-positive tissues derived from herring, then sampled for 32d. Blood cultures were positive as early as 6h post-exposure (pe) and peaked between 48 and 96h. From 7 to 32d pe only 2 fish exhibited positive blood cultures, suggesting a waning of the blood stage after 6d. Explant cultures of heart and spleen were also positive by 6 hours pe and all tissues were positive by 48h. *Ichthyophonus* was first observed in histological sections 25d pe, while no parasites were detected in blood films. The maturation of tissue schizonts was studied in trout (*Oncorhynchus mykiss*) exposed by gavage to a high (5,600) and low (2,300) dose of mature schizonts obtained from infected trout. At both doses more infected fish were detected at 60d than at 30d. Explant cultures identified more infected fish than

histology at both high and low dose exposures at 30d, while both methods performed equally well at 60d. The density of schizonts in each organ was higher at 60d than at 30d. Conclusions:1.- A circulating blood stage of *Ichthyophonus* is confirmed; its morphologic form is unknown. 2.- The blood stage is ephemeral, detectable for about 6-8d post exposure. 3.- *Ichthyophonus* can be isolated in culture by 6h post exposure, but cannot be visualized histologically until the 4th week pe. 4.- Infection prevalence and schizont density increases between 30 and 60d post exposure.

GEOGRAPHICAL DISTRIBUTION AND HOST SPECIFICITY OF THE ASIAN FISH TAPEWORM *BOTHRIOCEPHALUS ACHEILOGNATHI* YAMAGUTI, 1934

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The Asian fish tapeworm, *Bothriocephalus acheilognathi* (Bothriocephalidea), is a parasite of freshwater fish and have been reported as a cause of mortality of cultured and feral fish, especially carp fry. This tapeworm has been reported under numerous names (20 species names within 5 genera), but it seems that only one species, *B. acheilognathi*, which is typified by an arrow-shaped scolex with narrow deep bothria, occurs in cypriniform fish. The original definitive
hosts of this tapeworm are cyprinids from eastern Asia. Since the 1950's, this cestode has colonized throughout the world due to uncontrolled movement of carps (common and grass), guppies and other fish from Asia to other continents, including isolated oceanic islands and subterranean sinkholes (cenotes) in tropical Mexico. The species is unique among all fish tapeworms in its extraordinary wide geographical distribution, but also in an extremely wide host spectrum that currently includes 235 species of freshwater fish of 37 unrelated families and 15 orders. Two thirds (69%) of all published records (a total of 616 publications) refer to findings of the parasite in cyprinid fish. With regard to the extent and speed of recent expansion to new regions, this cestode occupies the most prominent position among all metazoan parasites. It has been shown that transmission of adult parasites can occur from fish to fish via predation, the predators serving as as postcyclic hosts. Spread on a local scale is assumed to have been facilitated by piscivorous birds, such as *Chlidonias niger*. The Asian fish tapeworm was also reported from an amphibian (axolotl ? *Ambystoma dumerilii*), reptiles (snake ? *Thamnophis melanogaster*, turtle ? *Pelodiscus sinensis*) and a bird (*Ixobrychus minutus*), but these hosts probably represent accidental hosts (incidental infections).

ZOOGEOGRAPHY OF ZOONOTIC *ANISAKIS* SPP. (ANISAKIDAE, NEMATODA) IN DIFFERENT CLIMATE ZONES

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Approximately 20.000 cases of human anisakidosis infections are reported every year from a wide range of coastal regions, primarily along Japan and Europe. This zoonosis, named after its causatives Anisakidae, a group of marine nematodes also known as seal-, cod- or herring worms, is the result of the ingestion of infectious larvae (L3) in raw or undercooked marine fish products. Several studies have provided indications that only few *Anisakis* species can cause clinical symptoms in humans, but it has become apparent that *Anisakis simplex* (s.l.) is the most important exciter. Hence, the identification of species and the knowledge about their distribution is of primary importance for understanding parasite epidemiology, especially for species of medical, veterinary and commercial importance. In a comprehensive study we used for the first time molecular sequence data of 373 specimens from 32 different elasmobranch and bony fish hosts and 22 sampling areas and combined them with previously published spatial data to model the species range of *Anisakis* spp. using a modification of the alpha-convex-hull interpolation algorithm. The distribution patterns can be restricted to certain areas within climate zones and oceans and are influenced by the species ranges and feeding behavior of their respective intermediate and mammalian final hosts.

ENDOPARASITES OF TWO INVASIVE FISH SPECIES, *CICHLA PIQUITI* (CICHLIDAE) AND *PLAGIOSCION SQUAMOSISSIMUS* (SCIAENIDAE), IN NATIVE AND INVADED BRAZILIAN BASINS: TESTING THE ENEMY RELEASE HYPOTHESIS

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Biological invasions are considered a major threat to biodiversity around the world, but the role of parasites in this process is still little investigated. Here we tested the enemy release hypothesis (ERH), which explains part of the success of the invasive species by the loss of their native enemies (parasites and predators), using the endoparasites of the fishes *Cichla piquiti* and *Plagioscion squamosissimus* (Sciaenidae) in three Brazilian rivers: Solimoes (SO), Tocantins (TO) and Paraná (PR). First, the parasites and their influence on the condition of the hosts in the native environment, the TO and also the SO for *P. squamosissimus*, were compared to an environment where the fish was introduced, the PR. Then, comparisons of the abundances of diplostomids and larval nematodes were made between the introduced fish and two predators native to the PR, *Hoplias malabaricus* and *Raphiodon vulpinus*. The use of GLMs showed that the condition of fish is negatively correlated with parasite abundance only in the native range (TO). For both introduced species, in the PR, abundance of *Contracaecum* sp. did not differ between natives and invaders; however, eye flukes were more abundant in the native fish *H. malabaricus*, which

may represent an advantage to the invaders. Although *P. squamosissimus* may have lost most of its native parasites as predicted by the ERH, it is now acting as a host for native generalist parasites. The results do not support the idea that the escape from parasites favoured the establishment of *C. piquiti* nor *P. squamosissimus* in the PR. Instead, the escape from the parasite's effects seems a better explanation, and further studies examining effects on host physiology and/or fitness in the native and introduced ranges are needed.

FREQUENCY DISTRIBUTIONS REVISITED

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Large data sets on parasite abundance gathered to discriminate fish stocks, also valuable for understanding community structure, may give some clues about the biology of individual parasite species, particularly those about which we know very little. Parasite frequency distributions are almost invariably overdispersed. Intuition tells us this is a result of a combination of factors of random or aggregated events and susceptibilities, many of which have been clearly implicated in theoretical studies of parasite population dynamics. Here the level of overdispersion in data on parasites from four species of fish is evaluated. The results suggest that the overriding factor contributing to their overdispersion is related to the number of hosts in the life cycle. It is particularly well shown by juveniles of *Anisakis* 1 from different fish species. Apparent exceptions, such as data on the cestode *Otobothrium cysticum* and on the monogenean *Pricea multae*, bring into focus aspects of their biology not otherwise evident.

OCCURRENCE AND DISTRIBUTION OF ANISAKID NEMATODES IN CAPELIN (*MALLOTUS VILLOSUS*) FROM THE BARENTS SEA: PRODUCT QUALITY AND FOOD SAFETY CONSIDERATIONS

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Capelin (*Mallotus villosus*) is among the most abundant fish species in the Barents Sea, and represents a critical food source for many predators in the area incl Atlantic cod. In Norway, the fish is of great economic value since considerable volumes of whole capelin and roe are regularly exported mainly to Eastern Europe and Japan. Despite its economic and ecological importance, the parasites of Barents Sea capelin are only poorly known. However, the presence of parasites in the edible parts may adversely affect both product quality and consumer safety. During February of 2009 and 2010, we investigated the occurrence and spatial distribution of anisakid nematodes in capelin (n=127 and n=193,

respectively; mean body weight ± SD: 26 ± 10 g) from the southern Barents Sea. The visceral organs and the flesh were examined by the pressing-method followed by inspection under 366 nm UV-light. Additionally, various freshly caught capelins were examined under a dissecting microscope for more accurate determination of the actual nematodes' infection site. Nematode species identification has been carried out by sequence analysis of the mitochondrial *cox2* gene (mtDNA *cox2*), Three anisakid species were identified: the 3rd-stage larvae of *Anisakis simplex sensu stricto, Contracaecum osculatum* B, and both 3rd- and 4th-stage larvae of *Hysterothylacium aduncum*, with *C. osculatum* B as the most abundant and prevalent species. While all 3 species occurred on the organs and mesenteries of the body cavity including the gonads, only *A. simplex s.s.* and *C. osculatum* B were found in the flesh. For example, the prevalence of *C. osculatum* B in the flesh ranged from 17 – 28 %, while the mean intensity was 1.4 (range 1 – 8) in both sampling years. The larvae were situated in the belly flaps, in close proximity to the peritoneum. This contrasts the findings of most other studies of *C. osculatum* B in fish. Although at least some larvae may have migrated into the belly flaps *post mortem*, possibly facilitated by the small size of the fish and hence a short migratory distance, our findings show that *C. osculatum* B may occur in the flesh of fish intended for human consumption, thus underlining its zoonotic potential.

MOLECULAR PROSPECTING OF THE GENUS *MARGOTREMA* SPP. (DIGENEA: ALLOCREADIIDAE), PARASITES OF THE SUBFAMILY GOODEINAE FRESHWATER FISHES (CYPRINODONTIFORMES: GOODEIDAE) ENDEMIC TO CENTRAL MEXICO

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Margotrema is a genus of specialist parasitic digeneans of freshwater fishes of the subfamily Goodeinae (Cyprindodontiforms: Goodeidae), distributed in river basins of central Mexico. *Margotrema* currently includes two species, *M. bravoae* and *M. guillerminae*. These species are morphologically differentiated by the extension of the intestinal ceca with respect to body length, the distribution of the vitellaria and the seminal receptacle shape; however, these characters show high polymorphism and therefore the delimitation of these two species is difficult using only this type of data. The genetic distances of 62 individuals distributed in 10 populations from 6 hydrological systems in central Mexico was calculated from sequences of the cytochrome oxidase I (COI). A total of 899 base pairs were obtained. The genetic distance among the populations ranged from 3 to 9 %. The phylogenetic tree of the populations of *Margotrema* was reconstructed by Bayesian Inference (using three outgroups). Based on the findings of this study, we suggest that *Margotrema* includes four independently evolving lineages. One lineage is associated with *Xenotaenia resolanae* (Goodeinae: Illiodontinii), endemic to hydrological systems from Western Mexico, other lineage is found in three goodein host species of the tribe Ilyodontini distributed in two hydrological systems; other lineage in *Characodon audax* (Goodeinae: Characodontini), endemic of hydrological systems from Northern Mexico, and the last lineage is found in four fish species of the genus *Allotoca* (Goodeinae: Girardinichthyini), distributed in four water bodies in central Mexico. The diversification of

these lineages seems to be the result of allopatric processes caused by several microvicariant events closely tied to the evolutionary history of their hosts.

PRELIMINARY FINDINGS ON AFRICAN SPECIES COMPLEX *PROCAMALLANUS* (*PROCAMALLANUS*) *LAEVICONCHUS* (WEDL, 1862)

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During parasitological research in north Kenya (at three localities at Lake Turkana) carried out in 2008 and 2009 were revealed, among other species, nematodes referable to *Procamallanus* (*Procamallanus*) *laeviconchus* (Wedl, 1862) from family Camallanidae. These nematodes have wide host spectrum and geographical distribution in Africa. Specimens were recovered mainly from stomachs of catfishes from families Mochokidae, Clariidae and partially also in Bagridae (Siluriformes) and in fish from family Citharinidae (Characiformes). For morphologic study of important differentiation features of nematode males and females, scanning electron microscopy (SEM) and light microscopy (LM) was used. *Procamallanus laeviconchus* is characterized mainly by the presence of almost rounded mouth opening, provided with peribuccal flange forming 6 bifid lobes. Deirids are very small and simple. Important morphological differences between specimens from different hosts were found in our material. Such features are: the presence/absence of the peribuccal flange, form of deirids, elevationof vulval lips, arrangement, form and number of small projections on female tails, and the definitive hosts. The found morphological features, poorly recognizable by LM, suggest that *P. laeviconchus* is a species complex, including at least three species as stated by Campana-Rouget already in 1961. This is now confirmed by the results obtained by the electron microscopy, and currently it is a part of continuous research using light microscopy, SEM and DNA analyses.

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TEMPORAL VARIATION OF *MEXICONEMA CICHLASOMAE* (NEMATODA: DANICONEMATIDAE) INFECTION IN THE CICHLID FISH *CICHLASOMA UROPHTHALMUS* FROM YUCATAN, MEXICO

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In temperate latitudes, parasite abundance in hosts varies seasonally and is driven mainly by temperature, but for tropical latitudes, there is a lack of information on key environmental factors affecting parasite abundance through time. Rainfall has been recently suggested as a key factor because both aquatic hosts and their parasites experience numerical changes due to annual patterns of precipitation and hydrodynamic disturbances such as tropical storms and hurricanes. A further complication in the tropics is that natural disturbances occur at time scales longer than a year (e.g. El Niño 3-5 years), for which it is necessary to carry out long-term observations. The aim of this study is to determine whether temporal rainfall patterns influence long-term fluctuations in the prevalence and mean abundance of the nematode *Mexiconema cichlasomae* in its intermediate (*Argulus* sp.) and definitive hosts *(Cichlasoma urophthalmus*) from a coastal lagoon in Yucatan over a period of 8 years variation in rainfall and monthly infection levels for both hosts were analyzed using time series and cross-correlations to detect possible recurrent patterns. Infections of *M. cichlasomae* in *Argulus* sp. showed six monthly peaks, while in *C. urophthalmus* the peaks were bi-annual. The latter peaks appear to be related to the accumulation of several generations of this nematode in *C. urophthalmus*. The present results therefore suggest that rainfall is a key factor affecting this host parasite system and that temporal variation in the infection of *M. cichlasomae* extends over periods longer than a year. Both results suggest the need for long term studies in temporal variations of infections in host-parasite systems in the context of Global Climate Change.

SPATIAL VARIATION IN PARASITES OF KING THREADFIN (*POLYDACTYLUS MACROCHIR*) AND BLUE THREADFIN (*ELEUTHERONEMA TETRADACTYLUM*) IN AUSTRALIAN WATERS; IMPLICATIONS FOR FISHERIES

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Threadfins (Family Polynemidae) constitute important fisheries in tropical and subtropical waters worldwide. Two ecologically similar threadfins; the king threadfin (*Polydactylus macrochir*) and blue threadfin (*Eleutheronema tetradactylum*), form significant components of the inshore commercial net fisheries of northern Australia, with annual catches of approximately 1,000t. Despite their importance, little is known on the movements of the two species. Here, metazoan parasite community assemblages (juvenile nematodes and cestodes, and an adult acanthocephalan) were used to determine the species's movements across northern Australia. Univariate and multivariate analyses indicated that whilst king threadfin were found to move great distances (up to 500 km), movements of blue threadfin were more restricted, with significant differences in parasite communities of fish separated by less than 100 km. The contrasting results suggest that these species need to be managed separately in order to ensure sustainability and prevent localized depletion.

PARASITE COMMUNITIES IN FISHES FROM THE INTERTIDAL ROCKY ZONE OF CENTRAL CHILE: COMPARISON BETWEEN TEMPORAL AND RESIDENT FISH

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This study compares the parasite community descriptors, host specificity and temporal variation patterns between temporal and resident fish species collected from 2006 to 2009 in the central coast of Chile (33º S). Fourteen fish species were found with a total spectrum of 40 parasite species, of which copepods and trematodes were the commonest. Parasite species had high host specificity and only few of them were shared among fish species. Adult parasites showed high host specificity and were found mainly in resident intertidal fish, whereas the temporal fish had parasites with different degrees of specificity. Temporal patterns of parasite communities were determined in 4 fish species (2 resident and 2 temporal fish). The abundance and the mean infracommunity richness as well as the total prevalence of parasites seasonally varied during the three years in resident fishes; the highest values of these parasitological descriptors were observed during the spring-summer periods, whereas the lowest values were found during the autumn-winter periods. For temporal fishes, there was a high variation of the parasite community descriptors, with little congruence among years. Part of this variation in both fish groups was due to the fish total length, although this could explain the parasite variation in resident fish only. Consequently, resident intertidal fish were characterized by their own parasite species and with seasonal variation predictable over time. The permanence time in the rocky intertidal zone and a regular contact with invertebrates (i.e., prey having parasites) may determine a "more stable" parasite communities in resident fish that in temporal fishes.

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DIVERSITY OF HELMINTH PARASITES IN FISH IN FLOOD-PLAIN LAKES OF THE YANGTZE RIVER

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In the flood-plain of the Yangtze River in China, distributed are a large number of shallow lakes which were once connected with the river. Since 1950s, sluices, damns or roads have been built up between lakes and the river, with only three lakes still having direct water flow with the river. Among these lakes, more than 100 species of fish are distributed, and their helminth parasite fauna have been investigated in some extent in the history. However, the species and genetic diversity, ecology, and the impact of the lacustrine isolation on parasite populations are of interest for ecological research on parasites and also on anthropogenic influence. Over the last a few years, populations of the cestode, *Bothriocephalus acheilognathi*, digeneans in the Bucephalus, nematodes in the *Procammallanus* and *Cammallanus*, as well as parasitic copepods in the *Sinergasilus*, were either examined either in a pattern of seasonal changes, or in genetic diversity in different localities or lakes. Recent research also devotes to investigate the genetic diversity of acanthocephalans in the *Pomphorhynchus*. A species distributed in north China was

described, and specimens were collected from Europe, North America in order to understand the phylogenetic relationship among species in this genus and also their speciation. It is hoped that collaborations could be established to include *Pomphorhynchus* spp. from Chile and other South American countries.

ASPECTS OF BIOLOGY AND PARASITIC INFECTIONS OF FISHES IN AGULU LAKE, SOUTH EASTERN NIGERIA

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The parasites of fishes in Agulu Lake in Anaocha Local Government Area of Anambra State, Nigeria were investigated between June 2006 and May 2007 to determine their prevalence, mean intensity and abundance and the effects of host size, weight, sex and season on these infection parameters. The fishes were caught through collective efforts of 3 men fishing for 3 hours per day per month for 12 months in planked canoe. The six arms of the lake were sampled using seine and gill nets as well as bamboo traps set overnight. Fishes caught were ice-preserved and later identified by experts and the use of voucher. The morphometric characteristics of the fishes were measured and the fishes examined for ecto- and endoparasites. Treatment, fixation and preservation of the parasites recovered followed standard procedures. A total of 1191 fishes belonging to 7 genera, 9 species and 4 families were caught. Eleven parasites species comprising metacercariae of 3 digenetic Trematods (*Clinostomoides* sp., *Clinostomum tilapiae*, *Clinostomum* sp.), one cestode (*Proteocephalu*s sp.), 5 nematodes (*Camallanus* sp.1, *Camallanus* sp.2, *Camallanus* sp.3, Oxyuroid, *Spironoura* sp) and 2 acanthocephalans (*Neoechinorhynchus* sp.1, *Neoechinorhynchus* sp.2) were recovered in all. *Tilapia zillii* harboured the highest number (5) of parasites species while *Paracharanna obscura*, *A. occidentalis* and *Hepsetus odoe* harboured the least (1) parasites species each. In terms of monthly distribution, only 2 of the parasites (*Clinostomoides* sp. and *Neoechinorhynchus* sp.1) occurred in all months. Variation in prevalence mean intensity and abundance did not show clear seasonal trend in most parasites with respect to host sex, there was a significant difference in prevalence among the sex groups for all parasites but none in mean intensity and abundance. The implications of the above findings are discussed.

SPRATTUS FUEGENSIS A SMALL PELAGIC FISH WITH A HIGH BURDEN OF THE NEMATODE *HYSTEROTHYLACIUM* SP.

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Sprattus fuegensis ("Falkland sprat" or "Sardina austral") is a small pelagic fish distributed in inner and shallow waters of southern Chile and Argentina. This species support an important local fishery with landings reaching 18.000 ton/years. Almost all clupeiforms from southern Chile were named as "sardine" and for long time this species was confused in the landing reports with *Strangomera bentincki* and *Sardinops sagax musica*. Since 2005 this species was recognized as a target species for local fishermen in the "inner sea". Published information about this biology species is very scarce and its metazoan parasites are simple unknown. In order to describe the metazoan parasite fauna of *S. fuegensis* we analyzed 278 individuals, obtained from five localities. Fish length in the whole sample ranged from 7.1 to 15.1 cm (11.5 ± 1.58 cm). Only two metazoan species were found, the nematode *Hysterothylacium* sp. and a Bomolochid copepod. The prevalence of *Hysterothylacium* sp. reached 88.5% and mean abundance was 11.03 (± 11.9) with a maximum of 59 nematodes in a fish of 13.6 cm length. The abundance (previous log n+1 transformation) was significantly associated to the total length ($r = 0.78$, $n = 278$, $p < 0.001$) and prevalence (previous angular transformation) was also significantly associated with fish length, with the 100% of specimens larger than 13.4 cm. parasitized by the nematode.

A BEGINNER'S GUIDE TO "FLUKOLOGY"

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Yamaguti's Systema Helminthum, produced ~50 yr ago, remains the first reference for many helminth researchers. Regarding web-based resources, a number of sites specialize in particular genera, but few synthesize current knowledge concerning the Monogenea. Given the lack of such a synthesis, basic taxonomic and biological information concerning the 700+ known monogenean genera is frequently difficult or impossible to access, often published in grey literature or inaccessible journals. Even when such data are available, images and descriptions of taxonomically informative traits are of variable quality. Here, we present a web-based resource, eponymously named "MonoDb", the steroid enhanced big sister of "GyroDb". This site provides access to records for recognised (and retired?) monogenean genera. In addition to overviews of monogenean biology, taxonomy and relevant research techniques written by experts, access will be provided to individual species records arranged by family and genus. Each species record will
comprise images and molecular data relevant to their taxonomic identification, original references for descriptions and other key information e.g. host and habitat etc. For type species and other important species or species groups, the site will contain authored reviews of current biological and systematic knowledge. We intend that the site allows users to

submit new data which will be refereed to ensure quality and consistency before upload to the publicly accessible databases. It is intended that the site be accessible for all users, including those with a casual interest in monogeneans and established researchers. Links to relevant sites such as FishBase and researcher and facility homepages will also be provided. A provisional version of MonoDb may be accessed at www.monodb.org.

GYRODACTYLUS SALMONIS: A STRAIN-ED RELATIONSHIP

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The native distribution range of rainbow trout, *Oncorhynchus mykiss*, in North America spans from the Aleutian Islands to the USA - Mexico border in Baja California. In N. America, this host is parasitised by at least 4 species of the monogenean *Gyrodactylus*: *G. avalonia, G. brevis, G. colemanensis* and *G. salmonis*. Of these, *G. colemanensis* and *G. salmonis* occur at fish farms across the USA and Canada. A sample of feral *O. mykiss* collected from Veracruz, eastern central Mexico, were found to harbour a species resembling *G. salmonis*. Morphology of the haptoral hooks indicated similarities with *G. salmonis*, but permitted their separation from each other. A parallel molecular study of 18S, ITS1-2, 5.8S and COI regions showed slight differences but these were not sufficient to erect a new species. Based on these findings we describe a new strain, *G. salmonis* morpha *mexicana*. Native Mexican trout are restricted to the north-west where they inhabit streams draining into the Sea of Cortez and the Pacific Ocean. In the Pleistocene, the range of salmonids extended 400 km further south than their current range. The current specimens were collected outside this range suggesting that parasites were most likely introduced with their hosts when they were translocated for aquaculture in the 1880s. Given the geographical separation between Mexican rainbow trout populations (both farmed and feral) and the native *O. mykiss* distribution range, it is conceivable that this *G. salmonis* strain has a limited gene pool and could eventually diverge from *G. salmonis sensu stricto*. We discuss the natural and anthropogenic scenarios that may have led to the isolation of this gyrodactylid population in central Mexico. This first record of *G. salmonis* m. *mexicana* in Mexico extends the known distribution range of *G. salmonis* in North America.

THE ROLE OF THREE-SPINED STICKLEBACKS IN *LEPEOPHTHEIRUS SALMONIS* (KRØYER, 1837) TRANSMISSION IN SCOTTISH SEA LOCHS

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Three-spined sticklebacks (*Gasterosteus aculeatus* L.) have a wide geographic distribution, including both freshwater and marine environments, and consequently the species are host to a large range of parasite species (Barber, 2007). Studies by Beamish *et al.* (2005) and Jones *et al.* (2006) reported settlement of *Lepeophtheirus salmonis* on three-spined sticklebacks captured in the Broughton Archipelago, British Columbia, Canada. Tank trials exposing sticklebacks to *L. salmonis* were carried out in Canada and Scotland to determine if sticklebacks play a role in the inshore infection dynamics of *L. salmonis*. Additional host choice behavioural assays were carried out in Scotland to determine *L. salmonis* directional preferences to Atlantic salmon and European stickleback entrained seawater. The results of infection trials carried out in Canada showed that sticklebacks had more lice at each time point ($p < 0.0001$) than pink salmon. During trials in Scotland lice counts were significantly greater on salmon than on sticklebacks at all time points ($p < 0.0001$). Behavioural assays conducted in Scotland demonstrated that copepodid *L. salmonis* were significantly attracted to Atlantic salmon ($p=0.03$) and stickleback entrained seawater ($p=0.002$) although actively choose salmon ($p=0.03$) over stickleback water. Copepodid *L. salmonis* settle on three-spined sticklebacks in greater numbers than on pink salmon. Although most parasites fail to completely mature on sticklebacks, this finding, if replicated in the marine environment, suggests that three-spine sticklebacks might play a role in the inshore lifecycle/transmission of the parasite in the Broughton Archipelago – or throughout the north Pacific Ocean. However, data from Scottish trials indicate that three-spined sticklebacks are unlikely act as a peripatetic host in the inshore infection dynamics of *L. salmonis* in Scotland. The reason(s) for these observed differences are likely to be due to genetic differences between stickleback populations and/or *L. salmonis* and is an area that requires greater study.

A PREVALENCE ASSESSMENT OF RED VENT SYNDROME IN WILD ATLANTIC SALMON (*Salmo salar* L.) IN THE UK

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During 2007, Marine Scotland Science (MSS), in Scotland and the Environment Agency (EA) in England and Wales reported increasing numbers of returning Atlantic salmon (*Salmo salar* L.) showing swollen and haemorrhagic vents. The condition, laterally termed "Red Vent Syndrome" (RVS) was subsequently reported in Ireland, Iceland, Norway and Canada. A multi disciplinary study to establish the cause of the condition were conducted in Scotland (Noguera *et al.*, 2008) and England and Wales (Beck *et al.,* 2008), with both

studies concluding the cause of the swollen, haemorrhagic vents was linked to the presence of high numbers of the larval nematode *Anisakis simplex* in the vent area, and the associated host reaction. In order to establish the extent of the condition, a prevalence assessment was carried out between 2008 and 2009 with the co-operation of MS/EA staff and fishery boards' biologists and owners. Five areas around Scotland (MSS) and three in England and Wales (EA) were identified to determine prevalence of RVS and compare if there were any differences between salmon populations. In Scotland, a total of 1370 salmon were examined and data shows that prevalence at all sites ranged from 6.6% to 17%. A vast majority of fish (90.24%) within the affected group, were classified as "mild" while 1.25% was classified as moderate, with no severe cases recorded. In England, a total of 1046 salmon were examined and prevalence ranged from 27% to 39%, hence it remained similar to 2007 or decreased in one of the rivers analysed. Severity of the condition was recorded on two of the rivers and showed 20% of affected fish were recorded as "severe", though the criteria applied for the classification was slightly different from that in Scotland, (RVI and RVII rather than mild, moderate and severe). Red Vent Syndrome could still be observed in the UK Atlantic salmon stocks in 2008 and was not limited to localised rivers but recorded absent in previously affected ones (England). Data from this survey in conjunction with published and personal communications would indicate that the incidence of RVS was lower in 2008 than the 2007. However further monitoring is necessary to evaluate if the syndrome continues to decline and to establish if there has been an impact on wild Atlantic salmon stocks.

THE SEARCH FOR CRYPTIC SPECIES IN FRESHWATER FISH HELMINTH PARASITES IN MEXICO: THE CLASSICAL TAXONOMY TO HOLISTIC APPROACH.... AND BACK TO CLASSICAL TAXONOMY

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The discovery of cryptic species in nature (morphologically indistinguishable, genetically distinct), has attracted the attention of systematists, ecologists and evolutionary biologists because such species have significant implications for evolutionary theory, biogeography and conservation planning. Parasitologists discover and describe new species of parasites with regularity based on a traditional taxonomic approach using solely morphological traits, and DNA-based taxonomic methods are increasingly used to complement these descriptions, following an integrative taxonomy approach. Implicit in their discoveries is the possibility to find cryptic species, where no morphological distinction a priori can be established. Empirical data on freshwater fish helminth parasites has increasingly shown the existence of cryptic species, which is relevant because it modifies our understanding of extant biodiversity. Following the main theme of the conference, in this paper I briefly review the concept of cryptic species, and I discuss the problems with recognizing such species based on empirical data obtained in host-parasite systems in Mexico, establishing a distinction between cryptic species prospecting (methods to detect putative cryptic species, e.g., DNA barcoding) and delimitation (testing we have them). Once delimited, then cryptic species require proper description, returning to classical taxonomic methods, with the implicit problem of finding distinguising characters to be used in the description of the

newly found species. The inventory of the freshwater fish helminth fauna in Mexico is nearing completion following a classical approach, but I argue that a modern view of the survey/inventory work that makes use of an integrative taxonomic approach will necessarily change our estimates of extant diversity.

SPIRONUCLEUS SALMONIS: ADHESIVE FLAGELLA INITIATE CLUSTERING OF TROPHOZOITES AND CLUSTERS OF CYSTS – NEW OBSERVATIONS ON ADAPTIONS FOR ENHANCED INFECTIVITY

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In vitro studies of piscine *Spironucleus* are yielding intriguing new insights into the cell biology and life cycle of these important pathogens of aquaculture and aquarium fishes. We cultured *Spironucleus salmonis* in newborn calf serum (Uldal, 1996), and observed highly organized clustering of trophozoites, and eventual formation of clusters of cysts. Tips of the posterior flagella became adhesive, followed by the rest of the posterior flagella, allowing trophozoites to stick together, creating clusters, reminiscent of a bunch of balloons. Clusters of pyriform trophozoites transformed into clusters of spherical cysts, as quickly as 30 seconds after inoculation of the primary culture. Adhesion of posterior flagella, and clustering of encysting trophozoites, has recently been seen in *Spironucleus vortens* in culture (Lloyd, Millet and Williams, pers. comm). Documentation of (i) adhesive flagella in multiple *Spironucleus* species, and (ii) multi-functional adhesive flagella in the alga *Chlamydomonas* (flagella facilitate adhesion of gametes), and in trypanosomatids *Trypanosoma* and *Leishmania*, (flagella involved in attachment to host surfaces), strongly suggests that what we report in *S. salmonis* is not an artifact. Interesting questions arise about when such clustering occurs in nature, and why. We suggest that adhesion and clustering in *Spironucleus* are key capabilities, and may be essential in the life cycle. Flagellar adhesion in *Spironucleus* trophozoites is probably triggered by deteriorating environmental conditions, such as that in the intestine after death of the fish. Clustering of encysting trophozoites facilitates clusters of cysts, which are likely to be (i) buoyant, increasing the chance of being ingested by a fish, and (ii) numerous enough for simultaneous ingestion of enough cysts to exceed the minimum infective dose. Thus, the formation of clusters of cysts can enhance infectivity in the aquatic phase of the life cycle, compared to only solitary cysts. We propose that this previously undocumented phenomenon may also offer a new treatment target, namely anti-adhesion therapy directed to inhibition of clustering.

MOLECULAR PHYLOGENY OF AFRICAN GYRODACTYLID MONOGENEANS

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Representatives of different genera of Gyrodactylidae infect a wide range of hosts from diverse aquatic environments. Recently undertaken parasitological surveys of the monogenean fauna of fishes in several countries throughout Africa demonstrate a high morphological diversity and species richness. The aim of this study was to investigate the phylogenetic relationships between gyrodactylid monogeneans of African freshwater fishes and other representatives of the family Gyrodactylidae, including a wide range of species/genera from both freshwater and marine systems. The phylogenetic analyses, based on SSU and ITS rDNA sequences, point to a polyphyletic origin of African *Gyrodactylus*. Interestingly, African *Gyrodactylus* spp. make up well-supported clades possibly indicating speciation within host orders: 1) parasites of the characin (Characiformes) families Alestidae and Citharinidae; 2) parasites of cichlids (Cichlidae); 3) parasites of catfishes (Siluriformes), consisting of a lineage infecting mochokids and one infecting clariids. *Macrogyrodactylus* spp. firmly cluster into a monophyletic group. The phylogenetic position of *Diplogyrodactylus* was not well resolved. We found that *Swingleus* and *Fundulotrema* form a clade with *Gyrodactylus* species belonging to the *G. wageneri*-group.

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PARASITIC FAUNA OF THE FRESHWATER FISH (ARATH) *ACANTHOBRAMA MARMID* CAUGHT FROM RIVER TIGRIS PASSING THROUGH MOSUL CITY, IRAQ

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The freshwater fish, *Acanthobrama marmid* caught from river Tigris passing through Mosul City, Iraq had been investigated for its parasites. The results revealed five species of parasites, these are: two protozoans namely *Trypanasoma acanthobramae* sp. n., *Myxobolus pfefferi*, one digenean *Pseudochetosoma salmonicola* ,one larval cestode, *Ligula*

intestinalis and one crustacean , *Ergasilus mosulensis*. *T. acanthobramae* found in the blood while *M. pfefferi* found in the gill filaments. *P. samonicola* was found in the gall bladder , while *L. intestinalis* in the body cavity. *E. mosulensis* was recovered from the gills. A trial was made to see if there is a relationship between the parasitic occurrence and the condition factor of the fish. Furthermore the impact of the *L. intestinalis* and gonad histology was also investigated.

PARASITES AS BIOLOGICAL TAGS FOR SOUTH AFRICAN SARDINES

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South African sardines, *Sardinops sagax*(Jenyns, 1842), were collected from several localities off the coast of South Africa and examined for parasites in order to identify species that may be used as biological tags. The use of parasites as biological tags for marine fish stock identification has not previously been attempted in South Africa, and the technique may be useful in addressing recent questions concerning stock structure of the local sardine population. To date 171 sardines, have been examined from 11 localities, ranging from Hondeklip Bay on the west coast to east of Algoa Bay on the east coast. Initial results show the regular occurrence of seven different parasite species: a digenean metacercariae of the "tetracotyle" type were found infecting the eyes, a coccidian protozoan, *Eimeria sardinae* (Thélohan, 1890) Reichenow, 1921, was found infecting the testes and a myxozoan, *Kudoa thyrsites* (Gilchrist, 1924), was found infecting muscle tissue. Two parasitic copepods were found, with *Clavellisa ilishae* (Pillai, 1962) attached to the gill rakers and *Nothobomolochus fradei* (Marques, 1965) on the gills. The muscle tissue of one fish harboured a single plerocercoid of the trypanorhynch cestode *Tentacularia coryphaenae* Bosc, 1802, and the gills of another sardine from off Port Elizabeth harboured a single specimen of the monogenean gill parasite *Neomazocraes sardinops* Lebedev and Parukhin, 1969. Initial indications are that the "tetracotyle" digenean holds the most potential as a biological tag.

THE THREE GROWTH PERIODS OF A MICROCOTYLID

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The chronology of post-larval development in *S. chrysophrii*, a microcotylid monogenean parasite of the gilthead seabream (*Sparus aurata* L.), was experimentally studied. Sixty-eight *S. chrysophrii*-infected gilthead seabreams were collected from sea-cages of a fishfarm off Murcia, Spain, dewormed and newly infected. Fish were periodically killed for 36 days post infection (dpi). Parasite growth curves, represented by number of clamps and mean body length, were sigmoid-shaped with a slow early growth period, approximately 18 dpi (up to 300-400 long specimens), a fast middle growth period, about up to 33 dpi (300/400-3000 long) and a slow late growth period, until adults reach the maximum number of clamps (3000-5200 long). The mean clamp pair addition rate per day was between 1 and 2, 0-1 during the first period, 2-3 during the second and 1-2 during the third one. This growth pattern is apparently shared with other microcotylids and seems to be related with periods of settlement, maturation and reproduction. A sigmoid growth rate has also been reported in species of molluscs with ecological and morphologic (metamorphic) changes during life.

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RESEARCH OF THE PARASITE FAUNA OF *ASTYANAX* AFF. *FASCIATUS*, COLLECTED ON THE SAO JOAO RIVER, PARANA, BRAZIL.

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Astyanax aff. *fasciatus* (Teleostei, Characidae), known as “lambari-do-rabo-vermelho?” is a small species of wide distribution in South America. The study of its parasitic fauna is of great importance, because it can reveal ecological, ethological and feeding aspects of the species, as well as the possible variations that exist on these aspects within the ecosystems inhabited by this species. With the objective of investigate the metazoan endoparasitic fauna of this fish in the Sao Joao river basin, municipality of Ponta Grossa, Parana, Brazil, specimens were collected in several points, between July of 2010 and January of 2011. The specimens were processed and identified. Two species of nematodes were identified: *Procamallanus* (*Spirocamallanus*) *pintoi* (Prevalence = 6.25%; Intensity = 1) and *Cucullanus* sp. (Prevalence = 3.13%; Intensity = 1). This is the first register of the genus *Cucullanus* parasitizing the intestine of *Astyanax* aff. *fasciatus*. Of all the 32 fishes analyzed (25 females and 7 males), only 3 females (9.4%) were parasitized. However, there was no significant influence of the host`s sex on the level of parasitism (Prevalence: U = 0.48, p = 0.31; Abundance: G = 1.57). It wasn`t observed correlation between the host`s length and the abundance (rs = 0.15; p = 0.65) and of that one with the prevalence (r = 0.52; p = 0.12). The level of parasitism was also the same in all the collection sites (H = 1.77, p = 0.2). The environment didn`t favor the parasitism and, due to the low prevalence, it wasn`t observed an influence of the host`s sex and length in the levels of parasitism. But even so, it was recorded, for the first time, the genus *Cucullanus* in this fish.

CENTRAL AMERICA IS AN AREA OF ENDEMISM FOR THE HELMINTH PARASITES OF FRESHWATER FISH

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The freshwater fish of Central America are a faunal assemblage distinct from that of North America and South America, and are parasitized by their own, endemic helminth fauna. This study is a review of helminth taxonomic composition and distribution in Central America generated through collection of bibliographic information on the adult helminths of freshwater fish recorded from the Isthmus of Tehuantepec, Mexico, to the Isthmus of Panama. To date, 105 helminth species have been reported in this region parasitizing 16 freshwater fish families. Fifty-eight percent of the helminth species currently known in the region have been found in three of these families: the cichlids (hosts to 34 helminth species); Characidae (hosts to 15 helminth species); and Heptapteridae (hosts to 12 helminth species). Of these 105 helminth species, 92% have been recorded only in Central America, meaning they are endemic. Eight of the 105 have been reported in South America and none in North America. The most abundant helminth groups in the region (in descending order) are nematodes, trematodes and monogeneans. No helminth family is endemic to Central America. The only suprageneric taxon recognized to date as endemic to Central America is the monotypic nematode subfamily Neophilometrinae. Seventeen of the known genera are endemic (10 trematodes, 4 nematodes, and 3 monogeneans), 22 are from South American lineages and two are from North American lineages. The data suggest Central America is a diversification center for the helminths of freshwater fish since this helminth fauna consists of species that apparently originated and evolved in this region. Most of the reported species are endemic and derive from generalized South American genera. The almost total lack of differentiation of endemic suprageneric taxons and the relatively low number of endemic genera suggest this fauna is young. Its distribution ranges exclusively from the Transversal Neovolcanic Axis Province (approx. the 19th parallel) to the Isthmus of Panama. It has not been able to invade Nearctic regions north of the Neovolcanic Axis and is not found in South America.

A NEW *ICHTHYOSPORIDIUM* SP. (MICROSPORIDIA) FROM THE GONADS OF ARROW GOBY (*CLEVELANDIA IOS*)

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Gonadal lesions were found in 34% (13/38) of arrow gobies, *Clevelandia ios*, sampled over a three year (2007-2009) period from one site in Morro Bay, California, whereas the infection was absent in fish from another site in the same bay. We conducted this investigation as gonadal tumors have been reported to be common in this fish from this geographic area. The lesions, found primarily in females and one single male fish, appeared as large, whitish masses replacing the gonads, not inconsistent with tumors at a macroscopic level. Histological examinations, however, revealed large xenomas within the ovaries, and no signs of neoplasia. Typical of the genus *Ichthyosporidium*, the large xenomas were filled with developmental stages and rather pleomorphic spores. Wet mount preparations showed two types of spores; macrospores (approximately 10 X 6 um) and microspores (approximately 7 X 4 um). Transmission electron microscopy showed stages consistent with the genus, i.e., diplokarya occurring in developmental stages. In addition, rDNA sequence analysis showed that the parasite from arrow goby was most closely related to, but distinct from, *Ichthyosporidium giganteum* and *Ichthyosporidium* sp. based on sequences available in GenBank. *Ichthysporidium giganteum* and *I. hertwigi* infect fishes in the families Labridae and Scienidae in the Atlantic Ocean, Gulf of Mexico and the Black Sea. We conclude that this microsporidium represents a new species in the genus *Ichthyosporidium*, the first species of this genus described from a goby and from the Pacific Ocean.

QUANTIFYING THE SPATIAL AND ENVIRONMENTAL VARIATION OF THE PARASITE COMMUNITIES OF BLACKCHEEK TONGUEFISH (*SYMPHURUS PLAGIUSA*) IN THE SOUTHERN GULF OF MEXICO

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It is a matter of current debate whether the parasite communities of fish are predictable entities or simply an aggregation of species coinciding in space and time. A large part of the problem is the low level of predictability found in space and time for these host parasite systems. We suggest that part of the problem has been not quantifying the contribution of spatial structure. Thus, our goal was to determine the variation explained by environmental and spatial predictors on the parasite community structure of the marine flat fish *Symphurus plagiusa*. We used a spatially explicit sampling design including 37 stations repeated over one year to quantify its temporal variability. The principal coordinates of neighbour matrices method was used to construct spatial models from the geographical coordinates among stations. The effects of both spatial and environmental variables on parasite community structure were detected using redundancy analysis. The patch size at which 60% and 80% qualitative similarity occurred was variable through the year. The patch size at 60% similarity varied between 38.7 and 105 km while those for 80% similarity varied between 3 and 86.8 km. Spatial and environmental variables contributed additively to the explained variance of parasite abundance (11.5– 73.7%) and species richness (12.9 – 43.8 %). These patterns are probably associated with the differential geographical distribution of both larval parasites and intermediate hosts at particular spatial scales across time. We suggest that the ability to predict ecological patterns and processes affecting parasite

community structure depends on the spatial resolution of sampling designs, and the environmental dynamics affecting the distribution of both hosts and parasites through time.

AMOEBA CAN ACT AS A "SILENT INFECTION" ON THE AQUACULTURE EUROPEAN SEA BASS (*DICENTRARCHUS LABRAX* L.)

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European sea bass (*Dicentrachus labrax* L.) aquaculture production has been growing in Europe in the last years. Therefore, the control of parasitic infections has become a major concern to fish farming industry. A survey on parasitic amoeba infection was performed, in Portugal. In our study, 237 European sea bass (around 30 fish per season per fish farm), were examined for amoeba, in two fish farms (one using a source of seawater SW - and the other brackish water - BW) during 2004. Gills were analyzed macro and microscopically (in fresh smears, hanging drop slides and histology). Also some fish features (length and weight), and some environmental parameters (water temperature, salinity and pH) were recorded. No disease outbreaks or fish mortality, as well as, any macroscopic lesions in the fish gills were recorded. However, the usual microscopic lesions caused by amoeba (hyperplasia, secondary lamella fusion and interlamellar vesicles) were recorded in heavily infected fish. Prevalence was rather high, 43% and 73%, for fish of farm SW and BW, respectively, and recorded higher values for autumn season in both farms. The host condition factor has shown different values for infected and non-infected fish of farm SW (0.72 and 0.75, respectively), but not for those fish of farm BW. However, in the later farm the fish length shown different values, with 12.6 cm and 13.6 cm, for infected and non-infected fish, what suggested a delay in fish growth. Though this infection can go unnoticed (with no macroscopic signs) and act as a "silent infection", it can cause important effects in fish culture systems. Therefore, the implementation of routine measures for its survey and control are recommended.

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SPECIATION STUDIES WITHIN CONGENERIC MONOGENEAN PARASITES

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Pseudorhabdosynochus species (Diplectanidae: Monogenea) are monogenean gill parasites of coral-reef fishes of the tribe Epinephelini (Serranidae: Perciformes). With their direct life cycle the Monogenea are an appropriate model for studying the process of parasite diversification because co-evolutionary patterns are not disturb by the influence of the intermediate hosts. Moreover they are highly diversified and they have highly specific relationships with their hosts. Similarly, the Epinephelini is a very diverse family among coral-reef fishes with about 98 described species, of which some have a large range of distribution. To investigate the pattern of diversification and speciation of the genus *Pseudorhabdosynochus* and to reconstruct its phylogeny, we used 28S, ITS1 and COI sequences. In this study, 51 species of *Pseudorhabdosynochus*, on the 57 described, associated to 21 species of fishes were analyzed. In the literature, the patterns of parasite speciation were debated. Does the diversification of the parasites result from the geographical isolation of host's populations or from an ecological shift of either the parasites or the hosts? A corollary question is then if speciation of the parasites is possible without evolutionary changes within the host?. Among the *Pseudorhabdosynochus* studied, we mainly detected either cospeciation pattern or host-switching events rather than intra-host speciation events. The patterns of diversification and speciation within the genus *Pseudorhabdosynochus* contrast with that observed for other biological models such as for the genus *Dactylogyrus* (Dactylogyridae) or even within the Diplectanidae for the genus *Lamellodiscus*. Indeed, for these models, cospeciation was rarely observed whereas intra-host speciation was more common. To pursue this study, we are now working on more detailed phylogeography of fishes and parasites to extend and refine our speciation patterns.

CONTROL OF BLOOD FLUKE INFECTIONS IN CULTURED PACIFIC BLUEFIN TUNA, *THUNNUS ORIENTALIS*

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Over the last decade, bluefin tuna culture has shown rapid growth in Australia, Europe and Japan. Despite its sensitive nature, bluefin tuna has traditionally been considered relatively tolerant to infectious diseases. However, problems associated with parasite infections have recently emerged in tuna farms. Mass mortality of 0 yr old fish was occasionally observed. Large numbers of parasite eggs were noticed in the gills of dead fish and blood flukes suspected to be the cause of the death. In our parasite survey of the artificially produced juvenile Pacific bluefin tuna cultured in Wakayama Prefecture, Japan, two species of *Cardicola* blood flukes, *Cardicola orientalis* and *C. opisthorchis*, were found. Monitoring using a newly developed PCR showed that the juveniles became infected shortly after being transferred to sea cages and the parasite intensity increased rapidly, reaching 100% within a few months. We conducted drug treatment against the blood flukes using praziquantel (PZQ), a common anthelmintic used for human blood fluke. Different doses of 150, 15, 1.5

or 0 mg/kg BW/day of PZQ were administrated to the fish and the number of eggs in the gill and adult worms in the heart was determined. Three-day administrations of 15 or 150 mg/kg BW/day eradicated the adult worm within a week. However, re-infection was observed 4 weeks after the treatment. The drug was not effective to kill the parasite eggs, but the number of eggs gradually decreased. The untreated control showed significantly higher mortality than the control groups, indicating the blood fluke is the cause of the death. The present study demonstrated the high efficacy of PZQ against the *Cardicola* blood flukes and suggested that the control of these flukes is essential for the sustainable culture production of Pacific bluefin tuna.

BIODIVERSITY AND ECOLOGY OF FISH PARASITIC GNATHIID ISOPODS AND FISH BLOOD PROTOZOANS FROM LIZARD ISLAND, GREAT BARRIER REEF, AUSTRALIA

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Coral reefs are marine ecosystems with among the greatest species diversity in the world. The Great Barrier Reef (GBR) is one of the richest and most complex of these systems. Gnathiid isopods are abundant on coral reefs and their juveniles (larvae) are common ectoparasites, where they feed on the blood and tissue fluids of teleost and elasmobranch fishes. When not feeding on fishes, gnathiids are cryptic and widely distributed, especially among coral reef habitats living in cavities, crevices, sponges, coral rubble, or sediment. Twelve genera are recognized and among these are almost 200 described species, the majority in the genus *Gnathia.* Gnathiids have a biphasic life cycle with 3 parasitic larval stages; the latter are also known as pranizae when engorged with fish blood and tissue fluids and zupheae when unfed. Species descriptions rely on the morphology of adult males. When juveniles or females are found, their identification can be difficult, a problem that will be discussed in this presentation. The juveniles of gnathiids are also known to be the main food source of the coral reef cleaner fish *Labroides dimidiatus*. These small ectoparasites have been found feeding on 70% of 56 species of reef fish surveyed on the Great Barrier Reef. This paper focuses on the research done during the past 10 years at Lizard Island, Great Barrier Reef, Australia and will report on the discovery of new gnathiid species from teleost and elasmobranch hosts, host parasite interactions, laboratory elucidated life cycles, the effect of feeding in aquaria and in the wild, as well as the role of gnathiids as vectors of fish blood protozoans in the tropics.

MICROHABITAT SELECTION OF DACTYLOGYRIDS (MONOGENEA: DACTYLOGYRIDAE) ON THE GILLS OF WILD SPOTTED ROSE SNAPPER *LUTJANUS GUTTATUS* (LUTJANIDAE) FROM MAZATLAN BAY, MEXICO

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The spatial distribution and coexistence of monogenean dactylogyrids was assessed on the gill of 63 specimens of wild spotted rose snapper, *Lutjanus guttatus* (Steindachner), caught at Mazatlan Bay, Sinaloa, Mexico. Five species were reported: *Euryhaliotrema perezponcei* García-Vargas, Fajer-Ávila et Lamothe-Argumedo, 2008, *Euryhaliotrematoides* sp., *Haliotrematoides spinatus* Kritsky et Mendoza-Franco, 2009, *H. plectridium* Kritsky et Mendoza-Franco, 2009 and *H. guttati* García-Vargas, Fajer-Ávila et Lamothe-Argumedo, 2008. All, except *E. perezponcei* and *H. guttati* represent new geographical records for the Pacific coast. The most prevalent dactylogyrid species was *E. perezponcei* (100%), *H. plectridium* and *H. spinatus* had > 80% prevalence, and *H. guttati* and *Euryhaliotrematoides* sp. had the lowest prevalence. The mean abundance of *H. plectridium* and *E. perezponcei* exceeded 60 parasites/fish, whereas *Euryhaliotrematoides* sp. and *H. guttati* had the lowest abundance. Gill arch 2 had the highest abundance of dactylogyrids followed in descending order by arches 1, 3 and 4. *Euryhaliotrema perezponcei* preferred gill arches 1 and 2 and the anterior gill sector; *H. plectridium* preferred arches 2 and 3 and the central sector, and *H. guttati* preferred gill arch 1. The intraspecific aggregation was stronger than interspecific aggregation indicating that all dactylogyrid species on spotted rose snapper were aggregated and there was no evidence of competition among the species.

DEVELOPMENT OF METACERARIAE OF *CLINOSTOMUM* SP. (DIGENEA: CLINOSTOMIDAE) INTO OVIGEROUS ADULTS USING EXPERIMENTAL HOST.

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Species of the genus *Clinostomum* present very similar morphology, making the correct identification of these parasites difficult. The growing and development of metacercariae of *Clinostomum* sp. into ovigerous adults was studied to obtain the identification of the species. The metacercariae were collected in the fish second intermediate host *Loricariichthys platymetopon*, caught in the floodplain of the high Parana River, Brazil. These larval stages were orally administered to 116 non-vaccinated specimens of young

chicken *Gallus gallus domesticus* (100 metacercariae per specimen) to obtain adult parasites. After infection, the hosts were examined daily (ten days period), and the parasites were sampled to observe their morphology and development stage. The development was graphically analyzed using the length of the body and the relative position of organs, to detect changes in their relative position. The comparisons between the morphometric characteristics of the forms were performed by the Tuckey Test (5% confidence level). The development of the metacercariae into ovigerous adults, completed in the mouth cavity of the chicken, took five days. The metacercariae were different from the adults only by the reproductive organs and length of the body. In the adults the testis were not intensely lobated, the gonads and the vitelline glands were well development, and the uterus increased size and was full of eggs. After this study the parasites were classified as *Clinostomum complanatum*. Thus, the examination of progenetic metacercariae may be an useful tool for the identification of the species.

PARASITES AS MARKERS OF THE TROPHIC POSITION OF FISH AND BIRDS IN THE FLOODPLAIN OF THE HIGH PARANA RIVER, BRAZIL.

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The knowledge on the parasite fauna fishes from the floodplain of the high Parana River is wide, but only a few studies connected fish to the life cycles of parasites, specially the ones that need many hosts, like Digenea. These parasites use birds as definitive hosts. The aim of this study was to connect the information about fishes and birds as hosts and food webs, using known communities of parasites of birds to infer the food composition of the final host. As initial analysis, a DCA (Detrended Correspondence Analysis) was performed to detect links between parasites, bird hosts and parasite infection site, using the PCORD 3.15 statistical program. DCA allows the ordination of species and samples, although unknown gradient, and recognize in what samples the parasites had maximum abundance. There was a clear gradient between DCA's graphics. To exemplify it, some cases will be described. Clinostomidae parasites, *Clinostomum complanatum* and *Ithyoclinostomum dimorphum*, were linked with *Ardea cocoi* birds as final host, present in the mouth cavity and oesophagus, respectively. Thus, this bird eats the fishes (intermediate hosts) of these parasites, previously recorded in the floodplain, *Hoplosternum littorale* and *Loricariichthys platymetopon* (for *C. complanatum*) and *Hoplias malabaricus* (for *I. dimorphum*). Digenean parasites *Sphincterodiplostomum musculosum* were linked with *Egretta alba* birds, as definitive host, present in the posterior small intestine. Its shows that *E. alba* eats ciclideans fishes, like *Satanoperca pappaterra*, previously registered as intermediate host of this parasite in the studied area. These cases showed the possible use of parasites as markers of trophic position in fish eating birds.

ONTOGENETIC CHANGES IN HETEROGENEITY OF PARASITE COMMUNITIES OF FISH: DISENTANGLING THE RELATIVE ROLE OF COMPOSITIONAL VS ABUNDANCE VARIABILITY

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Fish size is a key determinant of parasite community structure. Increasing numbers of both species and individuals in longer fish is a common pattern, due to larger bodied hosts can accommodate more parasites and ingest larger quantities of food, increasing exposure to infective stages. Fish size is generally correlated to age and trophic level, therefore, larger host accumulate long lived parasites over time and broaden the spectrum of potential parasites by feeding on larger preys, acquiring qualitative- or quantitatively different assemblages as they grow. It has been shown that juvenile fish or those with low trophic level harbour more variable assemblages than their counterparts. However, an important issue remains unsolved: how much of this variability is driven by differences in composition or abundance of assemblages? We address this issue using multivariate dispersions in infracommunities of *Conger orbignianus* as measures of β-diversity, using a set of dissimilarity measures with different degrees of emphasis on composition vs. relative abundance information. The average distance from infracommunities to their size class centroid in the multivariate space varied along an ontogenetic gradient, its significance depended on the measure used. Larger fish showed higher richness and abundance. However, smaller fish displayed lower variations in abundance but higher in composition. This could be drawn by stochastic events of encounter at low densities due to the dilute nature of parasites in previous hosts. As fish grow, assemblage´s composition becomes homogenized by repeated exposure, with abundance thus rising as the main source of variability. Discerning between both variables is crucial to understand how community structure is drawn by size-dependent variability of host populations.

MICROHABITAT OF *DACTYLOGYRUS* (MONOGENEAN) AND *MYXOBOLUS* (MYXOSPORIDIAN) GILL PARASITES OF *BARBUS MARTORELLI* ROMAN, 1971 (TELEOSTEI : CYPRINID) IN THE CENTRE REGION, CAMEROON.

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The gill parasite fauna of *Barbus martorelli* is much diversified and raises up the problem of biotope partitioning by these pathogens. The gill colonization analysis of these organisims as well as four distribution gradients : transversal, lateral, longitudinal and vertical was undertaken as a function of the host's side. The distribution of *B. martorelli* gill parasites did not reveal any asymmetry in function of the host's side. The transversal partitioning applied solely to *Dactylogyrus insolitus* and *Myxobolus barbi*. The lateral partitioning was inexistent except for *D. insolitus* which was mostly concentrated on the

posterior hemibranch of arch II and *Myxobolus njinei* which colonized mostly the anterior face of the same arch. The longitudinal partitioning was observed only for *M. barbi* which mostly encysted into sectors which are more opened to respiratory current. The vertical partitioning of Monogeneans was subject to the size of their sclerified haptorial pieces ; therefore *Dactylogyrus bopeleti* and *D. insolitus*, which are robust, accumulate mostly in the filamentary distal zone whereas *Dactylogyrus simplex* and *Dactylogyrus maillardi*, which are weaker, prefer the basal zone. The volume of ventilated water current and certain intrinsic factors of these fish parasites may determine their spatial gill distribution.

AQUARIUM FISH TRADE AND INVASIVE PARASITIC MONOGENOIDS: AN INDIAN PERSPECTIVE

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The aquarium fish sector is a widespread and global component of international trade, fisheries, aquaculture and development. The trade in aquarium fish and associated aquarium products has a real potential to advance socio-economic development around the globe, but the beneficial implications are not always straightforward. The uncontrolled transfer of aquarium fish is presently of great concern worldwide because of its ability to facilitate the intercontinental translocation of many parasites, particularly the monogenoids, leading to outbreaks of disease of national and international significance. Over the past few decades, instances of the harmful consequences of individual translocation of monogenoids with aquarium fish have been considerably accelerated. To make matters even more complicated, many countries have either no legislation or proper quarantine procedures for the import of aquarium fishes nor is there enough data for risk assessment of monogenoids. The author provides examples of invasive aquarium fish and their parasitic monogenoids from India and explains why the trade in aquarium fish is an ideal means for the concomitant introduction of monogenoidean parasites.

PARASITE-HOST ASSOCIATIONS OF AFRICAN FRESHWATER FISH

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The long evolutionary history of fish resulted in fish acquiring a large, diverse and mostly benign assembly of symbionts and parasites. These include representatives of different taxa ranging from Protozoa to Arthropoda and for the purpose of this paper are grouped according to their host associations. The analysis is based on data collected from surveys of all the major river drainage basins of southern Africa since 1980. The first group includes symbionts and parasites restricted to a single host fish, e.g. different species of the African endemic fish louse genus *Chonopeltis*. The second group has a narrow host range restricted to members of a specific fish family e.g. the copepod *Lamproglena monodi* which is host specific to a wide range of cichlid fishes in Malawi and the Zambezi system. The third

group also has a narrow host range, but is associated with different non-related host species e.g. the fish louse *Dolops ranarum*, while the fourth group is opportunistic with a wide host range sometimes also found associated with other non-piscean hosts e.g. *Trichodina heterodentata.* The fifth group are alien introductions, via the introduction of fish. South Africa has a particularly bad record with alien introductions as 22 of our 98 freshwater fish species are aliens. Some alien parasites remain associated only with their alien host, such as *Trichodina acuta* from trout, but others spread to parasitise local species indiscriminately. The introduction of the fish louse *Argulus japonicus*, the anchor worm *Lernaea cyprinacea* and the Asian tapeworm *Bothriocephalus acheilognathi* to South Africa are linked to the distribution of different carp species. The final group are species with ubiquitous distribution, Amongst these are white spot *Ichthyophthirius multifiliis,* and two species of the genus *Chilodonella*. Their origin and method of global dispersal is still unclear, and although introductions of alien fish species could also be responsible for their translocation there must be other, yet unknown, methods of dispersal as we also found them on wild fish in the Okavango Delta, a system so far unspoiled by alien fish introductions.

PROTIST-CRUSTACEAN-FISH HYPEREPIBIOSIS

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Crustaceans and fish are by far the most common hosts for members of the Peritrichia. Nearly 270 peritrich epibiont species belonging to 30 genera have been found associated with numerous representatives of the crustaceans, i.e: Branchiopoda, Branchiura, Copepoda, Malacostraca and Ostracoda. Epibiosis is a facultative, interspecific association between the epibiont and the basibiont. The epibiont attaches to the surface of a living substrate, whilst the basibiont normally lodges and constitutes a support for the epibiont. The association can be temporary or for the entire lifespan of the epibiont. In the case of epibionts found on free-living copepods, a mimetic protection can be provided, but they can also be disadvantageous to the basibiont as they can restrict mobility, increase the risk of predation or compete for nutrients. Contrary to this, hyperepibiosis is where the Peritrich (secondary epibiont) attaches to the parasitic crustacean (primary epibiont), which in turn is attached to a fish host (the basibiont). In these cases the trophic levels of the "bionts" are different and the true association is probably much more symbiotic in nature, compared to those found on free-living basibionts. To date, 35 *Epistylis* and 30 *Vorticella* species have been recorded as epibionts on a variety of crustaceans. Previously *Epistylis nympharum* was collected from the fish louse *Dolops ranarum*. *Epistylis branchiophila*, *E. cyprinceae*, *E. magna*, *Vorticella convallaria* and *V. microstoma* have been collected from *Lernaea cyprinacea*, whilst *E. epibarnimiana* was found on *L. barnimiana*. This paper deals with the hyperepibionts collected from *Dolops* (Branchiura) as well as from *Lernaea* and *Opistolernaea* (both copepods) that were found on variety of fish hosts from southern Africa. It is also the first record of epibionts from *Opistolernaea* species.

MONOGENEAN SPECIATION UNDER HOST RADIATION: CICHLIDS AND GOBIES THROUGH THE MAGNIFYING GLASS

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Mechanisms of explosive speciation have been studied for several fish models, but parasites occurring under such circumstances received almost no attention. Monogenean flatworms provide excellent targets, as their direct life cycle and host specificity ensure a close relationship with the host species. Their fast evolutionary rate gives them "magnifying glass" potential for scrutiny of host evolution. We investigate monogenean parasite diversity in two textbook cases of fish adaptive radiation, whose Monogenea were never recorded: Lake Tanganyika cichlids and eastern Mediterranean sand gobies. The former is the oldest and most divergent African Great Lake cichlid assemblage, while the latter are representatives of a goby centre of endemism. Hence both communities are historically and ecologically important. We generated morphological and molecular data to provide insights in parasite diversity and speciation mechanisms. While *Cichlidogyrus* is the most prevalent monogenean on Tanganyika cichlids, *Gyrodactylus* is rarely found in Lake Tanganyika but ubiquitous on Mediterranean sand gobies. A thorough comparison with the phylogeny of the host fishes shows a different phylogenetic history for both parasite groups, in line with their differential ability to switch infection sites and host species. Combined morphometric and genetic analyses point to an ancient diversity, high host specificity, within-host speciation, and confirm the magnifying glass effect. The results suggest both areas to be hotspots for Monogenea, rivalling their ichthyofaunal diversity. Relating our findings to the history of the fish radiations and their environment, we will add to a broader understanding of those ecosystems as a whole.

IS HOST-SWITCH STRESSFUL FOR PARASITES? HOST-PARASITE EVOLUTIONARY HISTORY AFFECTS THE DEGREE OF FLUCTUATING ASYMMETRY IN THE ATTACHMENT APPARATUS OF GILL PARASITES

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In evolutionary biology, the cost of host-switch or ability to infect multiple hosts is a central question in long-term evolution and specialization of host-parasite systems. Host-range expansion is thought to allow parasites to broaden their ecological niches by allowing access to new resources. However, it represents a challenging issue as parasites need to adapt a new environment, causing potential destabilization of parasite development. In this presentation, I measured fluctuating asymmetry of attachment apparatus of introduced gill parasites, as a measure of developmental instability, to address whether infection of a novel host lineage is concomitant with an increase of asymmetry. I report that host-parasite evolutionary history directly affects the degree of fluctuating asymmetry (FA) in parasite. Parasites infecting a novel host lineage experienced substantial increases in FA. In contrast, parasite infecting the ancestral host lineage did not increase FA. Results show that attachment apparatus shape, but not size, has a consistent plastic response to the host lineage, suggesting that the new host lineage represents a stressful environment for the

parasites. However, there is no evidence that FA increase is linked to decrease of fitness. Alternatively, this emerging pattern suggests the intriguing possibility that elevated FA is capacitating adaptive evolution by providing a mechanism for "evolvability" of phenotypic characters. Ultimately, I suggest the potential use of morphological fluctuation as an important clue to detect host-parasite specialization. Thus, placing parasites in a morphological context can contribute to our general understanding of parasite specificity in a multi-host system.

A NEW GENUS AND SPECIES (MICROCOTYLIDAE; MONOGENEA) FROM THE GILLS OF *ARGYROPS SPINIFER* (FORSSKAL) (SPARIDAE; PISCES) FROM THE SEA OF OMAN

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In addition to the ~150,000 tonnes of wild caught marine fish that are landed at Omani ports, Oman's modest 500 tonne aquaculture industry is expanding and is exploring the potential of a range of native species for farming. Of the 991 fish species known from Omani waters, certain species of seabream, grouper and snapper are of particular interest and are under assessment. Yet while aquaculture production of such species is expected to rise to meet the shortfall in wild catches, there is also a parallel requirement to identify potential threats to the health and welfare of farm stocks and to take appropriate steps to minimize their potential impacts on production. During a routine health survey of potential aquaculture species conducted throughout the period November 2009 to March 2011, a large number of monogeneans were recovered from the gills of king soldier bream, *Argyrops spinifer* (Forsskal) (Sparidae) caught in the Sea of Oman off the coastal city of Muscat and landed at Muttrah (23º 37' N; 58º 35' E). The monogeneans, the first to be formerly described from the Sultanate of Oman, appear to be unique within the Microcotylidae being in possession of a pair of large, muscular armed genital atria. The species is described using morphology (i.e. light, SEM and confocal microscopy), morphometrics and DNA sequencing-based approaches, and is placed in a new microcotyline genus erected to accommodate the new species.

HELMINTHS FAUNA IN SOME MARINE FISH FROM GULF OF THAILAND WITH TWO NEW SPECIES OF *CUCULLANUS* MULLER, 1777 (NEMATODA: CUCULLANIDAE)

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Fifteen species of marine fishes from Gulf of Thailand were examined for helminthic infection during February 2009 to January 2010. Nine hundred and thirty one specimens were collected seasonally and investigated (rainy season, cool-dry season and summer season) from two collecting sites; Hua-Hin (12.57436°N, 99.95721°E) and Pranburi District (12.38260°N, 99.89995°E), Prachuapkhirikhan Province. Twenty-seven 27 genera of helminthes were found (prevalence of infection = 55.85%) comprising of 5 genera of monogenea (13.53%), 12 genera of digenea (16.11%), 6 genera of cestode (7.41%), 4 genera of nematoda (22.77%) and 4 genera of acanthocephalan (5.37%). Moreover, in this study, 2 new species of nematodes were reported. It is belongs to the member of genus *Cucullanus* Muller, 1777 (Nematoda: Cucullanidae) and respectively indicated as follows; *C. rastrelligeri* n. sp. from the short mackerel, *Rastrelliger brachysoma* (Bleeker) (Scombridae) and *C. thaiensis* n. sp. from the brownstripe red snapper, *Lutjanus vitta* (Quoy & Gaimard) (Lutjanidae).

DIVERSITY OF MONOGENEANS PARASITES OF FISH FROM THE PEIXE'S RIVER, STATE OF SAO PAULO, WITH NEWS RECORDS FOR BRAZIL.

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Monogenea is perhaps the least known taxon of fish parasites in the entire Neotropical. Until the 1970's. Despite the efforts of taxonomists, the diversity of the Monogenea in the Neotropics is still largely unknown. Thus, additional efforts to carry out studies about their biodiversity are relevant. The Peixe's river is a tributary of the left bank of the Middle Tiete river basin in the region of Barra Bonita, Sao Paulo. Between 22 to 26 March 2010 and 9 to 13 August 2010, 180 specimens of fishes belonging to 13 species from Peixe's river, SP, Brazil, were collected in order to study of their monogeneans. The body surface, nasal cavity, fins and mandibular canals were examined in search of monogeneans. The gills were removed and placed in vials containing alcohol 70ºGL to fix any of the ectoparasites that be present. Some specimens were stained with Gomori's trichrome and mounted in Canada balsam; other specimens were mounted in Gray and Wess' medium for study of sclerotized structures. A total of 30 species from 13 fish host species were listed in the current study, including 29 new host records. This is first study of monogenean parasites from Peixe's river, therefore all the species found are new geographical records. In present work *Astyanax altiparanae* was the most parasitized fish species, with 8 species of monogenean parasites. Some of the species belonging to the family Dactylogyridae found in this study were only described parasitizing the gills of their hosts, but we are also finding other sites with high infestation prevalence and intensity, as the nasal cavity and the

surface. This data represent an increase in the knowledge of the biology of this group of parasites. This work expanded the geographic distribution and registered new host for some parasite species, with new records for Brazil.

CLINOSTOMUM DETRUNCATUM BRAUN, 1899 INFECTING *SYNBRANCHUS MARMORATUS* BLOCH, 1795 FROM THE MUNICIPALITY OF GUAIRA, PARANÁ STATE, BRAZIL.

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Studies concerning parasitic community ecology of Neotropical fish have been remarkably taking place in the last years as direct indicators of environmental quality. However it is still necessary studies in the field. Brazil has a considerable diversity of all freshwater fish of the world, but the parasitic fauna of the majority of these species has not yet been studied. This study aimed to report the infection of *Clinostomum detruncatum* Braun, 1899 in one specimen of *Synbranchus marmoratus* Bloch, 1795. The specimen was sampled using hand net with 0.5 cm mesh size in macrophytes, in Paraná River, at the municipality of Guaira, Paraná State, in April, 2011. The fish specimen (total length of 55 cm) was necropsied at the laboratory and sixteen free Digenean metacercariae were found in the coelomic cavity of *S. marmoratus*. The metacercariae were fixed with AFA solution and stained with carmine. Morphological analysis allowed concluding that they were specimens of *C. detruncatum*. According to data available, metacercariae of *Clinostomum* and *Odhneriotrema* may cause a disease known as Yellow Spots, which may trigger health problems for the fish host. Previous studies in Brazil showed the fish species *S. marmoratus* infected by *Clinostomum* sp. Our data corroborate the occurrence of clinostomids in this fish species, and furthermore report for the first time infection by *C. detruncatum*, contributing to knowledge of helminth infection in Brazilian freshwater.

ACCACOELIUM CONTORTUM (RUDOLPHI, 1819) LOOSS, 1899 (DIGENEA: ACCACOELIIDAE) IN GILLS AND PREPHARINGEAL TEETH OF SUNFISH, *MOLA MOLA* (L.)

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Accacoelium contortum (Rudolphi, 1819) Looss, 1899 (Trematoda: Accacoeliidae) is the only species of the genus *Accacoelium* Monticelli, 1893. In the parasitological analysis of more than 100 sunfish, *Mola mola*, (Teleostei: Molidae) from Murcia (Spanish Mediterranean), more than 300 specimens of *A. contortum* were collected. The locations of the parasite in the host were mostly gills and prepharingeal teeth, and, to a lesser extent, in the digestive tract. The other sunfish accacoelids were always located in the digestive system (*Accacladium serpentulum* Odhner, 1928; *Accacladocoelium nigroflavum* (Rudolphi, 1819) Robinson, 1934; *A. alveolatum* Robinson, 1934; *A. macrocotyle* (Diesing, 1858) Robinson, 1934; *A. petasiporum* Odhner, 1928; *Rhynchopharynx paradoxa* Odhner,

1928 and *Odhnerium calyptrocotyle* (Monticelli, 1893) Yamaguti, 1934). *A. contortum* is the only ectoparasitic accacoelid species, and one of the only external trematode species. The external environment is an extremely unusual location for a trematode. The attachment organs of these parasites seem therefore not to be prepared to fix the worms to the host external surface and need to highly modify their surrounding environment. For this reason, the parasites produce lesions in gills and prepharingeal teeth, abnormally severe for a trematode, producing large swellings and hollows in tissues. This adaptation is studied in the present work analyzing the relation between the damage degree and this strange habitat for a trematode.

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THE COMMUNITY OF METAZOAN PARASITES OF COMMERCIALLY IMPORTANT WILD MARINE FISH, WHITESPOTTED RABBITFISH *SIGANUS CANALICULATUS* IN SULTANATE OF OMAN

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Whitespotted Rabbitfishes *Siganus canaliculatus* are commercially important demersal fishes in the Sultanate of Oman and other Arabian Gulf countries. They have also been recognized to have high potential as a candidate for mariculture in Mediterranean countries like Egypt, Kuwait, Saudi Arabia and Israel. Several countries have reported parasite infections from *Siganus* spp. (East Africa, Australia, Egypt and China).During a routine fish health survey of commercially important fishes in Sultanate of Oman conducted throughout the period November 2009 to March 2011, a large number metazoan parasites were recovered from whitespotted rabbitfish *Siganus canaliculatus* around the Sea of Oman. A total of 80 medium and large sized specimens from 6 different regions in Oman were examined. Results of this study revealed infections of *S. canaliculatus* with parasites belonging to 7 genera of metazoan parasites. The current study is the first investigation on parasite fauna of a single marine fish host from Omani waters. The study also lists new geographical records.

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PARASITE COMMUNITIES IN THREE SYMPATRIC FLOUNDERS (PLEURONECTIFORMES: PARALICHTHYIDAE): SIMILAR ECOLOGICAL FILTERS DRIVING TO REPEATABLE ASSEMBLAGES

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The relative role of host phylogeny and ecology on parasite community structure is analyzed in 3 sympatric paralichthyids, the carcinophagous *Xystreurys rasile*, and the piscivorous *Paralichthys isosceles* and *P. patagonicus*, from Argentina. Due to their relatedness, inherited ecological and physiological traits and shared past histories are expected to provide certain similarity to parasite assemblages. This is our null hypothesis to focus in the effect of measurable traits (size, age and diet) across fish species, with departures of a general pattern interpreted as consequence of ecological filters preventing homogeneous infections. The % of individuals/species that host-specific parasites contributed to each component community, as well as their effect on similarity of assemblages within/across host species, showed that they were unimportant contributors to abundance, richness and similarity, being irrelevant for the repeatability within component communities and across fish species as a phylogenetically related group. To minimize the effect of variables other than diet or trophic level only trophically-transmitted unspecific parasites were included in further analyses. After controlling for fish size, congeneric fish harboured assemblages significantly different from those found in *X. rasile,* but similar each other because of their shared high trophic levels. Assemblages with equivalent structure, harboured by fish with different age-size relationships, showed that these variables seem to act at dissimilar rates on different features of assemblages. Indeed, age affected mainly the parasite abundance, whereas body size influenced mostly species richness. Concluding, similar ecological filters produce analogous infections across host species driving to homogeneous parasite communities.

PSEUDODACTYLOGYRUS SPP. IN WILD EEL POPULATIONS OF THE UNITED KINGDOM

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The European eel, *Anguilla anguilla*, is an economically important species that contributes to biodiversity within UK and European inland and coastal waters. The numbers of *A. anguilla* have suffered major decline in recent years and the species is now threatened. One contributory factor to this decline is the pathological impact of infectious agents, including parasites. To assist understanding of the role(s) of parasites in eel population decline, we have been conducting epidemiological studies that focus upon eel helminths of the United Kingdom. The gill monogenean *Pseudodactylogyrus* spp. is responsible for development of gill filament lesions, hyperplasia and haemorrhaging; collectively termed pseudodactylogyrosis, which is considered a major problem to the eel farming industry. However, there is limited information on the extent of *Pseudodactylogyrus* spp. in wild populations of eel in the UK. As such, we are in the process of examining eels from multiple rivers across England and Wales for pseudodactylid infection. Our initial data

confirm that *Pseudodactylogyrus* spp. is present in eels captured from rivers in South Wales and Cumbria, with prevalence ranging from 20% to 70%, whereas specimens examined from river systems in North Wales are non-infected. We are currently speciating these monogeneans with a view to better understanding their distribution amongst UK eel populations and facilitating improvements to the management of European eel stocks in the United Kingdom.

HOW IMPORTANT IS *SICYASES SANGUINEUS* IN THE LIFE CYCLE OF *PROCTOECES LINTONI* IN THE INTERTIDAL OF CENTRAL CHILE?

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In Chile, one of the host-parasite systems that has received considerable attention involves the *Proctoeces lintoni* trematode (Digenea: Fellodistomidae), which has been found in the gonad of keyhole limpets *Fissurella* spp. and in the intestine *Sicyases sanguineus* (clingfish). It has been reported that *P. lintoni* is transmitted to the clingfish, the definitive host, through consumption of the limpet, the intermediate host that harbors the metacercaria stage. However, the presence of ovigerous parasites in *Fissurella* spp. has been considered evidence of the progenetic development of *P. lintoni* that has brought to the limpets as alternative definitive hosts to the clingfish. In this context, the aim of this study was to compare aspects associated with the parasite population dynamic on limpet and clingfish, to assess it quality of final hosts. We developed a simple mathematical model to investigate the population biology of *P. lintoni* on the keyhole limpet *F. crassa* and on the clingfish *S. sanguineus* using prevalence, parasite abundance and fertility data over 7 years of field study. The simulations show that in the absence of clingfish, increased growth of limpets favors the parasite abundance in the system, increasing the survival of limpets and thus of the parasites. These results corroborate empirical evidence showing that at the same age, parasitized limpets have larger body size than unparasitized limpets. Finally, we discuss the use of the clingfish as definitive hosts of the *P. lintoni* trematode and we propose that the system *P. lintoni*-*S. sanguineus* is more the exception than the rule in the intertidal of central Chile.

SWEDISH INVESTIGATIONS OF PARASITIC INFECTIONS IN FARMED AND WILD PERCH (*PERCA FLUVIATILIS*) COLLECTED FROM THE NORTHERN COUNTY OF VÄSTERBOTTEN DOWN TO THE COASTAL WATERS OF ÖSTERGÖETLAND.

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European perch (*Perca fluviatilis*) is the most widespread fish specie in fresh- and brackish waters in Sweden. It is a popular specimen for sport fishermens, important for the fish industry and is also playing an import part in the Swedish aquatic ecosystem. During the last years it's interest as a new fish farming specie have increased. Both projects at Swedish universities and also private initiatives in Sweden have focused on the technical side of the development of perch farms. When put into reality this approach have faced several problems, some where the fish health and parasitic problems have played an important role. To better understand what kind of microbial threats the perches will encounter in Sweden a pilot project at SVA investigated these threats during 2010 in some wild perch populations from different parts of Sweden. The project was supported by KSLA (The Royal Swedish Academy of Agriculture and Forestry). Other investigations at SVA have diagnosed several parasitic perch diseases that where found in new small pilot farms. These experimental farming facilities encountered several fish health problems that gave important information on what kind of infections that could be encountered and become problematic when these farms would go over from experimental to commercial farms. Results from these different studies will be presented as examples of what kind of infections that will and can become a problem for the future perch farming activities in northern Europe.

IDENTIFICATION OF PARASITES COMMERCIALIZED AS ORNAMENTAL FISH IN THE CITY OF SÃO PAULO, BRAZIL

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The Discus fish is an endemic fish from the Amazon basin and it possesses a great importance in the ornamental fish market, both in national and international scale. Even with technological pack for its creation in captivity, most of the animals sold are resulted from extractivist fishing. juveniles of big fishes as *Pseudoplatystoma corruscans* are also sought for this purpose. The studies of the parasitic fauna of these animals are fairly precarious, despite of their great economic and ecological value as they are transported to several regions of the world, disseminating their parasites. The transport conditions of these animals are not always adequate and overall generate stress, as a result the susceptibility of diseases, including parasitic increases. Due to no information about the parasitic fauna, these animals go through a variety of treatments, mostly unnecessary, to finally achieve the location of commercialization. Aware of these conditions, in a preliminary analysis 2 were collected from each fish species in aquarium store in São Paulo. The *S. discus* parasited by Nematoda *Contracaecum* sp. larvae encysted in mesentery. The parasites presented an intensity of 10 and 3. The *A. ocellatus* had seven gill monogenetic *Gusevia asota* and one of nine fish were infested with cysts of the digenetic genus *Ascocotyle* sp. which also occurred, in large numbers, the gills of *P. corruscans*. Just one example of the latter fish was found in the gut

cyst Nematoda. The nematode of the genus *Contracaecum* sp. belong to the family Anisakidae which own the zoonosis character, what becomes alarming knowing this fish is served as a human food in the Amazon region. Studies with a larger number of animals are necessary to presume the Discus fish serves as a secondary host in this parasite.

NEW PROTEOCEPHALIDEAN CESTODE (PROTEOCEOPHALIDEA: PROTEOCEPHALIDAE), PARASITE OF THE CALLICHTHYIDAE (PISCES: SILURIFORMES) FROM THE PARANÁ RIVER BASIN, ARGENTINA

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The Proteocephalidea are widely distributed in the Neotropical Region. During a parasitological survey of fishes in the Parana River, an undescribed cestode was collected from callichthyids. The aim of this work is to elucidate the taxonomic status of this cestode. Worms found in the gut were isolated, fixed and processed following helminthological techniques to study internal morphology and the microthrix pattern. The new species belongs to the Proteocephalinae because it possesses ovary, vitelline follicles, uterus and testes in medullary position and are characterised by a small scolex with spherical uniloculate suckers and a large apical organ; a small strobila with low number of proglottides, all longer than wide; a weakly developed internal longitudinal musculature; an ovary delicate, H-shaped, with each branch slender and strongly folliculated at the extremes, situated at 25-33% from posterior end of mature proglottis; a uterus preformed, extending posterior to ovary in mature proglottides; a genital pore equatorial situated at 47-53% from anterior margin of mature proglottides; 40-48 testes per mature proglottides in 2 lateral lines; and acicular filitriches and gladiate spinitriches on the tegumental surfaces. The new worms could not be accommodated to any recognized genera, and represent a new genus within the Proteocephalinae. The subfamily currently has 14 genera; the new specimens were only compared with the 6 genera parasitizing South American freshwater fishes. They differ from *Brayela*, *Euzetiella*, *Pseudocrepidobothrium* and *Scholzia* by the shape of suckers and the morphology of strobila. In addition, the specimens differ from *Cangatiella* and *Proteocephalus* by the shape and position of ovary, and the distribution of testes. This is the first record of a proteocephalid from callichthyid hosts.

SENSING OF POLYCHLORINATED BIPHENYLS IN HEAVILY POLLUTED WATER RESERVOIR IN EASTERN SLOVAKIA USING FISH AND THEIR INTESTINAL PARASITE *ACANTHOCEPHALUS LUCII*.

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Levels of PCBs were measured in several organs and adipose tissue of 9 freshwater fishes as well as in thorny-headed worm *Acanthocephalus lucii* from the heavily polluted water reservoir Zemplínskašírava (Eastern Slovakia). In May and September 2004 and 2009, a concentration of six PCB congeners (28, 52, 101, 138, 153, 180) was determined. Tissue-specific differences in PCB concentrations were observed: liver > adipose tissue > muscles > hard roe > bones > brain expressed on a lipid weight basis. With respect to individual congeners, PCB 153 dominated being present in highest concentrations in comparison to other congeners in all fish organs as well as adipose tissue. Acanthocephalans, attached in the intestine of fish, absorbed high concentrations of PCBs and thus indirectly contributed to the decrease of PCB load in their fish hosts. Total PCBs broadly correlated with the trophic position of individual fish species within a food chain ($p < 0.01$). The concentrations were particularly high in predatory fish species, perch, pike and pike-perch (108.0, 90.1, 113.0 $mg.kg^{-1}$ lipid wt, respectively), but comparable PCB values were also found in non-predatory detrivorous freshwater bream (128.0 $mg.kg^{-1}$ lipid wt).The lowest PCB values were surprisingly assessed in European eel (17.1 $mg.kg^{-1}$ lipid wt). The study have shown that the kind of fish, its feeding habit and specific conditions of the habitat are mutually interrelated factors that are responsible for significant variations in fish body burdens. For human health, our findings of PCB values detected in muscles of fish were of great importance because the maximum permissible levels of these pollutants estimated for food (fish muscles) were exceeded several tens times.

USE OF MEBENDAZOLE FOR MONOGENEA CONTROL DURING TRANSPORT OF TAMBAQUI (*COLOSSOMA MACROPOMUM*)

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This study evaluated the use of mebendazole during two and four hours transport against monogenean in tambaqui (*Colossoma macropomum*). Fish naturally infected were subjected to transport for two and four hours in solutions containing 0, 10, 50 and 100 mg of mebendazole/L of water. Two duplicates were performed for each transport time, with the determination of initial infestation in each population prior to transport. Immediately and one week after transport, blood
samples were collected for analysis of glucose, after which the animals were sacrificed, their gills removed and fixed in formalin for the monogenean count. The results of the mebendazole application during two hours promoted low efficiency in controlling parasites, 35% in the concentration 100mg/ L, and under other concentrations no difference was observed from the control group. The number of parasites increased in all groups, seven days after treatment in the two hours transport. The concentrations of 10, 50 and 100 mg mebendazole / L for 4 hours of transport showed efficiency of approximately 53, 57 and 62%, respectively, in reducing the number of parasites. In the four hours exposure treatment the product had a toxic effect, causing 100% mortality seven days after treatment. Glucose plasma levels showed a normal increase after transport of two hours, including the control, indicating that the use of mebendazole did not induce stress and that the animals had tolerance to the treatment. However, after four hours of exposure it was observed

hyperglycemia and the animals became lethargic. Therefore, we concluded that the tambaqui is tolerant to mebendazole during transport for short time (2 h) but the product does not show effectiveness in controlling monogenean in the concentrations evaluated.

MORPHOLOGICAL AND MOLECULAR CHARACTERIZATION OF *ANISAKIS* LARVAE (NEMATODA: ANISAKIDAE) IN CUTLASS FISH *TRICHIURUS LEPTURUS* (L.) FROM BRAZILIAN WATERS

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Many adult nematodes of the family Anisakidae are parasites of aquatic mammals and fish-eating birds. Fishes usually act as intermediate hosts and consequently human infections may occur. Studies with the aim of identifying these parasites using molecular methodologies have helped to elucidate aspects of their taxonomy and ecology, their life-history and their hosts' ecology. Such studies have until recently been scarce in the brazilian coast. In this study, we collected anisakid larvae from *Trichiurus lepturus* off the coast of Brazil between August, 2010 and January, 2011. The body length of the larvae was measured directly and subsequently they were cut into three pieces: the anterior and posterior regions of individual larvae were cleared in glycerine for morphological identification and the middle portion was used to characterize the specimen genetically. Genomic DNA was extracted using a Charge Switch gDNA Mini Tissue kit (Invitrogen) according to the manufacturer's instructions. PCR followed by DNA sequencing was carried out using primer NC5/NC2 and *Anisakis* ITSF/ITSR designed to amplify a fragment of internal transcribed spacer ITS1, 5.8S and ITS2 of nuclear ribosomal DNA of anisakids and *Anisakis typica*, respectively. The sequencing was performed using a Big Dye Terminator kit (Invitrogen). From the 63 larvae recovered from 10 fish hosts, 14 were identified as *Anisakis* by morphological analysis of the anterior and posterior regions of parasites. The sequences alignments matched a 100% with *Anisakis typica* sequences deposited in GenBank recovered from adult worms taken from marine mammals in the southwestern Atlantic. The morphological data and genetic sequences alignments are presented.

TESTING ORIGIN OF THE FIRST "DAUGHTER" OF VIVIPAROUS GYRODACTYLIDAE

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Gyrodactylidae is a family within Monogenoidea represented by both oviparous and viviparous species. The viviparous clade is worldwide spread and has high species diversity likely associated to extensive adaptive radiation. One of the traits that contributed for the diversification of the group is the hipervivipariy since it allows the origin of an infrapopulation from a single parasite. The viviparous Gyrodactylidae are protogynous and the male copulatory organ (MCO) is formed only after birth of the first "daughter" worm. Thus, the origin of the first "daughter" is likely not a result of cross-fertilization. It is also not clear how most internal embryos become pregnant. Results of the main embryological studies are controversial and date from 1904 and 1966. The most accepted hypothesis is that the first embryos are generated by parthenogenesis, but the mechanisms involved are not yet elucidated. In this study, we describe the first results of an experiment whose purpose was to isolate subsequent generations from a single parent worm and determine their genetic profile. If the reproduction is by parthenogenesis, the first-born "daughter" is likely a clone or a near clone of its parent. We used Inter Simple Sequence Repeat (ISSR) markers to compare the genetic profile of each individual worm in a genealogical line. The results suggest that the first "daughter" is not a clone of the "mother" worm, which apparently rejects the hypothesis most widely accepted. While sexual reproduction may be involved in the generation of the first "daughter", the mechanisms associated with the fertilization of the oocyte of a "daughter" worm within the uterus of the "mother" worm is still unclear.

MULTIVARIATE DISPERSIONS OF COMPOSITION VS ABUNDANCE AS DRIVERS OF BETA DIVERSITY IN PARASITE ASSEMBLAGES OF *SERRANUS AURIGA* (SERRANIDAE) ALONG HOST ONTOGENY

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Parasite communities are dynamic systems driven by many interacting factors, among them host ontogeny produces variations in composition and abundance of parasites within assemblages, depending on changes in age, size and trophic level. It has been shown that juvenile fish or those with low trophic level harbour more variable assemblages than their counterparts. Here we analyze the ontogenetic changes in parasite assemblages of *Serranus auriga*, a species with low trophic level, which reaches small sizes at adult stage and feed on similar prey items along its life span. In order to assess the relative role of composition and abundance as drivers of changes in assemblage's structure, multivariate dispersions of infracommunities as measures of b-diversity were calculated using a set of dissimilarity measures with different degrees of emphasis on composition vs. relative abundance information. The average distance from infracommunities to their size class centroid in the multivariate space varied significantly along an ontogenetic gradient for those distance measurements emphasizing abundance, but not for those emphasizing composition. Stochasticity in events of encounter with infective stages, occurring at low densities in previous invertebrate hosts, which seem to be maintained along fish life-span, explains this pattern. On the other had, and as fish grow, assemblage's composition becomes variable in

terms of abundance, but increasing also aggregation of parasite populations, which render higher
inter-host differences within samples of larger fish.

ABOUT THE DIFFICULT SYSTEMATIC POSITION OF AN ACANTHOCEPHALAN OF THE ROUND SCAD, *DECAPTERUS PUNCTATUS* (CUVIER 1829) FROM BRAZIL.

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A total of 152 acanthocephalans were recovered from the intestine of 18 round scad, *Decapterus punctatus* (Cuvier 1829), from the coast of Cabo Frio, Brazil on November, 2008. The specimens clearly fit the diagnosis of the palaeacanthocephalan Order Echinorhinchida and according to its morphological characters they represent a new taxon. However, its assignation to a family status within this order is difficult and problematic. The dorso-ventral asymmetry of the proboscis hooks, as well as the presence of a perfect circle of basal hooks in the proboscis, abruptly larger than anterior hooks and of four tubular cement-glands agree with the characteristics of the genus *Rhadinorhynchus* Lühe 1911 (Rhadinorhynchidae). However, by lacking trunk spines, their inclusion in this family is not possible. Otherwise, *Neorhadinorhynchus* Yamaguti 1939 was erected as a subgenus of *Rhadinorhynchus* to include species with trunk unspined. However, for this feature, it was transferred, as a genus, to Cavisomatinae Meyer 1932 (Echinorhynchidae), which in turn was later raised to family status (as Cavisomidae), including *Neorhadinorhynchus*. Despite all species of *Neorhadinorhynchus* have a basal ring of proboscis hooks, and only two of them show dorsoventral asymmetry in the proboscis, no species of Cavisomide have been described as having basal hooks abruptly larger than precedent ones, a typical rhadynorhynchid characteristic. At present, the taxonomy of Echinorhynchida is complex and unsatisfactory due to the lack of stable characters useful at family-level, as well as to the incomplete descriptions of many species. A major revision of echinorhynchidans, with the assessment of the relative value of trunk spines as diagnostic features at family level is necessary, before giving a generic and family status to the present species.

STOCK COMPOSITION OF THE ROUGH SCAD, *TRACHURUS LATHAMI* NICHOLS IN SOUTH AMERICAN ATLANTIC WATERS: GEOGRAPHICAL PATTERNS OF PARASITE COMMUNITY STRUCTURE AS DISCRIMINATING TOOLS

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The aims of this study were: 1) to evaluate the effect of short- and long-term variability of parasite communities of *T. lathami* in a single locality and 2) to identify the existence of different stocks in three zones of south-west Atlantic waters. In total 273 specimens of *T. lathami* were examined. To assess the effect of both short term and long term variability on parasite burdens, three monthly samples were obtained from Miramar (MI) and two samples from Villa Gesell separated by a period of one year (VG) (Buenos Aires province, Argentina), respectively. To reveal differences between zones a third sample from Cabo Frio (CF) (Brazil) was analized. Differences across localities were analyzed after pooling fish from each Argentinean locality. All rough scad were parasitized by at least one of 27 parasite species. Similarity-based multivariate analysis showed no significant variability among the assemblages between both monthly and annual samples, but highly significant differences among localities. Comparisons of both prevalence and abundance between zones showed that the lower and higher number of differences occurred for the pairs MI-VG and CF-MI, respectively. A canonical analysis of principal coordinates showed significant differences among samples. *Grillotia carvajalregorum* was the most important species in determining the position of Argentinean samples, especially those from MI, while *Ectenurus virgulus*, *Raphidascaris* sp. and *Hysterothylacium* sp. were the most important species related to fish from CF. The parasite assemblage of *T. lathami* showed a notable persistence at both short- and long-term temporal scales within the same locality and a high variability at spatial scale, constituting an evidence of the existence of three independent stocks of *T. lathami* in South Atlantic waters.

BIODIVERSITY OF ZOOPLANKTON OFF THE COAST OF NAMIBIA AND ITS ROLE AS INTERMEDIATE HOST OF FISH PARASITIC *HYSTEROTHYLACIUM ADUNCUM*

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The Benguela region off the coast of Namibia is one of the most active upwelling regions of cold and nutrient rich water in the world due to perennial conditions over the Namibian shelf. Zooplankton communities of the Benguela ecosystem are characterized by high individual abundance and low endemism. Generally zooplankton is commonly used as first or intermediate host in the life cycle of fish parasitic helminths. In the present study plankton samples had been taken 2008 during the research cruise of the RV Maria S. Merian off the coast of Namibia with a $1m^2$-Double-MOCNESS-net for parasitological examinations. Copepoda (n = 9635) and Euphausiacea (n = 8140, e.g. *Euphausia hanseni* and *Nematoscelis gracilis*) were digested in a pepsin solution. No helminth larvae had been detected in the filtrate. The examined *Sagitta* spp. (Chaetognatha) (n = 350) from the offshore station were infected with L3-larvae of *Hysterothylacium aduncum* (Nematoda, Raphidascaridae) with a prevalence of 6.86 %. Either the investigated crustacea did not

serve as intermediate hosts or, more likely, the infection rates are quite low and the examined quantity is to small to prove an infection. Chaetognatha are active predators of Copepoda and serve as paratenic hosts in the life cycle of *H. aduncum* in the Benguela upwelling system.

NEW SPECIES OF *ACANTHOCHONDRIA* (COPEPODA: CHONDRACANTHIDAE) PARASITIZING THE LONGTAIL SOUTHERN COD, *PATAGONOTOTHEN RAMSAYI* (PERCIFORMES: NOTOTHENIIDAE) FROM PATAGONIAN WATERS, ARGENTINA

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A new species of parasitic copepod belonging to the genus *Acanthochondria* (Copepoda: Chondracanthidae) is described and illustrated based on specimens of both sexes collected from inner surface of the operculum of the longtail southern cod, *Patagonotothen ramsayi* (Regan) (Perciformes: Nototheniidae), from the Patagonian Shelf, Argentina (42–48°S; 60–63°W). The new species is characterized by the combination of a Type B-III antennule and Type A leg 2, in addition to both the cephalosome and the trunk being wider than long. The new species most closely resembles *A. incisa* Shiino, 1955, *A. ophidii* (Krøyer, 1863), *A. priacanthi* Shiino, 1964, and *A. tasmaniae* Heegaard, 1962, but differs from these species in the general measurements and proportions of the body, shape and size of head, shape and size of genitoabdomen and fine details of appendages such as the armature of antennule, ornamentation of both pairs of legs, number of teeth on mandible and maxilla, and ornamentation on maxilliped. This is the first *Acanthochondria* species recorded from a nototheniid and the second southernmost record of a species of this genus in the southwestern Atlantic Ocean.

PARASITE INFRACOMMUNITIES OF *HELICOLENUS LAHILLEI* NORMAN, 1937 (SCORPAENIFORMES: SEBASTIDAE) IN THE SOUTHWEST ATLANTIC OCEAN

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Helicolenus lahillei Norman, 1937 (rubio) is a benthopelagic deep-water fish that inhabits the continental shelf edge and upper slope, occurring off Uruguay, north Argentina and south Brazil. A total of 139 specimens of *H. lahillei* (LT: 17.7 ± 2.5) obtained from a research cruise (36.0-37.0°S – 53.5-54.5°W) carried out during February, 2008 were examined for parasite in order to describe its parasite infracommunities for the first time. From the total sample, 94.2% fish were parasitized with at least one of the 18 parasite species recorded: 2 monogeneans (*Microcotyle* sp. and *Neodiplectanotrema helicoleni*); 1 copepoda (*Acanthochondria helicoleni*); 1 acanthocephalan (*Corynosoma australe*); 4

cestodes (*Grillotia* sp1 and sp2, *Hepatoxylon* sp. and an undifferentiated larvae); 3 digeneans (*Derogenes varicus*, *Elytrophaloides oatesi* and *Psettarium* sp.); 5 nematodes (*Contracecum* sp., *Anisakis simplex* s.l. and *Hysterothylacium* sp. –all as larvae-, *Hysterothylacium aduncum* adult and larvae, and *Cucullanus incertus* adult); and 2 myxozoan (*Myxidium* sp. and *Ceratomyxa* sp.). We collected 737 macroparasite individuals (total mean abundance = 5.7 ± 4.3); being *H. aduncum* the most abundant species that dominated 53.4% of infracommunities. The values of infracommunity diversity descriptors were: species richness = 3.0 ± 0.9 (2-5); diversity (Brillouin) = 0.5 ± 0.2; dominance (Berger-Parker) = 0.6 ± 0.2 and evenness = 0.8 ± 0.2. Although the species richness was high at component community level, the low values of infracommunity descriptors and especially of abundance, when compared with other small benthic fishes of the region, could reflect the influence of the cold water Malvinas Current.

NEW RECORDS OF PARASITIC COPEPODS (CRUSTACEA: COPEPODA) FROM MARINE FISHES IN THE ARGENTINEAN SEA

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Global climate change is impacting the ecology and biogeography of marine fish populations. Some species and populations could be lost if they are unable to adapt to the new conditions or relocate to adequate habitats, while others may flourish and expand their ranges. Due to the dependence of parasitic copepods to their hosts, geographical shifts in their distribution can reinforce the utility of the detection of changes in fish distributions as indicators of global climate change. Therefore we consider necessary to increase the knowledge of the biodiversity of parasitic copepods in the Argentinean Sea that could be used as baseline information to detect future changes in the distribution of the marine biota driven by the global change. We provide new information on the distribution of 13 known species of parasitic copepods gathered by the authors in 11 species of marine fishes from Argentina, including 7 new host records and 9 new locality records. These species are: *Bomolochus globiceps* (Vervoort & Ramírez) and *Nothobomolochus cresseyi* Timi & Sardella (Bomolochidae); *Brasilochondria riograndensis* Thatcher & Pereira (Chondracanthidae); *Taeniacanthus lagocephali* Pearse (Taeniacanthidae); *Caligus rogercresseyi* Boxshall & Bravo and *Metacaligus uruguayensis* (Thomsen) (Caligidae); *Hatschekia conifera* Yamaguti (Hatschekiidae); *Clavellotis pagri* (Krøyer), *Clavella adunca* (Strøm), *Clavella bowmani* Kabata and *Parabrachiella amphipacifica* Ho (Lernaeopodidae), and *Lernanthropus leidyi* Wilson and *Lernanthropus caudatus* Wilson (Lernanthropidae). A list of host species lacking parasitic copepods, for which large samples were investigated by the authors, is also provided in order to compare in future surveys in a scenario where the outbreak of parasitic diseases could occur.

PRELIMINARY ASSESSMENT OF THE FACTORS INFLUENCING THE SPATIAL GENETIC DIFFERENTIATION IN *HELICOMETRINA NIMIA*, 1910 (TREMATODA, OPECOELIDAE).

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Parasite populations are of particular interest due to their fragmented distribution (within/between host in the same area and among geographic areas). These species with complex life cycles constitute an excellent model for understanding microevolution. To date, little is known about how different ecological factors (host environment, the host itself and the interactions of both components) influence microevolutive processes. These processes could be associated to the dispersion capacity of the larval stages and mobility type of the host, among others. Currently, genetic analyses are a powerful method for the study of parasite-host systems. In this study, we used COI and 18S to evaluate the spatial distribution of the genetic variation of an opecoelid parasite at a local scale. As a study model we used *Helicometrina nimia* Linton, 1910, an intestinal parasite found in at least 10 species of marine fish representing 6 families (Serranidae, Haemulidae, Pinguipedidae, Labrisomidae, Gobiesocidae y Ophidiidae) distributed in northern Chile. These different host species differ in their swimming capacity (differential vagility). Herein, we present preliminary results that suggest genetic differentiation at the population level of this parasite species which could be associated with displacement capacity and host habitat fidelity.

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EFFECT OF A CYMOTHOID ISOPOD, *CERATOTHOA* SP., ON BANDED SCAT (*SELENOTOCA MULTIFASCIATA*) FROM WATERLOO BAY (QUEENSLAND, EAST COAST OF AUSTRALIA)

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Cymothoid isopods, *Ceratothoa* sp., are regular buccal parasites of the banded scat *Selenotoca mustifasciata* in the Waterloo Bay, southeast Queensland. To explore sources of variation in prevalence and to test if infestation significantly affects the growth or condition of fish host, buccal cavities and fish condition were analysed for 122 specimens. The internal area of the buccal cavity and the area occupied by the isopod were measured and the relative proportion of free internal area was calculated. Although 97.54 % of banded

scat were infested with *Ceratothoa* sp., only 35.25 % had adult female isopods. Mean intensity of infection of all stages of *Ceratothoa* sp. was significantly higher in larger than in smaller fishes. The fish infected with adult female isopods were significantly longer and heavier than uninfected fish. No serious injury to the fish was detected; condition index, food intensity index and stomach weight did not differ between fish with and without *Ceratothoa* sp. Only the relative free internal area of the oral cavity of hosts infected with adult females showed correlation with food intensity and condition factor. The high prevalence of *Ceratothoa* sp., the lack of pathological alterations, the marginal effect of the isopod on the condition indices and food intensity show that, despite its impressive size, the isopod affects the general well-being of *Selenotoca multifasciata* only slightly.

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HEMINTH PARASITES OF FRESHWATER FISH IN THE STATE OF MORELOS, MEXICO

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During the study of helminth parasites of freshwater fish in Morelos State (Central Mexico), collected from 20 localities, rivers, lagoons and some fish pounds, carried out from 2001 to 2008, fish of 16 species were examined for helminth parasites. A total of 37 species of helminths were recovered (12 trematodes: *Creptotrema agonostomi, Genarchella astyanactis, Saccocoelioides* cf. *sogandaresi*, Sanguinicolidae gen. sp. (adults), *Clinostomum complanatum, Posthodiplostomum minimum, Tylodelphys* sp., *Uvulifer ambloplitis, Petasiger* sp., *Ascocotyle nana, A. tennuicolis, Centrocestus formosanus* (larvae); 11 monogeneans: *Cichlidogyrus sclerosus, Dactylogyrus dulkeiti, D. intermedius, D. vastator, Cleidodiscus sp.,Salsuginus sp., Characithecium costaricensis, Urocleidoides strombicirrus, Gyrodactylus* sp.1, *Gyrodactylus* sp.2, *Gyrodactylus* sp.3, 5 cestodes: *Botriocephalus acheilognathi, Corallobothrium fimbriatum* (adults), *Glossocercus auritus, Valipora mutabilis, Ligula intestinalis* (larvae); 8 nematodes: *Camallanus cotti, Capillaria cyprinodonticola, Dichelyne mexicanus, Rhabdochona ahuhuellensis, R. canadensis, R. kidder, R. mexicana* (adults), Acuariidae gen. sp., *Serpinema trispinosum, Eustrongylides* sp. (larvae), and 1 acanthocephalan: *Polymorphus brevis* (larva) from different organs. All descriptions were based on evaluation of original material.

CAN ECTOPARASITES OF ATLANTIC CHUB MACKEREL, *SCOMBER COLIAS*, AND ATLANTIC MACKEREL, *S. SCOMBRUS*, BE USED AS BIOLOGICAL TAGS TO DISTINGUISH BETWEEN THE TWO HOST SPECIES?

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Atlantic chub mackerel, *Scomber colias* Gmelin, 1789, and Atlantic mackerel, *S. scombrus* Linnaeus, 1758, (Scombridae) are two morphologically similar fish species that inhabit Atlantic waters. The common methods used to clearly distinguish these species are invasive and time consuming. The present study aimed to evaluate to what extent ectoparasites might be used as biological tags to easily distinguish *S. colias* from *S. scombrus*. To accomplish this objective, 40 *S. colias* and 42 *S. scombrus* were analyzed; ectoparasites were isolated, counted and identified. Parasitological parameters, prevalence (P) and abundance (A) were determined. In *S. colias*, 4 species were detected: *Pseudokuhnia minor, Grubea cochlear* and *Kuhnia scombri* (Monogenea) as well as individuals of the family Gnathiidae (Isopoda), the latter described for the first time in this host. *P. minor* recorded the highest prevalence (97.5%) and mean abundance (23.95 ± 22.34). In *S. scombrus*, 6 species were isolated: *K. scombri, K. sprostonae* and *G. cochlear* (Monogenea), *Caligus pelamydis* and *Clavellisa scombri* (Copepoda) and an individual of an Aegidae (Isopoda). *C. pelamydis* occurred with the highest prevalence (69.0%) and mean abundance (3.12 ± 4.33). Comparing the parasitological parameters among the two host species, several statistically significant differences were found. Indeed, it was possible to consider 4 ectoparasite species as good biological tags: *C. pelamydis* (recorded only in *S. scombrus*, with high prevalence values), *P. minor* (present only in *S. colias*, with very high prevalence and abundance values), *G. cochlear* and *K. scombri* (recorded in both fish species, but being more prevalent and abundant in *S. scombrus* than in *S. colias*).

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AN UPDATED KEY TO SPECIES OF *OCTOPICOLA* (CRUSTACEA: COPEPODA: OCTOPICOLIDAE)

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Octopicolids are minute copepods, difficult to discern to the naked eye or with a poor stereoscope, that were described to live in exclusive association with octopuses. Originally, they were placed within the Lichomolgidae Kossmann, 1877, a big family of poecilostomatoid copepods consisting, mainly, of associates of marine invertebrates. However, their systematic position at the family level was controversial since the beginning. Moreover, in the description of the first species known to science, i.e. *Octopicola superba* Humes, 1957, some important morphological differences were recognized between that species and other species of lichomolgids. The higher systematics of octopicolids was revised in 1996 by Humes and Boxshall. At that time, they erected the family Octopicolidae to accommodate all the taxa known
to date, arguing that the female members of this new family diverged from those within all other families of the lichomolgid complex in retaining the primitive 6-segmented condition of the urosome. Unfortunately, the identification key of Humes and Stock for the genus *Octopicola*, dating of 1973, was not updated so far, though another species, that is, *O. regalis*, was described only 1 year after its publication. Indeed, other morphological characters besides the ones considered by Humes and Stock seem valuable in distinguishing between different species. These
additional differences are the total body length, the shape of the genital somite, the length:width ratio of the caudal ramus and the female reproductive investment (egg number and size). Accordingly, a new key for Octopicola is proposed.

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SALT EFFECT ON PHYSIOLOGICAL RESPONSES AND MONOGENEAN CONTROL IN TAMBAQUI (COLOSSOMA MACROPOMUM).

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The main goal of this work was to evaluate the effect of salt on physiological responses and monogenean control in tambaqui (*Colossoma macropomum*). For this, tambaqui juveniles

(42.38 ± 0.47 g; 13.90 ± 0.06 cm) were kept in 350L tanks and acclimated during a period of 24 hours. The assays were conducted using the concentrations of 0, 2, 4, 6 and 8 g of salt.L-1 of water, with exposure of 30, 60 and 120 minutes, and three replicates for each treatment. The tambaqui tolerance to salt and the efficacy of salt against monogenean were evaluated by physiological analysis (glucose, chloride, sodium and potassium plasma levels) and parasitic indices (total number of parasites and prevalence). The exposure of tambaquis to salt in the concentrations of 4 g.L-1 during 120 minutes, 6 and 8 g.L-1 during 60 and 120 minutes promoted the increase of plasmatic glucose and in the concentration of 8 g.L-1 of salt for 120 minutes increased the levels of plasmatic chloride. The prevalence of monogeneans in the gills of tambaquis was 100% and the salt concentrations evaluated in this study were not effective in the reduction of monogeneans parasites in tambaquis.

THE EFFECT OF FISH PLOIDY LEVEL ON THE STRUCTURE OF METAZOAN PARASITE COMMUNITIES OF TENCH (*TINCA TINCA* L.)

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Polyploidy, the multiplication of entire sets of chromosomes, have been observed in several phylogenetically distant plant or animal orders, including both wild and farmed fish species. Polyploidization is a common method applied in fish commercial aquaculture. In the present study, we compared selected somatic parameters between diploid (2n) and triploid (3n) specimens of tench and we tested whether there is a relationship between metazoan parasite load and fish ploidy level. Tench, cyprinid fish species commonly used for induction of triploidy in aquaculture, was investigated in this study. Fish samples were collected from breeding pond in Vodňany (Czech Republic) during four periods (September 2008, December 2008, March 2009, June 2009), and 86 diploid and 74 triploid specimens were investigated. A total of 13 metazoan parasite species (*Gyrodactylus tincae, Asymphylodora tincae*, *Diplostomum* sp., *Tylodelphys clavata, Archigetes sieboldi, Caryophyllaeus* sp., *Khawia baltica, Neogryporhynchus cheilancristrotus, Valipora campylancristrota, Anodonta* sp., *Argulus foliaceus, Ergasilus sieboldi* and *Hydrozetes* sp.) were recorded. The significant differences in most of measured somatic parameters were observed between diploids and triploids. Neither host body size nor host sex had any effect on metazoan parasite abundance. The comparison of the total parasite abundance between diploid and triploid tench showed statistically significant higher parasitic load in diploids. Likewise, the significant higher abundance of endoparasites was recorded in diploids. The effect of ploidy level on ectoparasite occurrence was not found.

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MONOGENOIDEA FROM *CENTROPOMUS* SPP.: SALINITY INFLUENCES SPECIES RICHNESS?

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Guandu River is the most important resource of water supply of the city of Rio de Janeiro, Brazil and municipality, being characterized by presenting a great fish diversity and biomass of the Sepetiba bay watershed. Snooks are euryhaline fishes that migrate between marine and freshwater habitats. *Centropomus parallelus* (Poey, 1960), commom named "robalopeba", with coastal habits, occurring from South Florida, United States to southeast Brazil, in estuarine and lagoon regions, reaching freshwater. *C. undecimalis* (Bloch, 1972), common named "robalo-flexa" inhabits part of its life in estuarine habitats, migrating to the entrance of the ocean to spawn. Specimens of *Centropomus paralellus* and *C. undecimalis* from Guandu River were examined. Gills arches were removed and placed in vials containing 1:4000 formalin, after which, formaldehyde was added to reach 5% solution. Specimens were mounted unstained in Hoyer´s medium for study of the sclerotized parts and studied by light microscope. During studies on Monogenoidea fauna of *Centropomus* spp., three species of *Rhabdosynochus*, *R. hargisi, R. hudsoni, Rhabdosynochus* sp. were found parasitizing *Centropomus undecimalis* and *C. paralellus* and the microcotylid *Anakohnia brasiliana* was found only in *C. paralellus*. *R. hargisi* was more prevalent in *C. undecimalis*, followed by *R. hudsoni* and *Rhabdosynochus* sp., while in *C. paralellus*, *Anakohnia brasiliana* presented the higher prevalence. The present paper analyzes the occurrence of these species on two hosts examined, correlating to previous studies, giving new data on host distribution, and demonstrating the high tolerance of these ectoparasites with range of water salinity, allowing infestation by other members during migration.
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HELMINTH PARASITES OF *CTENOSCIAENA GRACILICIRRHUS* (METZELAAR, 1919) (PERCIFORMES: SCIANIDAE) FROM THE COAST OFF ANGRA DOS REIS, RIO DE JANEIRO STATE, BRAZIL.

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The study of helminth fauna of marine fishes is very important to understand biological and ecological aspects and the host-parasite relationship. Considering that mostly fish species are economically important, the presence of these helminths depreciates their commercial value, and some nematodes and trematodes larvae have a zoonotic potential. From August 2008 to February 2009, 203 specimens of *Ctenosciaena gracilicirrhus* from the Atlantic Ocean, off Angra dos Reis, Rio de Janeiro State, Brazil were collected in order to determine the helminth fauna of this species of fish. Ten species of metazoan parasites were collected: one species of Monogenea (*Choricotyle rohdei*); three species of Nematoda (*Hysterothylacium* sp. third stage larvae, *Raphidascaris* sp. third stage larvae, and *Procamallanus* (*Spirocamallanus*) *pereirai* third and fourth stage larvae and adults); six species of Digenea (*Opecoeloides pedicathedrae*, *Opecoeloides melanopteri*, *Diplomonorchis leiostomi*, *Aponurus laguncula*, *Parahemiurus merus* and *Manteriella* sp.).*Choricotyle rohdei* and *Hysterothylacium* sp. had the highest prevalence, mean

intensity and abundance. An aggregated pattern of distribution was observed in both, *C. rohdei* and *Hysterothylacium* sp. A positive correlation between the standard length of hosts and the parasitic abundance of *Hysterothylacium* sp. and *Choricotyle rohdei* was observed. The prevalence of *Choricotyle rohdei* was positively correlated with standard length of the host, while in *Hysterothylacium* sp. there was no correlation. *C. gracilicirrhus* represents a new host record to all species of Nematoda and Digenea presented herein. The genus *Manteriella* (Manter, 1947) is reported for the first time in South America. The new data enhanced the knowledge of the biodiversity.
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DOES SIZE MATTER? THE CASE OF THE LESSER-ENDOWED MONOGENEANS....

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Paperna (1979) discusses a number of monogeneans from African hosts. These include *Dactylogyrus pseudanchoratus* from *Barbus* spp. (Gabon and Tanzania) with short cirrus (20 to 30 micrometers). In comparison *Dactylogyrus helicophallus* from *Labeo* spp. (Uganda, Kenya and Tanzania) has a long (32 to 82 micrometers) cirrus. *Dactylogyrus pseudanchoratus micronchus* from *Labeo* sp. (Tanzania) has a cirrus of intermediate length (28 to 38 micrometers). This, together with anchor lengths, indicates that a range of intermediate forms may exist. During January 2010 two South African *Labeo* spp. were sampled from the Vaal Dam (Gauteng province, South Africa) using gill nets. Monogenean parasites were collected from gill smears and mounted in Malmberg's solution or glycerine jelly. Sclerotized parts were drawn using a drawing tube and compound microscope. Measurements were made from drawings. A new *Dactylogyrus* species was encountered that exhibited two forms typical to each of the host species examined. These forms mainly differ with regards to anchor size (larger in specimens from *L. capensis*), with short copulatory structures (cirrus length 16 to 33 micrometers) in both forms resembling that of the apparent *D. pseudanchoratus* "species complex". The anchor morphology (total and inner root length) of the two forms appears to be host specific and may be related to differences in host gill morphology. Molecular studies have become standard practice with regards to taxonomy of larger monogeneans (e.g. *Gyrodactylus* spp.). However, with regards to *Dactylogyrus* spp. the majority of molecular studies are concerned with evolutionary parasite-host relationships (i.e. phylogeny) and not species descriptions (i.e.taxonomy).

ECOLOGY OF THE *PROCAMALLANUS* (*SPIROCAMALLANUS*) *IHERINGI*, ENDOPARASITE OF *APAREIODON IBITIENSIS* (TELEOSTEI, PARODONTIDAE) OF THE SAO JOAO RIVER BASIN, PARANA, BRAZIL.

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This study investigated the influence of environmental factors, body size and sex of the *Apareiodon ibitiensis* (Amaral Campos, 1944) on the parasite fauna. A total of 33 specimens were collected in several environments of the Sao Joao river basin, Parana, Brazil, in the period between July 2010 and December 2010. The endoparasite`s prevalence was 51.5%, and it was composed by a single species of the nematode *Procamallanus* (*Spirocamallanus*) *iheringi* Travassos, Artigas et Pereira, 1928. Statistical tests were applied to check the influence of hosts attributes on the endoparasite fauna. The host`s sex may have influence in the parasitism levels due to behavioral and physiological differences between the fishes. However, the tests U from Mann-Whitney (Z=0.67; p=0.25) and G log likelihood test (G=0.30; p=0.57) didn't confirmed such influence. This is probably related to the similar reproductive strategies between males and females. The abundance of the parasite *P.* (*S.*) *iheringi* did not show a significative correlation (rs = -0.163; p = 0.37) with the body size of the host. It was not observed a significative correlation (r = -0.42; p = 0.34) between body size of the host and the prevalence of *Procamallanus* (*S.*) *iheringi*. No significant correlation between the Kn of parasitized and non parasitized fish and abundance of *P.* (S.) *iheringi* found. Therefore, none influence of parasitism in the *A. ibitiensis* was found by the use of quantitative indicators of the well-being condition of the host. In relation to the sites of collection it was not verified significant correlation with abundance of the parasitism (H=2.06; p=0.35). These sites did not differ among themselves, probably because they are not far from each other and there is not a strong anthropogenic influence in those environments.

ECOLOGY OF THE ENDOPARASITES OF *BRYCON ORBIGNYANUS* (TELEOSTEI, CHARACIDAE) OF THE UPPER PARANA RIVER FLOODPLAIN, PARANA, BRAZIL.

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Brycon orbignyanus (Valenciennes, 1850) is a neotropical migratory freshwater fish, distributed in the Parana-Uruguai basin, mainly in the Grande and Parana rivers. In order to analyze the parasite incidence, were collected 31 specimens of *B. orbignyanus* from the floodplain of the upper Parana River, in the period from September 2010 to May 2011, from the subsystems Ivinheima, Baia and Parana. It were found the following species of endoparasites: adult nematode *Procamallanus* (*Spirocamallanus*) *hilarii*, larvae of nematodes of the genus *Hysterothylacium, Contracaecum*, adults of the species of Acanthocephala *Echinorhynchus briconi* and cestodes of the species *Monticellia spinulifera*, encysted in the mesentery. For statistical analysis, we considered all species of parasites. All species showed a prevalence of 63.33%, mean abundance of 2.16 and mean intensity of 3.42. The Pearson`s (r = 0.31, p = 0.38) and Spearman's correlation (rs = 0.07, p = 0.68) shows that did not there was a significant relationship between host standard length and the prevalence and abundance of parasitism, respectively. Using the U test of Mann-Whitney (Z = 0.98, p = 0.16), we found that the host`s sex did not influence the abundance

of parasites. However, the G log likelihood test ($G = 3.93$, $p = 0.04$) showed that host sex had a positive effect on the prevalence of species of parasites. The U test of Mann-Whitney ($Z = 0.66$, $p = 0.25$) showed that relative condition factor (Kn) did not differ significantly between parasitized individuals and non-parasitized. The occurrence of endoparasites of complex life cycles in *B. orbignyanus* may be a consequence of the wide variety of food host.

USING ECOLOGICAL NETWORK ANALYSIS TO TEST PREDICTIONS ON THE LIMITATION OF HOST-SWITCH BY OVIPAROUS GYRODACTYLIDAE

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Gyrodactylidae is a taxon of great importance due to biological and economic factors. It includes oviparous and viviparous species. This is the only family of Monogenoidea that reproduces by hyperviviparity. Oviparous species are apparently restricted to South American and occur mainly in species of Loricariidae, whereas viviparous species have a worldwide distribution. Boeger et al. (2003) tested the hypothesis that the viviparous clade shows great diversification as a consequence of extensive adaptive radiation. As the model proposed by these authors, the viviparous species disperse due to its ability to host switch and, consequently, due to the ability to colonize new biogeographic regions. The oviparous clade is characterized by the production of egg with an adhesive droplet that serves to set the eggs on hard surfaces, providing an increase in the survival and success of larval form. However, the egg with adhesive droplet probably reduced the capacity of oviparous species to host-switch, limiting the range of potential host targets. Apparently because of this egg type, some symplesiomorphic features of Gyrodactylidae (in fact of a clade of Gyrodactylinea), which potentially represent key innovations such as the ability of multiple transmissions during the lifetime, do not promote adaptive radiation in the oviparous group. Thus, this study tests the hypothesis of Boeger et al. (2003) that predicts that the host spectrum for oviparous gyrodactylids is restricted to species with available hard structures on the body surface (mostly Loricariidae and Callichthyidae). An extensive sampling of fishes from the same stretch of a river on the coast of Parana was analyzed for Gyrodactylidae. The host-parasite relationships encountered are characterized by an analysis of ecological network. The parameters of each network (for viviparous and oviparous species and respective host species) are used to test the hypothesis of host limitation described above.

A NEW GENUS AND SPECIES OF MONOGENEAN (DACTYLOGYRIDAE) FROM THE GILLS OF *SATANOPERCA JURUPARI* (HECKEL) (CICHLIDAE) IN THE GUAMÁ RIVER, AMAZON DELTA, BRAZIL

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Satanoperca jurupari occurs in South America, mainly in the Amazon basin between Peru and the delta of this river in Brazil, with other reports from Bolivia and French Guyana. The only monogenean species previously recorded from this host is *Sciadicleithrum satanopercae*
(Dactylogyridae), which was reported from Peru. During our survey, fish were collected from the Guamá River in the delta region of the Amazon near Belém, Pará State, Brazil (01o27'21"S, 48o30'14"W) by local fisherman. Gills of five fish, previously removed in the field, were fixed in 4% formalin. Monogenean specimens recovered in the laboratory were transferred to 70% alcohol. For light microscopy, some specimens were cleared in Hoyer´s medium or stained with Gomori's trichrome, cleared in clove oil and mounted in Canada balsam. The worms were studied under bright-field and phase contrast microscopy. Diagnostic characters of the new genus and species include: the arrangement of the gonads, two pairs of eye-spots, a basally articulated male copulatory organ and accessory piece, a ventral bar with a median process and a vagina with a sclerotized tube.

A NEW SPECIES OF *RAPHIDASCARIS* (SPRENTASCARIS) (NEMATODA: ANISAKIDAE) FROM THE FISH *SATANOPERCA JURUPARI* (OSTEICHTHYES: CICHLIDAE)

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The Cihlidae is a fish family well represented in freshwater bodies of South America; within this group, *Satanoperca jurupari* (Heckel, 1840), commonly named demon heartheater, is a typical representative of the estuary of the Amazon River. During a survey of this fish species from the Guamá River, close to the Amazon River Delta, Pará State, Brazil, specimens of *Raphidascaris* (*Sprentascaris*) Petter and Cassone, 1984 were found in the intestine. The nematodes were fixed in hot AFA (alcohol, formaldehyde and acetic acid solution). For light microscopy (LM), specimens were cleared in glycerine and, after examination, stored in 70% ethanol. For scanning electron microscopy (SEM), nematodes were post-fixed in 1% osmium tetroxide in phosphate buffer, dehydrated through a graded

acetone series, critical-point dried and sputter-coated with gold. The new species is characterized mainly by the markedly larger size of ventricular appendix in relation to the oesophagus, presence of short male caudal alae, 14-16 subventral pairs of preanal papillae and 6 pairs of postanal papillae. The prevalence in fish (n = 59) was 27%, with an intensity of 1-124 (mean 16) nematodes per fish. The present material represents the first nominal species of *Raphidascaris* (*Sprentascaris*) parasitizing a cichlid fish in South America.

BOTHRIOCEPHALUS ACHEILOGNATHI IN LAKE WINNIPEG, CANADA: INVASION INTO NORTH TEMPERATE REGIONS OF NORTH AMERICA AND POSSIBLE ROUTE OF ENTRY INTO CANADA.

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The tapeworm *Bothriocephalus acheilognathi* is commonly referred to as the Asian tapeworm and was originally discovered in China in herbivorous carp (*Ctenopharyngon idellus*) in 1934 and has since been reported from other cyprinid species from every continent other than Antarctica. Since its original discovery it has established in cultivated and wild fish around the world. Reports list >100 species from 14 families and 7 orders of freshwater fish infected by the parasite. Recent studies in the Red River, Lake Winnipeg, Canada found *B. acheilognathi* in young of the year emerald shiners (cyprinid) and adult walleye, sauger, pike, white bass and goldeye in Lake Winnipeg. Over 80 % of emerald shiners in the samples were infected. There is no evidence of pathology in adult walleye, sauger, pike and goldeye but none of the fish samples examined to date are young of the year of these fish hosts. The distribution of *B. acheilognathi* in emerald shiner indicates that all stages of development are present in the early fall samples from the Red River delta. This suggests that not only are emerald shiners an important host for the dissemination of the eggs of the gravid worms but emerald shiners continue to acquire the parasite in the fall and may be an important source of new infections the following spring. There are several possibilities for this large scale invasion into an important freshwater commercial fishery in North America. There include 1) human activities i.e stocking grass carp into Alberta to remove aquatic weeds and stocking bass for sports fishing in Manitoba, Canada, 2) a new vacant niche and a disconnect from its original host, 3) susceptible intermediate and definitive hosts are present at high densities, 4) a host switch by the parasite to a new cyprinid host that is numerous and a major food source of several piscivorous species and 5) longer periods of warm water in the northern hemisphere, with temperatures remaining high in the early fall, has resulted in the availability of large numbers of tapeworm eggs in the fall. This is contrasted with most indigenous freshwater fish tapeworm species where transmission of infective eggs occurs during spring and early summer in north temperate regions. Potential routes of entry of the parasite into Canada will be discussed.

A NEW *HENNEGUYA* SPECIES (MYXOSPOREA: BIVALVULIDA): AN AGENT OF SEVERE CARDIAC LESIONS IN THE SPOTTED SEATROUT, *CYNOSCION NEBULOSUS* (TELEOSTEI: SCIAENIDAE)

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A new *Henneguya* species is described from the spotted seatrout, *Cynoscion nebulosus* (Cuvier) (Sciaenidae) as a causative agent of cardiac henneguyosis. This new myxosporean species is characterized by the morphology of spores and the sequence of SSU rDNA. Examination of 227 spotted seatrout from four South Carolina estuaries in 2008 - 2010 revealed a 33.5% total prevalence of lesions produces by *Henneguya* sp. in the bulbus arteriosus, its specific site of infection. The severity of lesions and their impact on the bulbus arteriosus is proportional to the number of plasmodial stages developing in this segment of the heart, being most pronounced in host reaction directed against spores liberated from plasmodia.

AQUATIC INVASIVE SPECIES OF THE RHINE RIVER (GERMANY) AND THEIR FUNCTION AS PARASITE HOSTS

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Due to the rise of various anthropogenicfactors, such as shipping traffic, canalization, aquaculture and environmental changes, biological invasions in large rivers have been increasing worldwide in the last years. Especially after the completion of the Rhine-Main-Danube Channel in 1992, the number of alien species in Germany increased rapidly, with a strong ecological impact on the local biodiversity. Furthermore invaders represent new potential hosts for native parasites or possibly introduce non-native parasites and diseases. These properties often lead to an elimination of species of the local fauna. In the present study the metazoan parasite fauna and feeding ecology of the invasive round goby *Neogobius melanostomus* from the Rhine River between the ports of Neuss and Duesseldorf in North Rhine-Westfalia, Germany was investigated. In addition 10.032 specimens of amphipods including four species, which represent the main prey of the gobies in this area, were also analyzed. With *Corophium curvispinum, Dikerogammarus villosus*, *Echinogammarus trichiatus* and *Orchestia cavimana* exclusively invasive species were detected. Expect *O. cavimana* (originally from the eastern Mediterranean Sea), all these alien species originate from the Ponto-Caspian region (Black Sea, Caspian Sea).We could determine the position of the above-mentioned aquatic invasive species in the life cycle of parasites, particularly of the non-native acanthocephalan parasite *Pomphorhynchus tereticollis* which introduced two different invasive species in its life cycle, one as intermediate host for development and one as paratenic host to guarantee a fast spread.

PARASITES AND OXIDATIVE STRESS IN *CHIROSTOMA JORDANI* (PISCES: ATHERINOPSIDAE) FROM THE CENTRAL PLATEAU, MEXICO

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The release of pollutants in aquatic systems have led to various mixtures of xenobiotics with potential to exert numerous adverse effects that may compromise fish health by inducing oxidative stress, decreasing resistance and fostering susceptibility to pathogens such as parasites. This study examines the potential correlations between changes in water quality, the presence of parasites and the oxidative stress of *Chirostoma jordani*, considered an important species for fisheries and an endemic fish of the Central Mexican Plateau. Water Quality Index (WQI) in the lake of Yuriria as in their tributaries and effluent was analyzed; an oxidative stress biomarkers battery (lipid peroxidation, superoxide dismutase, catalase and glutathione peroxidase) and parasite analysis were carried out. Ten parasites were recorded: *Uvulifer ambloplitis*, *Diplotomum* sp., *Posthodiplostomum minimim*; *Bothriocephalus achelognathi*, *B. pearsei*, *Valipora* sp.; *Eustrongylides* sp., *Contracaecum* sp.; *Polymorphus brevis* and *Neoergasilus japonicus*. Among them *Neoergasilus japonicus* and *Valipora* sp. were the most abundant in the component community. The WQI showed lower values to the tributaries and effluent especially during dry season. LPO level in gills was higher during dry season, but liver and muscle showed a significant increase during November and February. Antioxidant response was increase during November and February. Redundancy analysis reveals an association between the higher LPO in liver and *Valipora* sp. and LPO in muscle and gills with *B. pearsei* which coincides with the higher WQI. This shows that the health of *C. jordani* is compromised by the existence of xenobiotics that will promote reactive oxygen species generation and by some parasites rather than by changes in water quality parameters.

FIRST EUROPEAN EXTENSIVE STUDY ON SILVER EELS (*ANGUILLA ANGUILLA*) INFECTED BY THE PATHOGENIC INVASIVE NEMATODE, *ANGUILLICOLOIDES CRASSUS*

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An extensive study was conducted during the EELIAD project (eeliad.com) to test the relation between silver eel (*Anguilla anguilla*) quality and contamination by *Anguillicoloides crassus*. This invasive parasite (Nematoda) has been introduced in the early 1980's from Asia to Europe with its original host, the japanese eel, *Anguilla japonica*. Since then, it has been able to spread rapidly through most of its new host (the European eel, *A. anguilla*) geographic range. This hematophagous parasite induces pathogenic changes in the swim bladder and could be a major cause in the collapse of the European eel population, since potentially responsible for the lack of successful transoceanic migration and therefore its reproduction. We present here the results of the first study covering 11 european sites (7 countries) simultaneously. A total of 492 silver eels, considered as future spawners, were examined for epidemiologic parameters and SDI (swim bladder degenerative index). In most of the investigated sites more than 50% of the eels were infected with *A. crassus*, except in Bages-Sigean Mediterranean lagoon France (8%) and Burrishoole river Ireland, where no parasites has been detected. The highest prevalences (81-94%) and mean intensities (7.9-10.6) were recorded in Belgium, Denmark, France, Ireland and UK sites. In addition, UK sites displayed the most damaged swim bladders. No significant geographical trend was observed. Environmental conditions and probably also availability of intermediate hosts in each basin seems to be the major causes of differences in infestation levels.

A NEW GENUS OF MACRODEROIDIDAE MCMULLEN, 1937, DIGENEAN PARASITE OF *HOPLOSTERNUM LITTORALE* (HANCOCK, 1828) (PISCES: CALLICHTHYIDAE) FROM AMAZONAS STATE, BRAZIL.

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During studies on the helminthofauna of freshwater fish from Amazonas State, Brazil, sixty two specimens of *H. littoralle* from the floodplain region of Central Amazônia were examined. Two specimens from the Catalão Lake, and three from the Marchantaria Island, located near the junction of the Solimões and Negro Rivers, were parasitized by digeneans. The specimens collected were cold fixed in AFA with slight compression under cover glass pressure. Specimens were stained with Langeron's alcoholic acid carmine, dehydrated in an ethyl-alcohol series, cleared in beechwood creosote and mounted in Canada balsam as permanent slides. *Hoplosternum littorale* is a neotropical catfish, it is present in all of South America east of the Andes and north of Buenos Aires, including the Orinoco, Trinidad, coastal rivers of the Guyanas, Amazon River drainage, Paraguay, lower Paraná River, and coastal systems in southern Brazil. In Amazon region is considered a benthic fish, and inhabits streams, paranás, lakes and rivers of white, clear and black waters. The family Macroderoididae is represented by 9 genera, reported in marine and freshwater fishes in North, Central and South America, India, Caribbean region, Europe and Asia. In South America only the genus *Magnivitellinum* Kloss, 1966 has been referred parasitizing freshwater fish. The new genus is distinguished from all other macroderoidid genera by the position of the genital pore, lateral extracaecal, instead of median or submedian. It is most closely related to *Magnivitellinum* differing mainly by the combination of the following characters: position of the genital pore, extracaecal instead of median or submedian and in

the distribution of vitellarium, with follicles confluent or almost, in the anterior margin of ventral sucker.

A NEW SPECIES OF *PHILOMETRA* COSTA, 1845 (NEMATODA: PHILOMETRIDAE) FROM *PYGOCENTRUS NATTERERI* (KNER, 1858) (CHARACIFORMES: SERRASALMIDAE) A FRESHWATER AMAZONIAN FISH, BRAZIL.

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Pygocentrus nattereri occurs in the Amazonas, Paraná-Paraguay and Essequibo river basins, as well as in Brazil's northeastern region rivers. During the study of helminth parasites of fishes from Amazon basin, 345 specimens of *P. nattereri* were examined from six floodplains lakes: Baixio, Preto, Iauara, Ananá, Campina e Maracá situated on the banks of the Solimões River between the cities of Manaus and Coari. Forty two specimens were parasitized by a new species of *Philometra* in oculo-orbits and nasal cavity. The specimens collected were washed in physiological saline, and for morphometric studies were fixed in hot AFA (glacial acetic acid, formaldehyde and alcohol). Although nematodes of the family Philometridae present a pathogenic importance and occur frequently in fish, the fauna of philometrid remains poorly known. The new species is characterized by an anterior end of oesophagus forming conspicuous, strongly muscular oval to round bulb, well separated from cylindrical portion of oesophagus; between the bulb and the posterior portion of oesophagus there is a constriction forming a neck-like structure. The posterior end of body is rounded and does not present any papillae. The new species is most closely related to *P. coreii*, *P. ophisterni* and *P. poblana* in the extention of esophageal gland, which extends which overreach the nerve ring anteriorly. *Philometra*. n. sp. differs from these species mainly by having an oval to round bulb and none papillae-like in posterior extremity. This is the first report of a species of the genus *Philometra* parasitizing fish of the family Serrasalmidae.

METAZOAN ECTOPARASITES OF *LEPORELLUS VITTATUS* (ANOSTOMIDAE, CHARACIFORMES) IN THE ITAIPU RESERVOIR, PARANA, BRAZIL.

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Leporellus vittatus (Valenciennes, 1849) is largely distributed in rivers from Peru, Colombia, Guianas, and three major river basins in Brazil: Parana, Sao Francisco and Tocantins-Araguaia. The fish were collected between September 2006 and February 2007 in order to analyze the possible influence of standard length and sex of *L. vittatus* on the prevalence and intensity of infestation of ectoparasites. The 30 analyzed fishes had standard length ranging from 9.6 to 22.2 cm, of this total, 22 were infested with monogeneans found

that 647 are all of one species belonging to genus *Jainus*. The correlation coefficient "r" Pearson shown that there was no correlation between standard length and prevalence of infestation, on other hand, the correlation coefficient "rs" by Spearman's ($rs = 0.47$; $p = 0.018$) showed there are positive and significant correlation between the intensity of infestation and the standard length of fish. The size of hosts is often recognized in a variety of studies as a major determinant of the prevalence of parasites, this would be associated with increased quality and quantity of food items in diet of larger fish. These larger hosts can too provide more space for parasites, and shelter more species, and offer greater variety of niches for occupation by parasites thus allow simultaneous occurrence of more species of parasites. The test "U" Mann-Whitney ($z = 2.73$ $p = 0.006$) demonstrated there are significant difference in abundance of parasites in host males and females, females being more parasitized. Differences between sexes of host and changes in ectoparasite infestation are probably related to seasonal changes in composition of tegument. This result may suggest that ecological relationships such as habitat, behavior and diet between hosts males and females may be distinguished.

CAN DNA HELP DEFINING MORPHOLOGICAL DIAGNOSTIC CHARACTERS FOR GENERIC GROUPS WITHIN A POLYPHYLETIC *GYRODACTYLUS* (GYRODACTYLIDAE, MONOGENOIDEA)?

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Gyrodactylidae is a family with high species diversity within the Monogenoidea composed by oviparous and viviparous species. Of the almost 450 species known within the family, the majority belongs to *Gyrodactylus* that has shown to be polyphyletic. A first attempt to recognize taxonomic groups (subgenera) within *Gyrodactylus*, using the morphology of the osmorregulatory system, subsidized the subsequent proposal of new generic taxa. However, the proposal was never fully implemented by specialists, likely due to the difficulty on the observation of these features. Phylogenetic hypotheses based on molecular data sequences could represent an important asset in the definition of monophyletic groups within the genus. However, implementation of a classification based mainly (or solely) on DNA data is certainly not presently feasible. Morphological data still represent the most accessible data available from these species. However, the morphology of sclerites of *Gyrodactylus* spp. is greatly conserved and differences between species are often subtle. Thus, specialists appear to lack confidence on the use of these sclerites in the resolution of this taxonomic problem. Therefore, this study evaluates whether hook morphology is phylogenetically consistent, providing identification of species within monophyletic groups of *Gyrodactylus*. Morphological features of the hooks of available species were mapped onto a molecular phylogeny based on rDNA. The most parsimonious reconstructions of ancestral character states of hook features onto the working phylogeny resulted in a non-random distribution ($P < 0,05$). Thus, the analysis supports the hypothesis that hook morphology, likely combined with other sclerotized haptoral and reproductive features, may indeed represent an important source of information for the identification of monophyletic groups.

ENDOHELMINTHS OF *CICHLA PIQUITI* (PERCIFORMES, CICHLIDAE) FROM PARANÁ RIVER, MUNICIPALITY OF ILHA SOLTEIRA, SÃO PAULO STATE, BRAZIL

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Fifty specimens of *Cichla piquiti* from Paraná River, Ilha Solteira reservoir, municipality of Ilha Solteira, São Paulo state, Brazil were collected and had their parasite endohelminth community evaluated. All fish were parasitized by at least one helminth species (overall prevalence [P] = 100%) and parasites of eight *taxa* were found: *Procamallanus* (*Procamallanus*) *peraccuratus* in the intestine; third stage larvae of *Contracaecum* sp. and *Hysterothylacium* sp. in the visceral cavity, mesentery and serosa of the organs (Nematoda); *Austrodiplostomum compactum* (metacercariae) in the eye and *Genarchella genarchella* in the stomach (Trematoda); *Proteocephalus macrophallus, Proteocephalus microscopicus* and *Sciadocephalus megalodiscus*, in the intestine (Cestoda). *Hysterothylacium* sp. larvae (P = 86%) and *P. microscopicus* (P = 74%) were the most prevalent parasites. Infection caused by larvae of Anisakidae was influenced by seasonality, with prevalence and mean abundance of infection higher in the dry season. A negative correlation was observed between mean abundance of infection of *Hysterothylacium* sp. (L3) and *P. microscopicus* (r_s = -0.286, P = 0.04), maybe due to competition/antagonism between these parasite species. The introduction of cichlid fish in this reservoir may have resulted in the introduction of parasite species, such as proteocephalid cestodes. *Cichla piquiti* proved to be a new host for parasites previously introduced by exotic species such as *A. compactum*. These new records significantly expanded the list of parasites of *C. piquiti,* contributing to the knowledge of parasite-host relationship and geographical distribution of these helminth species. Besides, the records reinforce the need of studies that show changes in population dynamics of these parasites due to introductions of new host fish species.

PARASITIC INFECTIONS IN THE PRODUCTION OF PACU *PIARACTUS MESOPOTAMICUS* AND HYBRID PATINGA FROM THE NORTHWEST OF SÃO PAULO STATE, BRAZIL

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The aim of this study was to evaluate the occurrence of parasitic infections in "pacu" *Piaractus mesopotamicus* and hybrid "patinga" from the Northwest of São Paulo State, Brazil. Fish from three fish farms were evaluated every two months: A - Reproduction and larviculture (pacu / patinga), B - growout (patinga) and C - fee-fishing property (pacu / patinga). Thirty fish from each fish farm were collected from February to December 2010 for parasitological analysis. The parasites found were: monogenoids, ciliophorans and gastrointestinal helminths. The overall prevalence (P) in the properties A, B, and C were 70%, 90, and 93%, respectively. In the property A, the Dactylogyridae monogenoids were the most common parasites (P = 56.6%), followed by ciliophorans of *Trichodina* genus (P = 40%), and myxosporidans of the genera *Myxobolus* (P = 23.3%) and *Henneguya* (P = 16.6%). In the property B, the dactylogyrid monogenoids were the most prevalent parasites (P = 83.3%), followed by *Trichodina* sp. (P = 26.6%) and *Henneguya* sp. (P = 20%). In the property C, the intestinal nematodes *Rondonia rondoni* were the most prevalent parasites (P = 83.3%), followed by dactylogyrid monogenoids (P = 63.3%) and third stage larvae of anisakid nematodes *Contracaecum* sp. (P = 26.6 %). Regarding seasonal occurrence (dry and rainy seasons), significant difference was observed only to *Myxobolus* sp. prevalence of the property B (dry season =93.33%; rainy season=13.33%; Z = 4.026, p = <0.001). *Piaractus mesopotamicus* is a new host recorded for *Contracaecum* sp. larvae, which is a zoonotic helminth. This record is an important finding in terms of commercial value for Brazil, since pacu is largely used as food resource by population that dwells the surrounds of aquatic environment.

MITOCHONDRIAL GENES OF *SINERGASILUS POLYCOLPUS* (COPEPODA, ERGASILIDAE) PARASITIZING THE GILLS OF FISH

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The mitochondrial genomes can provide useful information of the phylogenetic relationships for arthropods from two aspects, i.e. gene arrangement and mitochondrial DNA (mtDNA) sequence data. However, so far there is no report on the mt genomes of species in the order Poicilostomatoida. The present study aims to determine the nucleotide sequence of mitochondrial geneme of *Sinergasilus polycolpus*, a poicilostomatoid copepod, parasitizing the freshwater fish *Hypophthalmichthys molitrix* and *Aristichthys nobilis*. The segments of Cyt *b* and *CO* I genes of *S. polycolpus* were amplified using the degenerate primers. Then the gene specific primers were designed on the above segments to amplify the long mtDNA sequence fragment with Long-PCR. Finally, the mtDNA sequence of 12917 bp in length was determined from *S. polycolpus*, with the accession number of EU621723 in the GenBank database. This sequence is composed of A of 35.0%, T of 35.8%, C of 14.0% and G of 15.2%, and furthermore the GC-Skew and the AT-Skew are 0.041 and -0.011, respectively. According to the sequence homology and the structure characteristics, the total of 35 genes were identified, including one 12S rRNA, twenty-one tRNA and thirteen protein-coding genes. However, the amplification for the segment containing putative 16S rRNA, $tRNA^{Arg}$ and $tRNA^{Thr}$ genes and control region was unsuccessful. The 13 protein-coding genes have ATA, ATG, ATC and ATT as initiation

codons, and TAA, TAG, TA and T as termination codons, respectively. TA and T are incomplete termination codons. All the 21 tRNA genes, ranging from 54 to 63 bp in length, can be folded to form the figure of clover leaf knot. Other than 3 tRNA genes without TψC arm, the length of TψC arms of tRNA genes vary from 1 to 4 bp. Of 35 genes, 4 protein-coding genes, i.e. *CO* I, ND5, Cyt *b* and ND4, and 7 tRNA genes, i.e. $tRNA^{Leu(CUN)}$, $tRNA^{Met}$, $tRNA^{Pro}$, $tRNA^{Asp}$, $tRNA^{Glu}$, $tRNA^{Tyr}$ and $tRNA^{His}$, are encoded on the N strand, the remainders on the J strand. In addition, 12 gene overlapping sites were found in the *Sinergasilus polycolpus* mtDNA. It is necessary to study the mt genomes of more species in order to elucidate the phylogeny of the copepods.

PREVALENCE OF *TRICHODINA* PARASITE IN DIFFERENT STOCKING DENSITIES OF NILE TILAPIA IN CAGES

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The cage culture of Nile tilapia (*Oreochromis niloticus*) is increasing in Norwest of São Paulo State, Brazil, because of the large hydroelectric reservoirs. However, *Trichodina* has been the mainly cause of death. The aim of this study was to evaluate the prevalence of the protozoan *Trichodina* sp. in different stocking densities of tilapia culture in cages ($6m^3$). The study was carried out in the Cooperative of Fish Farmers from Santa Fé do Sul and Region, Ilha Solteira reservoir, São Paulo State, Brazil (20°12'10"S, 50°58'31,15"W), and was divided in two stages. At the stage I, fish with 78g were used to test four stocking densities: D1 – 800 fish/cage; D2 – 2000 fish/cage; D3 – 2500 fish/cage and D4 – 3000 fish/cage. At the end of this stage, average weight of 255g, fish were selected into three sizes (small, medium and large), except D1 (100 kg/m^3 - 800 fish/cage). At the stage II, the medium fish were used to test three stocking densities: D2 – 80 kg/m^3 (600 fish/cage); D3 – 100 kg/m^3 (800 fish/cage) and D4 – 120 kg/m^3 (900 fish/cage). The water temperature and the level of dissolved oxygen were measured inside the cages. The number of dead fish was taken daily. At the stage I, prevalence of *Trichodina* parasite was 100% in the two higher densities. The mortality rate was around 3 to 4% and D4 had higher mortality rate than others treatments. The level of dissolved oxygen reduced as the increasing of stocking density. In the stage II, prevalence of *Trichodina* sp. was around 33,3% and the mortality rate was around 0,4 to 1,2%, without difference between densities. To prevent *Trichodina* infestation, we recommend adopting densities lower than 2000 juveniles of Nile tilapia in cages of $6m^3$ (until 80 kg fish per m^3).

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TWO NEW SPECIES OF *CLESTOBOTHRIUM* (CESTODA: BOTHRIOCEPHALIDEA), PARASITES OF *MERLUCCIUS AUSTRALIS* AND *M. HUBBSI* (GADIFORMES: MERLUCCIIDAE) FROM THE PATAGONIAN SHELF OF ARGENTINA

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The genus *Clestobothrium* is widespread among the Gadiformes. In the continental shelf of South America have been recorded *Clestobothrium* sp. and/or *C. crassiceps* parasitizing *Merluccius australis*, *M. gayi* and *M. hubbsi*. The aim of this work is to determine the taxonomic status of *Clestobothrium* parasitizing *M. australis* and *M. hubbsi* from the Patagonian shelf of Argentina, adding data about the microthrix pattern. The worms found in the intestine were isolated, fixed and processed following helminthological techniques to study internal morphology and with scanning electron microscopy to determine the microthrix pattern. Two new species of bothriocephalids, *Clestobothrium* sp. 1 from *M. australis* and *Clestobothrium* sp. 2 from *M. hubbsi* are described. *Clestobothrium* sp. 1 can be typified by the following features: a medium-size strobila with 410–528 proglottides, 49–90 testes per mature proglottis, partially surrounding the ovary posteriorly; a transversely elongated genital pore situated anterior to spurious articulations; presence of a genital atrium; a globular cirrus-sac occupying 4–6% of mature proglottis width and a vagina with sphincter. *Clestobothrium* sp. 2 is characterised by its small size; 71–219 proglottides; 39–64 testes per mature proglottis, usually surrounding completely the ovary posteriorly; a rounded genital pore situated at the same level of spurious articulations; and an oval cirrus-sac occupying 8–16% of mature proglottis width. *Clestobothrium* sp. 2 shares with *Clestobothrium* sp. 1 the number of osmoregulatory canals (6) and the type and distribution of microtriches, except for the central surface delimited by the 2 lips. *Clestobothrium crassiceps* differs from the 2 new species in the number of testes, the absence of genital atrium and vaginal sphincter, and the number of osmoregulatory canals (4).

STOCK DISCRIMINATION OF *HOPLOSTETHUS ATLANTICUS* (ORANGE ROUGHY), A DEEP FISH OF THE JUAN FERNANDEZ ARCHIPELAGO, BY USE OF PARASITES

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Hoplostethus atlanticus is a cosmopolitan deep-water fish. It is found on seamounts, ocean ridges and the continental slope, normally <500 m. Global understanding of *H. atlanticus* life cycle is poor for a species that has been classified within the top five most vulnerable exploited deep-sea fishes. The use of parasites for separating stocks the fishes commercially exploited among its notable history the study in the orange roughy of New

Zealand. The method of the parasites showed no ecological homogeneity among some of the fishing zones, which today has resulted in different management zones. This study is a first qualitative and quantitative record of the parasitic infracommunities deep-sea fish orange roughy of the Juan Fernandez Archipelago. For this, in the year 2005, examined the parasitic fauna of 194 individuals from 5 fishing zones areas near the Juan Fernandez Archipelago (JF1-JF4 and Bajo O`Higgins). The 194 individuals examined were parasitized. It was found 10 taxa and collected over the 30.000 parasites. The most abundant and prevalent parasites were nematodes, of which 2 reach sexual maturity in predators of the orange roughy, and one reached in him. There is a great similarity in the composition of the fauna of parasites between fishing zones. However, a simple discriminant analysis revealed that Bajo O`Higgins and JF4 are the zones most different in composition and relative abundance of taxa in the assemblages parasitic on individuals hosts. The biological interpretation of these variations of parasitism suggests a higher relative abundance of elasmobranch, probably sharks predators in JF1. The greater presence in JF2 -JF4 of monogenea *Diclidophoridae* gen. sp, a parasite that is transmitted directly, suggests a greater isolation or density of orange roughy in this fishing zone, compared with Bajo O`Higgins.

INTERMEDIATE HOSTS FOR FISH PARASITES IN GALICIAN WATERS

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Many fish species of commercial interest from Galician waters are affected by parasites which are well-known as important biological pollutants affecting flesh quality and causing pathology and diseases leading to decrease fisheries economic benefits. Furthermore, some of these helminth parasites constitute a potential risk for public health because they are responsible of gastroalergic disorders in fish-consuming population. The parasites posses complex life cycles and their transmission through the food webs play an important role to reach their final host which may occupy the top level predators depending on the parasite's question, but their recruitment in the lowest trophic levels, especially on zooplankton is unknown. Due to the great importance of the zooplankton within the marine pelagic trophic webs, and taking into account that they are a key component in the dietary habits of the early stages of development of many cephalopods, fish and mammals, the aims of this study were: (i) detail the role of the euphausiid *Nyctiphanes couchii* as a first intermediate host in the life cycle of acanthocephalans and anisakids; ii) present the second intermediate hosts for digenean trematodes in NW Iberian waters; iii) to provide data on the demographic infection values for these parasite larvae in their host populations; and (iv) to draw tentative parasite life-cycle strategies in the zooplankton communities.

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CYMOTHOA ISOPODS PARASITIC ON MARINE FISHES IN THE SOUTH WESTERN INDIAN OCEAN, INCLUDING RECORDS OF TWO NEW SPECIES.

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Cymothoid isopods are a unique parasitic group found parasitizing marine fishes around the world. In Africa, however, few studies have been done on these parasites and information on their biodiversity, occurrence, distribution and hosts is scanty. This data is necessary to understand the effects these parasites have on their host populations and specifically the effects on hosts already used or targeted as potential mariculture species. The family Cymothoidae includes a group commonly known as tongue-replacement isopods or 'tongue biters' found on the tongue within the buccal cavity. Although frequently observed by fishery scientists, the taxonomy of these parasites still requires much revision. The most recent reviews of one of the 'tongue biter' genera, *Cymothoa*, shows approximately 48 species of which only three are from the South Western Indian Ocean. Due to the naturally high biodiversity of this region, this low number is most likely not a true reflection of the actual species numbers present. To test this hypothesis, cymothoid isopods were collected during the past two years from Zanzibar, Tanzania, as well as from the East Coast of South Africa. Additional material from the South African Museum in Cape Town was also obtained to clarify their taxonomic status. The isopod collected in Zanzibar was removed from the buccal cavity of a parrotfish. After comparisons to known species it was found to be new to science and recently named *Cymothoa hermanii*. Likewise, a new species was discovered from Sodwana Bay, on the South African East Coast, in the mouth of the large-spotted pompano (*Trachinotus botla*) with a prevalence of 73%. This species still remains unnamed. This paper reports on the complete taxonomic review and descriptions of these parasitic isopods from the South Western Indian Ocean.

MOLECULAR IDENTIFICATION OF SPECIES OF GENUS *CONTRACAECUM* (NEMATODA: ANISAKIDAE) MATURING IN FISH-EATING BIRDS OF NORTHERN IRAN.

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The occurrence of *Contracaecum* spp. in birds from Iran are those reported in Barus et al., 1978. Despite the existence and several reports of this genus larvae in fishes of Iran (Gonzalez-Solis et al., 1997; Ansari et al., 2010; Shamsi and Aghazadeh, 2011), there is not information about their definitive hosts. In the present study, 17 species (n= 123), of fish eating birds from Northern Iran, have been parasitologically examined and among them, 7 waterbird species (*Ardea purpurea*, *Botaurus stellaris*, *Larus fuscus*, *Larus ridibundus*, *Phalacrocorax carbo sinensis*, *Podiceps cristatus* and *Nycticorax nycticorax*), have been found infected by nematodes belonging to the genus *Contracaecum*. Several *Contracaecum* specimens have been identified based on morphology and mtDNA *cox2* sequences analysis (Mattiucci et al., 2008). *C. rudolphii* sp. B has been identified in the cormorants examined, while a sibling species of *C. microcephalum* has been identified in *Ardea purpurea, Botaurus stellaris* and *Nycticorax nycticorax.* (*Contracaecum* spp. larvae found in *Podiceps cristatus and Larus* spp are still under study). Most of the *Contracaecum* worms have been found free in gizzard, in some cases under the koilin layer of gizzard, free in proventriculi and sometimes posterior part of esophagi. The highest prevalence (P= 100%) and the intensity (range 3-190) values of the infection have been observed in cormorants.

ABNORMALITIES OF THE STROBILAR MORPHOLOGY IN *PROTEOCEPHALUS PERCAE* FROM PERCH (*PERCA FLUVIATILIS*) IN DEGRADED AQUATIC ENVIRONMENT.

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Proteocephalus percae (Cestoda, Proteocephalidea) is a polyzoic tapeworm parasitizing perch in the Holarctic Region. Its strobila consists of proglottides highly variable in shape that is normally considered as a usual feature in this tapeworm. However, during recent examinations of perch parasites from the water reservoir Ruzín located in the eco-region highly contaminated with heavy metals (eastern Slovakia), numerous unusual or abnormal structural features were quite often found in mature proglottides of *P. percae* tapeworms. Afterwards, several tens of these parasites from contaminated locality and reference sites in peri-alpine lakes (Switzerland) and fish ponds (Czech Republic) were microscopically examined for morphological irregularities. Majority of tapeworms showed habitual appearance; in several specimens were identified some, maximum 3, abnormal incorporated proglottides. Abnormalities were categorized into two basic groups: (i) anomalies linked with proglottization and maturation of the strobila and (ii) anomalies linked with segmentation and growth of the strobila. Following anomalies that mostly have relevance to reproductive organs were found: the doubled ovary, presence of extra ovarian lobe or only a single ovary lobe, less developed ovary, reversal location of the ovary in proglottis, the absence of cirrus sac and doubled cirrus-sac. Additionally, four types of incomplete separation of successive proglottides have also been encountered. Results demonstrated that the tapeworms from contaminated site exhibited three times higher frequency of abnormalities (33%) than those from reference sites (11%). Thus, we hypothesize causality between the occurrence of morphological abnormalities and existing contamination of the water reservoir.

UNEXPECTED RESPONSE OF A CAPTIVE BLACKEYE THICKLIP, *HEMIGYMNUS MELAPTERUS* (TELEOSTEI: LABRIDAE), FROM LIZARD ISLAND, AUSTRALIA, EXPOSED TO JUVENILE GNATHIIDS (ISOPODA: GNATHIIDAE)

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In high numbers, ectoparasitic juvenile stages of gnathiid isopods feeding on teleost and elasmobranch fishes in aquaria, fish farms, or in the wild, can induce severe host pathology. However, while interactions between gnathiids, cleaner and client fishes have been well documented from the Great Barrier Reef (GBR), Australia, the effects of blood-feeding juvenile gnathiids on fishes in this location remain largely unknown. Exposing a captive *Hemigymnus melapterus* experimentally to *Gnathia aureamaculosa* juveniles at Lizard Island Research Station, GBR, as a prelude to conducting fish blood parasite transmission experiments, culminated unexpectedly in death of the fish host within 30 min. Examination of the *H. melapterus* gills by low power microscopy revealed numerous juvenile gnathiids associated with large masses of fish mucus. Histological sections through gill tissue showed mucus balls, but few juveniles attached to gill filaments. Some filament fraying and displacement of primary and secondary gill lamellae was also detected. It is concluded that death of this experimental fish was probably induced by sudden blood loss and stress.

METAZOAN PARASITE ASSEMBLAGES OF SEA BASS *PARALABRAX HUMERALIS* (SERRANIDAE) FROM NORTHERN CHILE

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There are few studies about biology of the Chilean sea bass *Paralabrax humeralis* and little is known of theirs parasites fauna. This species is distributed mainly in the Pacific coast from Ecuador to Valparaiso in Chile. This occupies rocky sandy substrates, kelps (*Lessonia trabeculata*), and shell reef microhabitats. *P. humeralis* is an important component of ichthyofauna of northern Chile. It has a high trophic diversity and it is characterized as an euriphagic species, with crustacean and ichthyophagous feeding habits. The aim of this study is estimate population and community quantitative descriptors of the metazoan parasite fauna of *P. humeralis* and evaluate possible variations among close localities. In addition, we evaluated the existence of relationships between host size and population descriptors. A total of 116 specimens of *P. humeralis* were collected from four localities in northern Chilean coast, and 2296 parasites belonging to 24 taxa were recorded. Preliminary results showed that at component community (CC) level, there were significant differences in prevalence of parasites among localities and that the parasite community is mostly

composed by generalist species. The most prevalent and abundant species were Copepods: *Caligus quadratus* and *Hatschekia* sp; Digenean: *Helicometra fasciata*; Acanthocephalan: *Corynosoma* sp. There was a weak relationship between parasite fauna and host size. Only two ectoparasites and one endoparasites species showed a positive correlation with host size. These results suggest that *P. humeralis* do not accumulate parasites over time and trophic changes likely occur with host age. At CC level, quanti- and qualitative variations in the parasite fauna among localities were also recorded.

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POPULATION STRUCTURE OF *CORYNOSOMA AUSTRALE* (ACANTHOCEPHALA: POLYMORPHIDAE) IN PARATENIC FISH HOSTS FROM PATAGONIA, ARGENTINA

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Corynosoma australe is a common parasite of pinnipeds from the Southern hemisphere. Cystacanth larvae of this species are found in a number of fish species that act as paratenic hosts. We investigated the population structure of cystacanths of *C. australe* in 544 individuals of 20 fish species collected in the neritic zone of the Patagonian Sea in Argentina. A total of 1050 cystacanths was collected in 17 pelagic, demersal and benthic fish species. The highest infection levels occurred in 2 benthic species, i.e. *Paralichthys isosceles* (prevalence [95% C.I.]: 100% [73.0-100.0]; mean intensity [95% C.I.]: 15.9 [9.0-26.8]) and *Prionotus nudigula* (91.7% [73.0-8.9]; 2.7 [1.9-4.3]); and 1 demersal species, *Raneya brasiliensis* (93.8% [69.8-99.9]; 2.3 [1.7-3.1]). The latter is one of the main preys of the South American sea lion, *Otaria flavescens*, in the area but *P. isosceles* and *P. nudigula* are rarely consumed. No significant size differences were found between cystacanths collected from different fish species, suggesting that all fishes are suitable hosts for *C. australe*. Interestingly, the sex ratio was significantly female-biased at the cystacanth stage (sex ratio [95% C.I.]: 44.9% [38.0-47.7]). In species of *Corynosoma,* sex ratios are assumed to be 1:1 in the paratenic host, the adult female-bias observed in the definitive host usually being explained by the longer life span of females. The reason why the sex ratio of *C. australe* is already biased in fish is unknown, but this bias is expected to be transferred to the pinniped definitive host.

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INTERANNUAL VARIATIONS OF METAZOAN PARASITE COMMUNITIES OF PERUVIAN MORWONG *CHIRODACTYLUS VARIEGATUS* (VALENCIENNES, 1833) (PERCIFORMES: CHEILODACTYLIDAE) IN THE ZONE OF CHORRILLOS, LIMA, PERU

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This research evaluates the community structure of parasites of *Chirodactylus variegatus* (Valenciennes, 1833), and analyzes whether the composition, richness, diversity, prevalence and mean intensity of their parasite communities ranges from four samples taken between 21 years in Lima, Peru in November 1989 to March 1990, May to July 1996, March-April 2006 and August to September 2010. Metazoan parasites were collected and counted using conventional techniques. During 2006 and 2010, the total abundance was 4.8 (0-21) and parasite species richness was 1.0 (0 to 3 species of parasites per fish). Fifty-eight hosts showed infection with at least one parasite (75.3%). There were seven taxa of parasitic species: a monogenea *Microcotyle nemadactylus*, a digenean *Helicometrina nimia*, a cestode *Diphyllobothrium pacificum*, a nematode *Similascarophis chilensis*, an acanthocephalan *Corynosoma obtuscens*, and two copepods *Caligus cheilodactylus* and *Clavellotis dilatata*. A comparative analysis between the parasites of *C. variegatus* in 1989-1990, 1996, 2006 and 2010 show a decrease in the prevalence of *C. cheilodactylus* and *C. dilatata*, maintained in the prevalence of *M. nemadactylus*, and an increase in the prevalence of *C. obtuscens*. The average intensity decreased for monogeneans and copepods. The differences between years could be influenced by variations in sea temperature that affected the stages of reproduction of parasites in the amplitude of the period studied and the sex ratio of male hosts in each sample.

PARASITE COMMUNITY OF CABINZA GRUNT *ISACIA CONCEPTIONIS* (CUVIER AND VALENCIENNES, 1830) (PERCIFORMES: HAEMULIDAE) IN THE ZONE OF CHORRILLOS, LIMA, PERU

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The parasite community of *Isacia conceptionis* (Cuvier and Valenciennes, 1830) (Cabinza grunt) a demersal coastal specie of rocky bottoms with algae and/ or sand was evaluated, and analyzes the composition, richness, diversity, prevalence and mean intensity of a sample taken from December 2010 to March 2011 from Chorrillos Fish market, Lima, Peru. Of the total of 123 specimens examined, 64 (52.03%) were females and 59 (47.97%) were males. The fish showed a mean total length of 21.7 cm (16.5 cm to 28.4 cm). Parasites were collected, fixed, preserved and quantified using standardized procedures. The parasite assemblage showed a higher percentage of endoparasites (62.11%) than ectoparasites (37.89%). Total abundance was 2.02 (0-8) and parasite species richness was 1.19 (0 to 2

species of parasites per fish). Forty-seven hosts showed infection with at least one parasite (38.11%). Eight *taxa* of parasite species with their respective prevalence and mean intensity of infection were found: two monogeneans *Pseudoeurysoechis travassosi* (4.07% and 1.4) and *Choricotyle isaciencis* (11.38% and 1.5), a digenean *Proctoeces lintoni* (0.81% and 2) a tapeworm larva *Nybelinia lingualis* (2.44% and 1), two nematodes, a gen. sp. unidentified (4.88% and 2.17) and *Proleptus carvajali* (1.63% and 1), an acanthocephalan *Corynosoma* sp. (14.63% and 2.17) and finally a copepod *Clavella simplex* (6.5% and 1). The total length was not observed associated with the total parasite abundance, with the richness of parasite species and with the two most prevalent parasites (*C. isaciencis* and *Corynosoma* sp.). The gonadosomatic index (GSI) was not found related to overall abundance and with parasite species richness. Finally, in the component parasite community was found a Brillouin diversity index of 1.51, a Pielou equitability index of 0.79 and a Simpson dominance index of 0.75.

CHARACTERIZATION OF *CALIGUS* SPECIES FOUND IN FISHES FROM NORTHERN CHILEAN COAST.

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Caligids (sea lice) are recognized worldwide as abundant in natural fish populations, generalists, and highly pathogenic in cultured fishes. *Caligus* and *Lepeophtheirus* are the most prevalent genera of Caligidae family. Along the Chilean coast, 21 species have been recorded parasitizing different fish species. Of these, 10 species belong to the genus Lepeophtheirus and 11 species belong to Caligus (*Caligus aesopus, Caligus bonito, Caligus cheilodactylus, Caligus debueni, Caligus fistulariae, Caligus flexispina, Caligus lalandei, Caligus products, Caligus quadratus, Caligus rogercresseyi, Caligus teres*). However, there are other four records of *Caligus* species in four fish species (*Bovichtus chilensis Cilus gilberti, Merluccius gayi gayi, Trachurus murphyi*), whose specific identity needs to be clarified. The aims of this study are, first, to characterize the diversity of *Caligus* spp. in the northern Chilean coast, trough morphological identification, and molecular tools (COI and 18S genes). Second, to determine the host specificity of these *Caligus* species; and third, to estimate the female fecundity in the different fish species. So far, 6 different morphologies of *Caligus* have been recorded in 16 fish species. Of these, three Caligus species have been morphologically identified: *C. lalandei* present in *Seriola lalandi* (mean abundance: 1,5; prevalence: 21,30%); *C. cheilodactylus* present in 4 hosts (mean abundance: 1,55; prevalence: 9,45%) and *C. quadratus* present in 7 hosts (mean abundance: 4,25; prevalence: 29,40%). The other morphologies of *Caligus* are being studied. All specific identity will be clarified using molecular tools.

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MOLECULAR IDENTIFICATION OF ANISAKID NEMATODES ISOLATED FROM PACIFIC COD, *GADUS MACROCEPHALUS* (GADIDAE) IN KOREA

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The occurrence of anisakid nematodes in Pacific cod (*Gadus macrocephalus*) from Korea was investigated and the isolated worms were identified by molecular methods. Pacific cod were obtained from local fish markets in the east coast of Korea, examined for the nematodes collection and the nematodes were identified by PCR-RFLP with NC5-NC2 primer sets and restriction enzymes (TaqI, HinfI, HhaI, RsaI, HaeIII). The results showed a high prevalence (81.1%, 30/37) of nematodes infection in Pacific cod from the east coast of Korea, and the mean intensity was 6.6 larvae/host. The nematodes (198 worms) were mainly found freely in the digestive tract (intestine=57.1%, stomach=28.3%). PCR-RFLP analysis of 156 samples revealed 2 different banding patterns. Based on the banding pattern of PCR-RFLP analyses and the direct sequencing of ITS region of rDNA, 2 nematode species (*Hysterothylacium aduncum* and *Anisakis pegreffii*) were identified from Pacific cod in our study. *H. aduncum* was found in the digestive tract and comprised 96.2% of tested worm (150/156). *A. pegreffii* was found in the pyloric caeca or body cavity, with a low prevalence (3.8%, 6/156). Although there are a few reports on anisakid nematode infection in Pacific cod from waters nearby Japan, but most of them were *Anisakis simplex* and to a lesser extent, *A. pegreffii*. These different nematode species distribution in Pacific cod are thought to be caused by different food items and different migration routes. Thus, these nematodes can be used as biological tags for Pacific cod stock studies, although more extensive long term studies are necessary.

PARASITIC FAUNA OF HYBRID SILURIDAE FISHES OF DIFFERENT HATCHERY STAGES IN BRAZIL

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Recently, hybrid *Pimelodidae* catfish have been gaining importance in Brazilian fish culture, due to their efficient food conversion, high growth rates and good acceptance as game fish. Although fish artificial reproduction techniques are well developed for some species, information still scarce on the larviculture of Brazilian hybrid fish. During larviculture fish are sensible to stress and become likely to be affected by parasitic agents, which results in broodstock losses . This study aimed to evaluate the parasitic fauna o the hybrid "cachapinta" (*Pseudoplatystoma reticulatum* x *P. corruscans*) and "jundiara" (*Leiaurus marmoratus* x *P. reticulatum*) during larviculture, to establish adequate

prophylactic measures for controlling broodstock losses, as well as stop parasites from spreading to other production phases. 315 animals were evaluated, 126 jundiara and 189 cachapinta hybrids, divided in larvae, post-larvae and fry stages. Larvae and post-larvae were pressed between slide and cover slip and observed under optical microscope. Fry were observed under stereomicroscope for external and internal, after necropsy, evaluation. Water quality parameters were measured during all culture stages. Parasitological examination revealed the protozoa *Epystilis* sp., *Trichodina* sp. and *Ichthyophthirius multifilis*; and the helminthes Monogenoidea, *Diplostomun* sp. larvae and metacercariae, distributed in both hybrid species analyzed. The protozoa *Epystilis* sp., *Trichodina* sp. and the digenetic metacercariae were the most frequent and abundant parasites in post-larvae and fry stages for both species analyzed.

FIRST REPORT OF *TRICHODINA COLISAE* (CILIOPHORA: TRICHODINIDAE) IN PACU (*PIARACTUS MESOPOTAMICUS*) CULTURED IN BRAZIL

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Trichodinids are motile ciliates with worldwide distribution that are considered one of the major parasitic agents in cultured fish. In Brazil, most of the trichodinids parasitizing important cultured fish species are still unknown down to species level, demanding further taxonomical studies on this group. This study characterized morphologically *Trichodina colisae* Asmat & Sultana, 2005 from cultivated pacu (*Piaractus mesopotamicus*) in Brazil. Body smears were air-dried at room temperature and after impregnated with silver nitrate in order to study details of the adhesive disc. Prevalence was 52%. *Trichodina colisae* is considered a medium-sized trichodinid with mean body diameter 41.9 $\pm$ 4.6 (34.7-51.3) µm, denticulate ring 19.2 ± 2.8 (15.0-24.4) µm, adhesive disc 33.3 ± 4.9 (26.8-48.9) µm diameter, number of denticles 20.5 ± 1.3 (18.0-23.0), pins per denticle 8.3 ± 0.9 (7.0-10.0) µm, blade 4.0 ± 0.6 (3.1-5.5) µm, central part 1.7 ± 0.3 (1.3-2.3) µm, ray 4.7 ± 1.6 (3.1-8.6) µm and span 9.6 ± 1.3 (5.5-11.8) µm. The present study reports not only the second occurrence of *T. colisae* over the world, but also the first occurrence in Brazil and South America.

NEW GENUS OF CRYPTOGONIMIDAE, A DIGENEAN PARASITE OF *RHAPHIODON VULPINUS* (PISCES: CYNODONTIDAE) FROM BRAZIL.

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Five specimens of *Rhaphiodon vulpinus* Agassiz, 1829 were examined from the Capivara River, an affluent of the Tocantins River, Tocantins State. Only one was parasitized in the

intestine, by eleven digeneans which represent a new genus of the family Cryptogonimidae Ward, 1917. *R. vulpinus* is a freshwater fish which inhabits tropical waters and ranges its distribution in South America, being recorded in Guyana, Venezuela, Ecuador, Peru, Brazil, Paraguay, Uruguay and Argentina. In Tocantis River this species is one of the most important species in terms of abundance and biomass. The specimens collected were cold fixed in AFA with slight compression under cover glass pressure, were stained with Langeron's alcoholic acid carmine, dehydrated in an ethyl-alcohol series, cleared in beechwood creosote and mounted in Canada balsam as permanent slides. The family Cryptogonimidae is represented by 68 genera, reported in marine and freshwater fishes, reptiles and amphibians all over the world. In Brazil four genera has been referred parasitizing fish: *Iheringtrema* Travassos, 1948, *Metadena* Linton, 1910 *Palaeocryptogonimus* Szidat, 1954, *Parspina* Pearse, 1920. The main morphological characters of the new genus are prepharynx long, testes tandem, contiguous, in posterior extremity of body and uterus occupying all space between ovary and anterior testis. The new genus is most closely related to *Adlardia* Miller, Bray, Goiran, Justine & Cribb, 2009 mainly by the space between ovary and testes filled with uterine loops, differing from it by having tegument strongly armed with spines, by the location of ovary, position and location of testes, presence of gonotyl, number of oral spines, caeca ending blind in posterior extremity of body and by the absence of uterus posterior to testes.

ECOLOGY OF THE COMMUNITY OF PARASITES OF *SALMINUS BRASILIENSIS* IN THE UPPER PARANÁ RIVER FLOODPLAIN, BRAZIL

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Salminus brasiliensis (Characiformes, Characidae), popularly known as "dourado", is found only in South America, where it is economically important because of its appreciated meat. The objective of this study was to identify the parasite fauna of *S. brasiliensis*, and to assess possible correlations between parasitism, host characteristics (standard length, relative condition factor - Kn, sex, gonadal maturity stage) and seasons. For this study we analyzed 56 specimens of "dourado", captured in the upper Paraná River floodplain between March 2009 and August 2010. In the total, 828 endoparasites were collected and processed: *Cladocystis intestinales* (Digenea), *Monticellia coryphicephala* (Cestoda), *Octospiniferoides incognita* (Acanthocephala), *Contracaecum* spp. larvae and *Contracaecum* sp. Type 2 larvae (Nematoda). *Octospiniferoides incognita* and *Contracaecum* spp. larvae showed significant positive correlation between prevalence and sex of the hosts, the females being more parasitized. There was no significant correlation between parasitism and standard length, nor gonadal maturity, showing that parasitism was not related to the lifespan and/or breeding season of the hosts. The abundance of *Contracaecum* sp. Type 2 larvae increased in summer, suggesting that the strategy of the parasite may be related to factors such as temperature and periods of flood and drought. The Kn differed significantly between infected and uninfected individuals considering the parasite *Contracaecum* sp. Type 2 larvae, and the infected fish showed lower Kn, indicating a negative effect of parasitism on the fish`s health. The same nematode species showed significant negative correlation between the abundances and the Kn of the hosts. Thus, the

endoparasites of *S. brasiliensis* were correlated with sex and Kn of the hosts, as well as with the seasons.

DISTRIBUTION OF *ERGASILUS SP.* ON THE GILLS OF *LAMPRICHTHYS TANGANICANUS* COLLECTED FROM LAKE TANGANYIKA.

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Four species of *Ergasilus* have been described from fishes in Lake Tanganyika. During a recent survey specimens of *Ergasilus sp.* were found on the gills of 32 *Lamprichthys tanganicanus* from seven localities. Gills were removed after the fish were killed by severing the spinal cord. Parasites were fixed intact on the gills in an acetoformaldehyde alcohol solution and preserved in 70% ethanol. Gills were examined with a dissection microscope, parasites were identified to species level and attachment position and abundance on each gill arch were recorded. The prevalence of infection was 84.40%; the mean intensity 7.56, and the overall abundance 6.38. The total number of parasites was 204 with a maximum intensity of 29 parasites. There is a significant difference between the abundance on the left gill and the right gill. The reason for this difference is not yet known. This is the first record of *Ergasilus sp*. on *L. tanganicanus* and also the first time the distribution is described.

FINE STRUCTURE OF *LONGICOLLUM PAGROSOMI* (ACANTHOCEPHALA: POMPHORHYNCHIDAE) AND INTESTINAL HISTOPATHOLOGY OF THE RED SEA BREAM, *PAGRUS MAJOR*, INFECTED WITH ACANTHOCEPHALANS.

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The results described the structure of *Longicollum pagrosomi* and histopathological characters of the intestine of the red sea bream, *Pagrus major,* infected with acanthocephalans, using the light and electron microscopes. Among the six samples of *P. major*, *L. pagrosomi* was identified in the posterior intestine of five fish samples. Adult *L. pagrosomi* (total length, 8 - 27 mm) is divided into the presoma (proboscis, anterior neck, and posterior neck) and metasoma (trunk). The proboscis had vertically arranged hooks (40 micrometers;m in length), with ten hooks per row, and the septum was observed between the posterior neck and trunk. The tegument thickness of the proboscis was approximately micrometers; and it was composed of thin, circular muscle fibers. The outer fibrous membrane was approximately 1 micrometers, and the connective tissue layer was approximately 35 micrometers in thickness in the anterior neck. The tegument of the posterior neck enclosed the cephalic ganglion and had longitudinal and vertical muscle fibers, and the tegument thickness was approximately 45 micrometers. The tegument of the body, which was approximately 1 mm in thickness, was composed primarily of muscle and collagen fibers, and the structure of the tegument was different, depending on the body

region. In the inflammatory connective tissue, collagen and muscle fibers were split and revealed partial necrosis. In the vicinity of the acanthocephalan, the mucosal epithelia contained hypertrophied nuclei, and the epithelial layer was collapsed. In an extreme case, the mucosal fold was degenerated because of pressure from the acanthocephalan.

MOLECULAR IDENTIFICATION OF ANISAKID NEMATODES ISOLATED FROM PACIFIC COD, *GADUS MACROCEPHALUS* (GADIDAE) IN KOREA

Kim, J.H., Eko, S. & Jeon, C.K.
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The occurrence of anisakid nematodes in Pacific cod (*Gadus macrocephalus*) from Korea was investigated and the isolated worms were identified by molecular methods. Pacific cod were obtained from local fish markets in the east coast of Korea, examined for the nematodes collection and the nematodes were identified by PCR-RFLP with NC5-NC2 primer sets and restriction enzymes (TaqI, HinfI, HhaI, RsaI, HaeIII). The results showed a high prevalence (81.1%, 30/37) of nematodes infection in Pacific cod from the east coast of Korea, and the mean intensity was 6.6 larvae/host. The nematodes (198 worms) were mainly found freely in the digestive tract (intestine=57.1%, stomach=28.3%). PCR-RFLP analysis of 156 samples revealed 2 different banding patterns. Based on the banding pattern of PCR-RFLP analyses and the direct sequencing of ITS region of rDNA, 2 nematode species (*Hysterothylacium aduncum* and *Anisakis pegreffii*) were identified from Pacific cod in our study. *H. aduncum* was found in the digestive tract and comprised 96.2% of tested worm (150/156). *A. pegreffii* was found in the pyloric caeca or body cavity, with a low prevalence (3.8%, 6/156). Although there are a few reports on anisakid nematode infection in Pacific cod from waters nearby Japan, but most of them were *Anisakis simplex* and to a lesser extent, *A. pegreffii*. These different nematode species distribution in Pacific cod are thought to be caused by different food items and different migration routes. Thus, these nematodes can be used as biological tags for Pacific cod stock studies, although more extensive long term studies are necessary.

A NEW GENUS AND SPECIES OF DIDYMOZOIDAE (DIGENEA) FROM THE SKIPJACK TUNA *KATSUWONUS PELAMIS* (SCOMBRIDAE) IN BRAZIL

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2.- Fundação Carlos Chagas Filho de Amparo à Pesquisa do Estado do Rio de Janeiro - Faperj

During the survey of helminth parasites from scombrid fishes, a new genus and species of Didymozoidae was found encysted in the wall of the stomach of skipjack tuna *Katsuwonus pelamis*. Didymozoids are parasites of marine teleosts, mainly scombrids and rarely of freshwater fishes. They represent a different group of parasites mainly by the general

morphology highly adapted to different sites, not common to other digenean. Sixty one specimens of *K. pelamis* were examined for helminths from January 2004 to April 2011. Fishes were obtained from local fishermen from the coastal zone of the State of Rio de Janeiro, off Cabo Frio, Brazil, southwestern Atlantic Ocean. Parasites were released from cysts and fixed under strong cover glass pressure in AFA (alcohol 93%, formalin 5%, acetic acid 2%), stained in alcoholic-acid carmine, dehydrated in an alcohol series, cleared in methyl salicilate and mounted in Canada balsam. The new species was found in spherical cysts containing two fused hermaphroditic individuals with bodies divided into two regions. Posterior regions not completely fused with longitudinal aperture in deep cavity from which emerge free anterior regions. The new genus and species are placed in Gonapodasmiini, subfamily Gonapodasmiinae. It differs from all other genera mainly by the morphology of bodies' posterior regions not completely fused, forming one globular mass not lobed, presenting elliptical aperture in deep cavity, from which emerge elongate anterior regions and also by the two sets of testes ramified in three to four branches each. The new genus and species are named in honour of Profs S. E. Pozdnyakov from Russia and D. I. Gibson from England.

HENNEGUYA SPP. PARASITIZING *CYPHOCHARAX NAGELII* (STEINDACHNER, 1881), *PROCHILODUS LINEATUS* (VALENCIENNES, 1837) AND *STEINDACHNERINA INSCULPTA* (FERNÁNDEZ-YÉPEZ, 1948) (CHARACIFORMES) FROM THE PEIXES RIVER, STATE OF SAO PAULO.

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The Brazil has a highly diversified fauna of freshwater fish, about 8000 species, which corresponds to 24% of all freshwater fish species in the world. In many regions of the world, wild and cultivated fish are infected by numerous myxosporean parasites of the genus *Henneguya* Thelohan, 1892. This genus includes about 150 species. Actually, 41 valid *Henneguya* species have been reported to infect Brazilian fish. The Peixe's river is a tributary of the left bank of the Middle Tiete river basin in the region of Barra Bonita, SP. Between 22 to 26 March 2010 and 9 to 13 August 2010 were collected were collected 25, ten and eight specimens of *C. nagelii*, *P. lineatus* and *S. insculpta* respectively from Peixes River. Immediately after each collection, the fish were killed by transection of the spinal cord. The fish were dissected and the gills (*C. nagelii* and *S. insculpta*) and pyloric cecae (*P. lineatus*) containing several whitish cysts were removed and examined with a light microscope equipped with Nomarski interference-contrast (DIC) optics and was performed ultrastructural studies. The morphology and dimensions of *Henneguya* spp. found were compared with those of other *Henneguya* spp. that parasitize Brazilian freshwater fish and from other continents and presented differences. The prevalence of infection was 16.7%, 25% and 10% in *C. nagelii*, *P. lineatus* and *S. insculpta* respectively. Exist one species described in *C. nagelii*, but the specie found here present very differences. Exist two species described parasitizing the gills of *P. lineatus*, but the specie registered here for this

host was found parasitizing the pyloric cecae and is dissimilar the two species. None species of *Henneguya* was recorded in *S. insculpta* at a moment. This is the first register of myxozoan parasites in Peixe's river.

ZOOGEOGRAPHY AND GENETIC VARIABILITY OF ZOONOTIC *ANISAKIS* SPP. (ANISAKIDAE, NEMATODA) IN DIFFERENT CLIMATE ZONES

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Anisakid nematodes take up an exceptional position within the marine parasite fauna. Members are worldwide distributed and known as the causative agents of the human anisakidosis, a painful inflammation of the gastrointestinal tract caused by the ingestion of larvae in raw or insufficient cooked fish and fish products. Due to the high prevalence in commercially important teleost fish species such as *Clupea harengus* or *Oncorhynchus* spp., members of the genus *Anisakis*are considered as the most common causative agents of this zoonosis. The broad knowledge about the distribution of *Anisakis* spp. is therefore of particular importance to predict the likelihood of infections in a given area. In the present study, molecular data of *Anisakis* spp. were used to estimate the species range of *Anisakis* spp. using a modified geographical interpolation approach. ITS ribosomal DNA sequences of 381 larval *Anisakis* spp. from 22 sampling locations in different climate zones and oceans isolated from 32 different bony and elasmobranch hosts were analysed to assess the genetic variability of the ITS-1/5.8S/ITS-2 marker. Geographic modelling indicates, that the species ranges of *Anisakis* spp. can be restricted to certain areas within climate zones and oceans and are influenced by the species ranges and feeding behavior of their respective intermediate and mammalian final hosts. Sequence analyses revealed that the genetic variability of the rDNA marker is high enough to distinguish *Anisakis* sibling species, but it provides not enough variable sites for reliable phylogenetic analyses.

NEW SPECIES OF *CUCULLANUS* (NEMATODA: CUCULLANIDAE), PARASITE OF THE INTESTINE OF *CICHLA PIQUITI* (PERCIFORMES: CICHLIDAE) FROM TOCANTINS RIVER, BRAZIL

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The genus *Cucullanus* Müller, 1777 comprises over 100 species of parasites of fish worldwide, including 27 species described for the Neotropical region, specifically 16 to Brazil. Species of *Cucullanus* found in Brazil almost exclusively parasitize fishes of the order Siluriformes, with only two exceptions. In total, 25 specimens of *Cichla piquiti* were collected in the reservoir of Lajeado (10º 66'55" S 48º 42'36" W), Tocantins River, Brazil, in October 2009, where 14 specimens of *Cucullanus* n. sp. were found. In this study, a new species of *Cucullanus* is described and compared to other species of the genus present in

the same zoogeographical region and in the same group of hosts, the order Perciformes. The main characteristic of the new species is the presence, both in males and females, of a sclerotized pointed structure at the distal end of the tail, provided with spines on the ventral portion.

DYNAMICS OF INFECTION OF TRYPANOSOMES FOUND IN *HYPOSTOMUS AFFINIS* AND *HAEMENTERIA* SP.

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Natural fish trypanosomiasis is widespread with high prevalence in the wild. Leeches are the vector involved in trypanosomes transmissions in aquatic environment. The purpose of this study was to report the prevalence and intensity of infection of trypanosomes and infestation by *Haementeria* sp. in *Hypostomus affinis* from Rio Pomba, MG, Brazil. *Hypostomus affinis* (n=34) were collected from Pomba river, (21º21'07"S, 43º02'49" O) Guarani City, MG, Brazil. *Haementeria* sp. Found infesting fishes were counted and removed. Blood samples were obtained by cardiac puncture and the prevalence of the infection was determined by the presence of trypanosomes in stained blood smears. Parasitemia was estimated counting trypanosomes in 50 fields (10 Ocular X 20 Objective). The number of trypanosomes in leeches was determined by maceration of 10% of collected leeches in PBS and counting the developmental forms in haemocitometer. Statistical analyses were performed using analyses of variance of Kruskall-Wallis at the significance level of $p<0.05$. Leeches were found during all the seasons infesting *H. affinis* located mainly in the mouth. Infestation was analyzed during a year and varied significantly during the different seasons. In the winter the intensity of infestation reached 5 leeches per fish and in the autumn it presented a low number, approximately 1 leech per fish. Trypanosomes were detected in all *H. affinis* captured, characterizing 100% of prevalence. The parasitemia ranged throughout the seasons, in the spring and summer the parasitemia was approximately 1 parasites/cm2 and in the autumn was 1.7 parasites/cm2 and winter it showed a peak of 5.8 parasites/cm2. Approximately 62.5% of the leeches were infected with trypanosomes. The mean number of trypanosomes was 1.6×10^4 parasites/mL. These data showed that the elevation of the parasitemia coincides with elevation of intensity of infestation of leeches in the winter.

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DEVELOPMENTAL FORMS OF TRYPANOSOMES FROM FISHES HOSTS *HYPOSTOMUS AFFINIS* AND *HYPOSTOMUS LUETKENI* AND OF THE LEECH *HAEMENTERIA* SP.

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Trypanosomes of fishes have a worldwide occurrence and are transmitted by the sanguivorous leeches in which the parasite multiplies and undergoes morphological transformation. The objective of this study was characterize the developmental forms of trypanosomes found in armored catfishes and leeches through the morphology and morphometry. *Hypostomus affinis* (n=34) and *Hypostomus luetkeni* (n=10) naturally infected were captured from Rio Pomba (21º21'07"S, 43º02'49" O), Guarani, MG, Brazil. Blood samples were collected by cardiac puncture. *Haementeria* sp. founded on fishes were dissected and removed the proboscis, crop and gut and prepared thin smears. Trypanosomes were processed by light and scanning electron microscopy. Morphometric characterization was made in 20 parasites of each developmental forms. Trypanosomes exhibit pleomorphism and the morphological analyses indicated four morphospecies separated according to morphological variations. Morphospecies 1 presents long and broad body; morphospecies 2 presents long and slender body with tapered extremities, some trypanosomes presented several vacuoles along the body. Morphospecies 3 presents long and striate body with more variable posterior end shape, often tending to be wider than related long forms and morphospecies 4 present a short and slender body. Trypomastigotes of the all morphospecies exhibit a rounded kinetoplast located in the posterior region of the body and a long free flagellum. Epimastigotes and trypomastigotes were detected in the crop and stomach of *Haementeria* sp. and were observed in binary fission. Trypanosomes are shorter than blood trypomastigotes and presented elongated and slender body. Only epimastigotes were detected in the gut and presented a bar shaped kinetoplast and granules distributed along the body. Trypomastigotes presented rounded kinetoplast and also presented granules.

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THE CONTRIBUTION OF THE STABLE NITROGEN ISOTOPIC COMPOSITION ($\delta^{15}N$) TO THE VARIABILITY OF *ANISAKIS* MUSCULAR RECRUITMENTS IN COMMERCIAL FISH SPECIES

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The incidence of macroscopic parasites, especially *Anisakis* spp. at commercially important fish species is a well-known emerging problem that is causing negative effects on fisheries and seafood industries. In the present work, 500 fish individuals divided into 10 lots

belonging to 10 relevant species from NW Atlantic waters (FAO 27 fishing area), were collected and examined for the presence of anisakid larvae in their musculature. Before necropsies, every single fish was externally inspected, weighed and measured. Then, a sample of 5 grams of muscle from each individual was taken, processed and prepared before carrying out a complete study of stable nitrogen isotopic composition ($\delta^{15}N$) by means of Isotope Ratio Mass Spectrometry (IRMS). The effects of size, weight and $\delta^{15}N$ of fish on the recruitment of the musculature-infecting anisakids, were studied in detail. Results have been discussed in relation to trophic shifts tracing pathways for *Anisakis* recruitment and infection in the flesh of fish. The study has revealed that larger, heavier and enriched $\delta^{15}N$ fish had larger parasite infrapopulations. However, $\delta^{15}N$ of the fishes described the parasite recruitment to the host population almost equal than did total length or body weight. In conclusion, results revealed that $\delta^{15}N$ contributes to the variability in the number of anisakids present in the flesh of fish, being one of the reliable categorical predictors of anisakid infections in many fish species.

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A COMPLETE STUDY OF MICROSPORIDIANS IN THE MUSCULATURE OF *LOPHIUS BUDEGASSA* AND *LOPHIUS PISCATORIUS* FROM ATLANTIC WATERS.

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The presence of macroscopic parasites at commercial interest fish species is a widely known reality that is increasingly causing troubles at fisheries and seafood industries. Microsporidia have been reported to appear forming visually apparent xenomas in anglerfish species. In the present work, individuals of *Lophius budegassa* and *Lophius piscatorius* from NW Atlantic waters were sampled and examined with the aim of determine identification, distribution and site of infection of the parasites present. Besides nematods of the genera *Anisakis* spp, *Spraguea lophii* were found forming two different sizes of groups of xenomas in cranial and vertebral nervious tissues of both fish species. Demographic values of infection for microsporidia were also given. After removing and preparing xenomas for histological studies, scanning and transmission electron microscopy (SEM and TEM) were carried out for fresh spores, thus a wide ultraestructure description was also given. Molecular analyses of the xenomas, based on the small subunit ribosomal DNA gene were performed to identify the microsporidia species. This work presents a complete report of *Spraguea lophii* in *Lophius budegassa* and *Lophius piscatorius* providing precise diagnosis data, distribution information and detailed descriptions of internal structures of spores.

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A STAGING SYSTEM APPROACH FOR THE OVERALL PROGNOSTIC ASSESSMENT OF FISH LOTS INFECTED BY ANISAKIDS.

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A total of 1082 individuals distributed in 13 lots belonging to 12 fish species from 4 Atlantic FAO fishing areas, were sampled and examined for the presence of anisakid larvae in fish muscle. After hazard identification by genetic sequencing and exposure assessment by anatomic extent and demographic characterization of infection, all data were fitted for each fish species to a new proposed staging schema of parasite prognosis. In absence of a golden standard method for inspection and precise definition of the quantum satis for anisakids in contaminated fish lot, the point staging system (called SADE) showed promise to fish operators as a reasonably precise handle measurement for evaluating the likely outcome of infected fish lots after being diagnosed. For this purpose, a flow diagram was defined and proposed. This new tool has the aim of helping fish operators to carry out fish lots encoding during self-control processes. This new prognostic model could help in planning manufacturing, commercial and research decisions by adding a prognostic stratification at the time of inspection. Furthermore, the holistic staging approach provides an improved inspection format to guide HACCP programs for the uniform exchange of information among fish operators, Administration and researchers, thus facilitating standardization and communication. In the future, this staging version could be adapted and validated in classification and wording for similar overall prognostic purposes in other muscular parasites infecting seafood products.

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SOFTWARE DEVELOPMENT FOR MANAGEMENT OF PARASITIZED FISH STOCKS AND PRODUCTS.

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Food safety problems as zoonoses, gastroenteritis, allergic disorders, and decreases on visual quality, are the major repercussions that parasites present in seafood products are generating since several years. For this study, 1082 individuals belonging to 12 fish species from 4 Atlantic FAO fishing areas, were inspected an necropsied within 12 hours and 48 hours post-capture. After examining every single fish by means of an exhaustive visual inspection of the musculature, the flesh of each individual was digested in a pepsin solution. All parasites found were observed and photographed under stereomicroscope, optical and electron microscope, and then collected and preserved. After identification by genetic sequencing, demographic categorization of infection for every parasite and fish species was determined. The aim of this study was (1) to find, diagnose and categorize the parasite species with safety and commercial quality implications in the Atlantic studied stocks, and (2) to create a reliable predictor tool for fishery operators and industries. Therefore, all data obtained were used to generate a new software called RAPPs (Rapid Assessment Protocol for Parasites). Its primary objective will be to allow users access to all available information about parasites distribution and abundance, for the studied fish species in the geographic areas sampled. In the upcoming years, this useful tool could be improved by the sampling of new lots of fish species, with the aim of offering a more complete instrument that helps to reduce this emergent hazard at origin. Hazard Analysis Critical Control Point (HACCP) programmes at seafood industries should be reviewed to integrate this innovating tool, thus ensuring low-parasited fish to consumers.

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AN EXPERIMENTAL APPROACH TO THE STUDY OF PERSISTENCE IN PARASITE ASSEMBLAGES OF INTERTIDAL FISH ASSEMBLAGES OF CHILE

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Persistence of parasite assemblages in rocky intertidal fish assemblages was assessed through experiments of differential perturbation regimes of fish abundance in six natural pools between October and December 2010, in the Valparaíso region, Chile. Pools were differentially defaunated from which 292 fish individuals of 11 species were examined for parasites and diet contents. We compared the composition, abundance and richness of host and parasite assemblages before and after repeated defaunations, which were classified as short (1 mo) and long term (2 mo). These comparisons included total parasites and also separated by ecto and endoparasites. We found no differences in composition of the fish assemblage nor in composition of parasite assemblages between disturbed and undisturbed pools, though some differences were seen between sampling occasions. There were no differences in parasite richness between disturbed and undisturbed pools, after examining the residuals of regressions with the host body mass, with the host density and with the host dietary breadth. However, parasite abundance was higher in disturbed pools. Parasite

richness was found to be higher among previously undisturbed pools and after 2 mo of recovery time. In general, our results suggest a high level of persistence of host and parasite assemblages, though a long term study is needed.

BIOMONITORING THE FISH HEALTH AND PARASITES AT TWO IMPOUNDMENTS IN THE OLIFANTS RIVER, LIMPOPO PROVINCE.

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Monitoring water quality in a water body provides little information about bio-availability and effects of pollution at the biological level when chemical and physiological changes or responses are not considered. Changes occurring in fish populations due to chemical stress are manifestations of biochemical, histological and physical alterations, and can give a relatively rapid indication of how environmental conditions affect fish populations. The aim of this study is to assess the fish health and parasites of four indigenous fish species (*Clarias gariepinus, Labeo rosae, Oreochromis mossambicus* and *Schilbe intermedius*) from Flag Boshielo Dam (FBD) and Phalaborwa Barrage (PB) by applying the fish Health Assessment Index (HAI). The HAI is a quantitative index that allows statistical comparison between different water bodies and it gives a rapid indication of the health status of a selected environment. The seasonal population HAI values have been calculated for the four fish species at both impoundments. The overall mean HAI values were higher at FBD than PB. At both impoundments, the highest HAI values were recorded for *C. gariepinus* and the lowest for *L. rosae*. In recent years, new applications of fish parasites as appropriate biological indicators of environmental stress have been developed. These applications emanates from the fact that parasites of fish are an indigenous component of a healthy ecosystem and that the biotic response of parasites to environmental stressors is reflected in the health of fish. Pollution can increase parasitism if the host defense mechanisms are negatively affected, thereby increasing host susceptibility. Conversely, pollution can also decrease parasitism if the parasites are more susceptible to a particular pollutant than the host, or pollution levels eliminate the suitable intermediate host. The seasonal abundance of all metazoan ecto- and endo-parasites was recorded from the four host fish species. The results showed that *C. gariepinus* hosted the highest number of parasite species (n=15), followed by *O. mossambicus* (n=12), while *L. rosae* and *S. intermedius* hosted nine parasite species. At both impoundments *C. gariepinus* had the highest parasite abundance and mean intensity rates. According to the HAI and PI, the fish health was more impacted at the FBD by the water quality than at the PB.

DIVERSITY OF METAZOAN PARASITES OF THE SILVER CATFISH AND MOZAMBIQUE TILAPIA AS INDICATOR OF POLLUTION FROM THE OLIFANTS RIVER, SOUTH AFRICA.

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Major industrial and mining operations in the upper catchment area of the Olifants River (South Africa) have resulted in the gradual deterioration of the water quality, which probably contributed to the major crocodile kills in parts of the river. Fish parasites form an integral part of the aquatic ecosystem and parasites can be used as indicators of water quality because of the variety of ways
in which they respond to pollution. *Schilbe intermedius* (Silver catfish) and *Oreochromis mossambicus* (Mozambique tilapia) were sampled at the Phalaborwa Barrage and Flag Boshielo Dam in the Olifants River of the Limpopo Province. Parasites were fixed and preserved using standard methods. Water samples were taken concurrently and selected variables determined. The parasitological data was correlated with water quality data from the two localities. The variability of the calculated biotic indices and the degree of interactivity among parasites suggests that the structure of parasite communities (especially the different groups, i.e. monogeneans, digeneans, cestodes, nematodes, copepods and branchiurans), is affected differently by water contamination levels and the type of pollution (e.g. organic or metal pollution). The results showed that *O. mossambicus* hosted the highest number of parasite species (n=12), followed by *S. intermedius* (n=9). The highest parasite diversity was recorded at PB, the less impacted site.

NEW *POLYCLITHRUM* (MONOGENEA: GYRODACTYLIDAE) FROM EXTERNAL SURFACE OF *MUGIL LIZA* (MUGILIDAE) FROM SAMBORombÓN BAY, ARGENTINA.

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Gyrodactylids of genus *Polyclithrum* Rogers 1967 are parasites of external surfaces of mugilids. At present, this genus comprises a total of five nominal species: *P. alberti* Ernst, Whittington & Jones 2000), a parasite of *Mugil cephalus* from Queensland, Australia; *P. boegeri* Ernst, Whittington & Jones 2000, found in *M. liza* from Rio de Janeiro, Brazil; *P. corallense* Ernst, Whittington & Jones, 2000 a parasite of *M. cephalus* from Heron Island, Australia; *P. mugilini* Rogers, 1967, a parasite of *M. cephalus* from Georgia, USA, and Black Sea, and *P. ponticum* Gerasev, Dmitrieva & Gaevskaja, 2002, a parasite of *M. cephalus* from Black Sea. Now in the course of a parasitological survey of brackishwater fishes in Samborombón Bay, Argentina we have collected several monogenean species including a new species of *Polyclithrum* found in the body surface of *M. liza*. This is the first record of the genus in Argentina. The new species differ for all previously described species, mainly by the morphology of male copulatory organ and most of the measurements

of haptoral sclerites. Therefore, *Polyclithrum* specimens collected from *M. liza* from Samborombón Bay represent a new species currently being described.

USE OF CYPERMETHRIN AGAINST SEA LICE *CALIGUS ROGERCRESSEYI* IN CHILE

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The use of Cypermethrin for the control and treatment of Sea Lice *Caligus rogercresseyi* will be described in a poster presentation. Cipermethryn is used in Chile since October 2010, applied by bath treatment as an effective method to treat external parasites in salmon and trout farmed population. Information about use, number of treatments and number of treated fishes will be presented. Efficacy data will also be shown based on field collected data considering the number of parasites, separated in stages, before and after treatment.

COINFECTION BY *EDWARDSIELLA ICTALURI* AND *ICHTHYOPHTHIRIUS MULTIFILIIS* AFFECTS HEMATOLOGY AND SURVIVAL IN CHANNEL CATFISH *ICTALURUS PUNCTATUS*

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This study evaluated two coinfection models on the survival and hematological parameters in channel catfish *Ictalurus punctatus* infected with *Ichthyophthirius multifiliis* (Ich) and/or *Edwardsiella ictaluri*. In Trial I fish were exposed to Ich theronts five days prior to *E. ictaluri* and high mortality (84-86 %) resulted in Ich exposed fish regardless of *E. ictaluri* exposure. In Trial II fish were exposed to *E. ictaluri* two days prior to Ich theront infection. Coinfection resulted in significantly increased mortality (59 %) as compared to the fish exposed to single infection (i.e., *E. ictaluri* 42 % or Ich 19 %). Hematological assessment was conducted 3, 6 and 17 days after Ich infection in Trial I and 2, 8 and 17 days after *E. ictaluri* infection in Trial II. Red blood cell counts and hematocrit showed decreased values 6 and 17 days after Ich infection in Trial I. Decreased mean corpuscular volume and hematocrit was observed in Trial II 2 days after *E. ictaluri* infection. Lymphopenia was demonstrated in both trials in coinfected or single infected treatments as compared to non-infected fish. This work furthers our knowledge of coinfection with *E. ictaluri* and *I. multifiliis* in channel catfish.

FIRST RECORD OF *DIPHTEROSTOMUM BRUSINAE* (DIGENEA: ZOOGONIDAE) IN JUVENILES OF *MICROPOGONIAS FURNIERI* (PISCES: SCIENIDAE) IN ARGENTINA

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Zoogonids are common and widespread digenean parasites of mainly marine fishes. They parasitize gastrointestinal tract, gall and swim bladder, and bile ducts of teleosts and some elasmobranchs. Over a three-year period, a survey was carried out to increase the knowledge of parasites of fishes in brackish waters of Argentina. We found adult specimens of *Diphterostomum brusinae* parasitizing the intestine of juveniles of the whitemouth croaker, *Micropogonias furnieri*, in Bahía Blanca estuary (N=142) and in Samborombón Bay (N=265) (Buenos Aires Province, Argentina). Prevalence (P) and mean intensity (mI) were higher in the first site (P = 18.3 % vs. 14.7 %; mI = 18.9 vs. 6.7). Measurements and morphology of specimens perfectly fits with the description made for *D. brusinae*. Adults typically have a densely spiny tegument, two small and sacular intestinal caeca and a well-developed ventral sucker with two pairs of muscular lips. In a previous work, we have also found larval stages (sporocysts, cercariae and metacercariae) parasitizing the snail *Buccinanops globulosus* (Nassariidae) in Samborombón Bay. They are similar to those described for *D. brusinae*. In this work we record for the first time *D. brusinae* in *M. furnieri* and we also propose the life cycle of this species in Samborombon Bay, Argentina.

PROCAMALLANUS (*SPIROCAMALLANUS*) *SPIRALIS* (CAMALLANIDAE) IN NEW HOST AND LOCALITY - SEM AND LM OBSERVATIONS

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Camallanid species of *Procamallanus* (*Spirocamallanus*) *spiralis* (Baylis, 1923) from the intestine of *Synodontis frontosa* Vaillant, 1895 (Mochokidae, Siluriformes) from Lake Turkana (Kenya) is redescribed and imaged by scanning electron microscopy (SEM) and light microscopy (LM).Taxonomic features, such as cephalic structures, oval mouth aperture with 8 papillae in 2 concentric circles of 4 and 2 lateral amphids, serrated spiral thickenings in the orange-brown, longer than wide, and thick-walled buccal capsule with simple, well-developed basal ring, deirids, vulva, unequal spicules and number and localization of male's caudal and cloacal papillae were observed. Of the two similar species [*P.* (*S.*) *dalenae* Boomker, 1993; P. (S.) *mazabukae* Yeh, 1957] occurring in freshwater fishes of Africa, *P.*(*S.*) *spiralis* differs in distinctly smaller sizes of buccal capsule,number (10-12) of spiral ridges in the capsule, length of muscular oesophagus, distance of nerve ring from anterior end, and male's tail length. The translucent first-stage larvae having a denticulate process and embryos in different stages are described too. Cleavage sequences, blastomeres forming the morula and the blastula stages in the uterus and the subsequent gastrules were found. *Synodontis frontosa* represents a new host record, and Kenya is a new geographical record for this species.

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PARASITOFAUNA OF *BATHYPTEROIS MEDITERRANEUS* (OSTEICHTHYES: IPNOPIDAE) FROM WESTERN MEDITERRANEAN WATERS.

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Bathypterois mediterraneus is the most common fish below 1000 m in western Mediterranean waters. However, there are no studies on the parasite fauna of this species or of any of the other species belonging to the genus *Bathypterois*. Samples of *B. mediterraneus* were obtained from the continental slope at two different geographical areas (Catalonia and Balearic Islands) at different depths between 1000 and 2200 m during July 2010. A total of 170 individuals were examined for parasites. Data were grouped according to location (Catalonia or Balearic Islands) and depth of capture (1000-1400 m, 1400-2000 m or 2000-2200 m). Five parasite species were found: *Steringophorus* sp. (Platyhelmintha, Trematoda), a metacestode of Tetraphyllidea sp. (Platyhelmintha, Cestoda), *Anisakis physeteris* s.l., *Hysterothylacium aduncum* (Nematoda, Ascaridida) and *Lernaeenicus* sp. (Copepoda, Siphonostomatoida). *H. aduncum* showed a significantly higher abundance at 2000-2200 m than at the rest of depths no matter the locality (Mann-Whitney U test, P = 0.000 in all cases). On the other hand, our results show significant differences between the abundance of *Steringophorus* sp. in both localities at all depths except at 2000-2200 m (Mann-Whitney U test, P = 0.084). Deep water fauna is believed to be homogenous, however the differences found in this heteroxenous parasite abundance point to local differences in the intermediate host distributions.

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MONOGENEA OF THE GENUS *DACTYLOGYRUS* FROM SOUTH AFRICA

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Monogenea of the genus *Dactylogyrus* are parasitic gill worms, predominantly on cyprinid fishes. They are a highly diverse group, with a distribution and zoogeography linked to the evolutionary history of their cyprinid hosts. In Africa, more than 92 species have been described from its fishes as compared to the more than 900 nominal species described worldwide, consequently causing confusion within this largest helminth genus. In South Africa only three studies serve as records for *Dactylogyrus* Monogenea with only 11 species present thus far. The present study adds 6 species to the list and 4 of them may be described as new. In the present study undertaken in lake Tzaneen, South Africa, cyprinid fish hosts (n=88) were collected using gill nets. Nine *Dactylogyrus* spp. were collected from the various cyprinids sampled. Three of them previously found in South Africa are *D. afrolongicornis afrolongicornis* and *D. allolongionchus* collected from *Barbus trimaculatus* as well as *D. spinicirrus* from *Labeo barbusmarequensis*. Two are new geographical records and these are *D. brevicirrus* and *D. cyclocirrus* on the gills of *Labeo cylindricus*. Four species to be described as new are *D. radiatus* from *Barbus radiatus*, *D. unitaeniatus* from *Barbus unitaeniatus* and both *D. sevidi* and *D. molybdinus* from *Labeo molybdinus*. In South Africa, monogenean studies are still in the infancy stage of taxonomic identifications, probably due to very little aquaculture practices and fish farming. Price, Korach & McPott (1969) described 2 species. Price, McClellan, Druckenmiller & Jacobs (1969) described one species and found another species. Mashego (1983) described 3 new species, recorded new hosts for 5 species and reported one other species. The species are discussed with a focus on new species. It is envisaged that more species will be found in South Africa as more cyprinid hosts and freshwater bodies are subjected to investigations.

A PILOT PROJECT TO STUDY THE EPIDEMIOLOGY OF FISH-BORNE HELMINTHIC ZOONOSES IN ITALY FOR EVALUATING INFECTION RISK TO HUMANS

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Zoonoses can be considered among the most important health risks both in the developing countries and in most advanced economies; in particular parasitic zoonoses are characterized by a difficult control because of frequent complexity of life cycle of causative agents and the articulated routes of transmission. The most effective control tools remain so

far surveillance and health education, which are essentially based on adequate knowledge of the etiological agent and its epidemiology. The changing in eating habits, particularly with the introduction of some fish products eaten raw as sushi and sashimi, or as "fish carpaccio", cold smoked or marinated fish products, has been resulted in an increasing attention to the parasitic fish borne zoonoses during the last decade in Italy. Considering the recent EU Regulations on Food Hygiene, the lack of data on zoonotic helminths infestations in Italian fish population and the recent establishment of a Circular of the Ministry of Health on "Emergence of opisthorchiasis in central Italy", it is of primary importance to undertake and/or expand the research aimed at identifying the presence and diffusion of zoonotic parasites in aquatic animals present in the national water environments, developing appropriate diagnostic methods, clarifying their biological and ecological characteristics and identifying the possible routes of transmission to man. Main aim of the project "*Molecular characterization and epidemiology of fish-borne zoonosis by parasitic helminths in Italian fish resources: defining parameters for evaluating infection risk to humans"* financed by MIUR-Italy (PRIN 2008) has been to provide a scientific update on the presence and diffusion of zoonotic helminths such as flukes (*Opisthorchis* spp., *Heterophyes* sp.), cestodes (*Diphyllobothrium* spp.), and nematodes (*Anisakis* spp.) in fish species from national freshwater, brackish and marine environments and to assess diagnostic tools useful to their identification at species level. The bulk of data so far obtained will allow not only to enlarge and establish an epidemiological picture on the distribution of these helminthes in some Italian fish species, but also to monitor their occurrence in order to set up control measure to avoid infection risk to humans.

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METAZOAN PARASITES OF THE HEAD OF THE ATLANTIC CHUB MACKEREL *SCOMBER COLIAS* (OSTEICHTHYES: SCOMBRIDAE) FROM THE WESTERN MEDITERRANEAN SEA.

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The Atlantic chub mackerel *Scomber colias* (Gmelin 1789) is an economically important pelagic fish from the Atlantic Ocean and the Mediterranean. Most parasitological information comes from Atlantic and eastern Mediterranean fish and little is known from the western Mediterranean. This study is focused on the head parasites of *S. colias* from this area. Parasites were collected from 29 fish from the Gulf of Asinara (Sardinia) and 30 from the Gulf of Valencia (Spain) in spring 2009 and 2011, respectively. Nine species of parasites were found: *Grubea cochlear, Kuhnia scombercolias, Kuhnia scombri, Pseudokuhnia minor, Nematobothrium* sp., *Nematobothrium* cfr. *faciale*, *Nematobothrium filiforme, Nematobothrium scombri, Clavellisa scombri*. *P. minor* was the dominant species; *K. scombercolias*, *N.* cfr. *faciale* and *N. filiforme* are reported for the first time in

the Mediterranean. *K. scombercolias* was only found in Sardinia and *Nematobothrium* sp. in Spain. The intensity of infection of *P. minor* was positively correlated with host size (r = 0.19). *K. scombercolias, K. scombri* and *N.* cfr. *faciale* showed significant differences of prevalence between localities. Previous studies on the parasites of *S. colias* from the Atlantic Ocean and the eastern Mediterranean described geographical differences in the parasite assemblages, suggesting the existence of separate fish populations. The parasites of *S. colias* from the western Mediterranean seems to differ between the Sardinian and Spanish areas and from those from the eastern Atlantic and eastern Mediterranean areas. Further studies could suggest the usefulness of some of these parasites as biological tags.

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DIDYMOZOID TREMATODES ON THE GILLS OF THE ATLANTIC BLUEFIN TUNA *THUNNUS THYNNUS* (OSTEICHTHYES: SCOMBRIDAE)

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Atlantic bluefin tuna *Thunnus thynnus* is a pelagic fish inhabiting the Atlantic Ocean and the Mediterranean Sea. It is one of the most important and valuable finfish worldwide. Present study shows the didymozoid parasites on the gills of *T. thynnus* from different areas of the Mediterranean Sea and the Atlantic Ocean. Parasites were collected from 29 fish. Tunas were caught between 2005 and 2011 from 2 localities of the western Mediterranean (Sardinia and eastern coast of the Spain) and one of the north eastern Atlantic Ocean (Gulf of Cadiz). Hosts were divided into two size classes (101-131 cm and 167-226 cm fork length). Nine didymozoid were found: *Didymocystis reniformis*, *Didymocystis* sp. 1, *Dydymosulcus* sp. 1, *Didymosulcus* sp. 2, *Didymosulcus wedli*, Didymozoidae gen. sp., *Didymozoon pretiosus*, immature didymozoid stage, and *Wedlia bipartita*. *D. wedli* and *Didymocystis* sp. 1 were the dominant species in Mediterranean and Atlantic hosts, respectively, and *Didymocystis* sp. 1 was only found in the larger fish. *D. wedli* showed differences of prevalence and mean intensity between host size groups and the two western Mediterranean localities. The parasite richness of the smaller fish from Sardinia was more similar to that observed from the Mediterranean Spain coasts than those from the north eastern Atlantic (Gulf of Biscay) and the Adriatic Sea (Mladineo et al 2008, J World Aquacult Soc 39: 281- 289; Rodriguez-Marín et al 2008, Aquat Living Resour 21: 365-371). The parasite richness of the larger fish from the Gulf of Cadiz was more similar to that from the Gulf of Biscay than to that from the Mediterranean Sea. The differences observed may be due to host size, geographical distribution, and migrations of distinct fish groups.

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A BAYESIAN COMPARISON OF TWO HELMINTHES POPULATION IN JUVENILES OF *MUGIL LIZA* FROM SAMBOROMBON BAY, ARGENTINA.

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The main objective of this presentation is to compare the helminths population in juveniles *Mugil liza* from Samborombon Bay mainly with Bayesian statistsics. Samples were collected at two sites, one in the North, in the relief Channel of Salado River (Site 1), and the other in the south in the Ajo River (Site 2). A total of 65 juveniles of *M. liza* from Site 1 and 93 from Site 2 were captured. Fishes were weighted, measured and revised for helminths. The prevalence and intensity was calculated for Digenea, Monogenea and Acantocephala. Nematoda was not considered in this study due to its low prevalence. The Bayesian tests were made using WingBUGS free software. The digenean species was *Dicrogaster fastigata, Hymenocotta manteri*, and the metacercarie *Ascocotyle* (*Phagicola*) sp. This is the first record in Argentina for *H. manteri*. The Monogenean was *Ligophorus saladensis*, *Metamicrocotyle macracantha* and *Microcotyle pseudomugilis*. Only one species of Acantocephala, *Floridosentis mugilis*, was collected. We found a high prevalence and intensity of Digenean in Site 2, a high prevalence of Monogenean, but the intensity was lower compared with Site 1 ($p>0,05$). The Acanthocephalan had the same prevalence in both sites, but the intensity was high in Site 1 ($p>0,05$). Those differences might be due a Phosphorus and Nitrogen gradient from north to south of the Bay and a different type of contamination in the water of Site 1 (As, Cr, Cu, Pb, Zn) and in the sediments of Site 2 (Pb y Hg). Besides a greater marine influence at site 2 may have contributed to the observed differences in both sampling sites.

PROCTOPHANTASTES NETTASTOMATIS (DIGENEA: ZOOGONIDAE) FROM VANUATU DEEP-SEA FISH: NEW MORPHOLOGICAL FEATURES, ALLOMETRIC GROWTH AND PHENOTYPIC PLASTICITY ASPECTS

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Proctophantastes nettastomatis (Digenea: Zoogonidae; Lepidophyllinae) has been found in the intestine of three species of deep-sea fish, *Dicrolene longimana* (Ophidiidae, Ophidiiformes), *Bathyuroconger sp.* (Congridae, Anguilliformes), and *Venefica tentaculata* (Nettastomatidae, Anguilliformes). The fish were collected near the islands of Espiritu Santo, Erromango and Epi, respectively, in the archipelago of Vanuatu (Southern Pacific Ocean) at depths ranging from 561 to 990 m. Morphological and histological analysis showed that the Vanuatu specimens differ from *P. abyssorum*, *P. gillissi*, *P. glandulosum*, *P. infundibulum*, and *P. brayi* but are close to *P. nettastomatis* discovered in Suruga Bay, Japan. The morphological variability of the species is described. Morphometric data allowed the identification of positive allometric growth for the hindbody, negative allometric growth for the ventral sucker and a growth phenotypic plasticity between Ophidiiformes and Anguilliformes definitive hosts.

PARASITES OF GADIFORM FISH SPECIES FROM WESTERN MEDITERRANEAN

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Gadiform fishes assume an important role in the ecology of the Mediterranean deep-sea megafauna community due to its dominance in the upper and middle slope. There are several studies concerning their bathymetric distribution and biology in the Western Mediterranean. However, parasitological studies of deep-sea gadiformes are still scarce. The purpose of this study is to report the parasite fauna of two gadiform species, *Phycis blennoides* (Gadidae) and *Lepidion lepidion* (Moridae) from Western Mediterranean. During 2007 and 2010 parasitological analyses of deep-sea fish from Barcelona (Western Mediterranean) were done within the "BIOMARE" and "ANTROMARE" projects frame. Along these projects 60 fish species were captured by trawling at depths between 435 and 945 m. *P. blennoides* (n= 503) and *L. lepidion* (n=346) were two of the more frequently captured fish, representing the 20% of the total captures. All fish organs were parasitologically analysed and quantitative descriptors of parasite communities were calculated. From the 172 *P. blennoides* analysed, 8767 parasites were collected, corresponding to 28 taxa. From *L. lepidion*, 104 individuals were analysed in which ones it were collected 306 parasites of 12 different taxa. Eight parasite species were shared by both hosts. *P. blennoides* showed highest diversity and abundance of parasites. The digenean *Bathycreadium elongatum* was the most prevalent in *P. blennoides* (88%), while the acanthocephalan *Echynorhynchus* sp. was the most prevalent in *L. lepidion* (78%. Parasite faunas provide interesting information of both species, pointing to overlapped ecological niches.

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ULTRASTRUCTURAL AND MOLECULAR ANALYSIS OF *HENNEGUYA PIARACTUS* (MYXOSPOREA) PARASITE OF GILLS OF CULTIVATED *PIARACTUS MESOPOTAMICUS* (CHARACIDAE) IN BRAZIL.

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The genus *Henneguya* is the most abundant in South America and can cause serious damage to economically important fish species. *Henneguya piaractus* commonly infects *Piaractus mesopotamicus*, an endemic species from the Plata River basin and is the one of the main species on fish farming in Brazil. In this work we provide ultrastructural characteristics and phylogenetic position of *H. piaractus* found infecting gills of *P. mesopotamicus* in fish farms from Sao Paulo state, Brazil. A total of 278 fishes were collected between February 2008 and March 2010 in 3 fish farms and the prevalence of *H. piaractus* were P=57.7%; P=36%; P=100%. Ultrastructural analysis showed a thin layer of granular material between the plasmodial wall and the host cells. The single plasmodial wall was connected to a plasmodial ectoplasm zone through numerous and extensive pinocytotic canals. Mitochondria and earliest stages of sporogenesis were observed at the periphery of the endoplasm, whereas mature spores were found in the central region. Partial sequencing of the 18S rDNA resulted in a sequence of 1.913 base pairs, which did not match with any Myxozoa sequences available in the GenBank. The phylogenetic analysis of 27 species with 792 informative sites showed the tendency of *Henneguya* species to cluster according to the order/family of their host fish. *H. piaractus* is the only member of the clade of myxozoans parasites of Characiformes fish.

PARASITES OF THE KILLIFISH *RIVULUS APIAMICI* COSTA, 1989 (CYPRINODONTIFORMES: RIVULIDAE) AS BIOINDICATORS OF ANTHROPOGENIC IMPACT IN TWO STREAMS FROM UPPER PARANÁ RIVER BASIN, BRAZIL

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The presence or absence of parasites in host populations is the result of a complex of factors, some biotic and others abiotic. The presence of parasites permits inferring the richness of vertebrates and invertebrates in a particular habitat. Likewise, the absence of certain parasites and the presence of other can be indicative of a host individual that reflects environmental changes. We provide the checklist of parasites of *Rivulus apiamici* in two streams with different stages of conservation. In addition, we determined the use of parasites as bioindicators of these habitats. We collected 11 specimens of *R. apiamici* in a degraded stream in the municipality of Araatuba, Sao Paulo state and 23 specimens in a preserved stream in the municipality of Diamante do Norte, Parana state. Of the 11 specimens, five were parasitized (gills: Monogenea, cysts *Ascocotyle* sp. and *Trichodina* sp.; intestine: the adult Digenea *Phyllodistomum* sp. and mesentery: cyst Cestoda). Of the 23 specimens, only one was parasitized (mesentery: cyst Nematoda). The most prevalent parasites were *Ascocotyle* sp. (36%) and *Phyllodistomum* sp. (27%), Monogenea, Cestoda cysts had a prevalence of 9%. The highest mean intensity was to *Phyllodistomum* sp. with 4.6 followed by *Ascocotyle* sp. with about three parasites per fish. *Phyllodistomum* sp. presented the highest mean abundance of 1.27, and the lowest was for Cestoda cyst with 0.09.The high species richness of parasite of *R. apiamici* found in the degraded stream reflect the richness of vertebrates (fishes, birds) and invertebrates (water bugs, snails, dragonflies) observed in this environmental. On the order hand, this richness of vertebrates and invertebrates is not observed in the preserved stream which does not favor the presence of heteroxenous parasites with complex and multiple host life cycles.

FISH PARASITES: A SMALL WORLD TO BE DISCOVERED

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“Fish parasites: a small world to be discovered” was a project funded by the EXPLORA Program - CONICYT (National Council for Science and Technology-Chile). The main goal of EXPLORA was the disclosure and appreciation of science using high school students as a objective public. During the development of this project, 100 students from five schools of Antofagasta were trained in the study of parasites of marine fish. Specifically, they learned about host-parasite relationships, the impact of fish parasites in economic activities (fisheries and aquaculture) and effect on public health. Students were grouped into different working teams (17) and, under the guidance of a team of monitors, developed a specific research project over a10 month period. At the end of the project, each work group showed their results in the First Scholar Ictioparasitological Congress.

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MONOGENEAN COMMUNITIES OF *CLARIAS GARIEPINUS* AND *OREOCHROMIS MOSSAMBICUS* AS BIOINDICATORS OF POLLUTION

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The complex interactions between parasites, hosts and the environment are influenced by the stability of the ecosystem. This paper presents comparative analyses of the occurrence of monogeneans on *Clarias gariepinus* and *Oreochromis mossambicus* sampled from three reservoirs: an unpolluted reference site, Luphephe-Nwanedi Dams, a moderately polluted site Flag Boshielo Dam and a severely polluted site, the Return Water Dam at a mining site. The parasite assemblage comprised 13 species (*Gyrodactylus rysavyi*, *Macrogyrodactylus clarii*, *M. congolensis*, *Quadriacanthus clariadis*, *Q. aegypticus*, *Cichlidogyrus halli*, *C. sclerosus*, *C. dossoui*, *C. tilapiae*, *Scutogyrus longicornis* and three *Enterogyrus* species). All 13species were identified from Luphephe-Nwanedi Dams compared to 11 at Flag Boshielo Dam and only two at the Return Water Dam. Parasite diversity indices showed an increase from the severely polluted site to the unpolluted site and all monogeneans (except the three *Enterogyrus* species) were most abundant at the unpolluted site. The results of this study emphasize the negative impact of mining activities on the environment. Fish hosts collected at the mining site supported the least diverse monogenetic parasite communities, suggesting the sensitivity of monogeneans to degraded water quality.

TWO NEW SPECIES OF *PARSPINA* PEARSE, 1920 (DIGENEA, CRYPTOGONIMIDAE) FROM FRESHWATER FISHES (GYMNOTIFORMES) OF THE PARANÁ RIVER BASIN IN ARGENTINA

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Digeneans are widely parasitizing fishes from the continental waters of Argentina. A total of 56 species have been recorded in Parano-Platense basin and 10 species in the Argentinean Patagonia. During a survey of the helminth fauna of fishes from the Parana River basin, 2 undescribed species were found in the Gymnotiformes. The worms found in the gut were isolated, fixed and processed following helminthological techniques to study internal morphology and tegument surface using a scanning electron microscope. The taxonomic study allowed us to assign the 2 new worms to *Parspina* Pearse, 1920 within the Cryptogonimidae. *Parspina* sp. 1 (from *Gymnotus carapo*) differs from *Parspina* sp. 2 (from *Eigenmannia virescens*) in the number of oral spines (32–39 vs. 30–33) and their length (28–47 μm vs. 16–28 μm), the distribution of tegumental spines and their anchorage,

the types of sensory papillae on the body surface (3 types vs. 2 types), the body space posterior to caeca (5% vs. 13% of total body length), the dimensions of the pars prostatica (52 x 34 µm vs. 24 x 10 µm) and in lacking a gonotyl (vs. present). *Parspina* sp. 1 and *Parspina* sp. 2 differ from *P. bagre* Pearse, 1920 (type species, from Venezuela) and from *P. argentinensis* (Szidat, 1954) (from Argentina) in the number of oral spines (20–21 and 21–28), their length (28–32 µm and 35–60 µm), and the total body length. Furthermore, the 2 new species differ from *P. argentinesis* (Szidat, 1954) in the arrangement of the vitelline follicles (1 continouous band vs. 2 groups, on each body side) and the smaller pars prostatica (149 x 49 µm in *P. argentinensis*). Up to day, only 5 species of cryptogonimids have been described in Argentina, and now *Parspina* sp. 1 (fifth intestinal helminth found in *G. carapo*) and *Parspina* sp. 2 (first intestinal helminth found in *E. virescens*).

SPATIAL EPIDEMIOLOGY OF *ANISAKIS* IN ATLANTIC WATERS: SYSTEMATIC REVIEW AND GIS

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Although the impact of the marine trophic structure on epidemiological processes and infection dynamics of *Anisakis* in fish populations and seafood products are the subject of intensive studies, the spatial epidemiology of this highly prevalent re-emergent marine parasite have so far been neglected. The interest on spatial demographic infection values induced the creation of risk maps for many geographical areas, which may help to underline hot-spot infection areas as a pre-harvest control measure to reduce or minimize the risk of *Anisakis* infection during the value chain of fishery products. A literature search using the ISI Web of Knowledge databases was performed to compile articles published from 1947 to 2011 and related to the keyword *Anisakis*. A total of 929 inputs were obtained and the information from 104 selected papers with geo-referenced samples were extracted from each study and entered into a computerized database. ArcGIS 9.3 was used to link epidemiological information to FAO´s vector layer of fishing areas. This map layer uniquely identifies each fishing area by polygon ID. A series of maps were produced showing the averages of the parameters of infection for each polygon in the Atlantic Area. The information retrieved covered parasite and host species, sampling size, geographic location, date, infected organ-site, prevalence and mean intensity-abundance of infection, and method for parasite detection. Elaborate cartography includes specific set of maps showing demographic infection values for *Anisakis* spp. related to both host order and species of fishery importance. A sound epidemiological follow-up for *Anisakis* spp. was created. The results suggest that GIS databases represented a useful tool to draw the spatial epidemiology of marine parasite species with zoonotic, economic or anaesthetic relevance in a given infected resource being commercially exploited anywhere.

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ANISAKIDS IN FRESH FISH FROM VIGO MARKETS

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A total of 1910 individuals distributed in 25 fresh lots belonging to 13 fish species from Vigo markets were seasonally sampled and examined by first time by the pressing method on a computer-image scheme for the presence of anisakid larvae in fish muscle. After confocal studies on the emission spectra of anisakids, an UV-Cabinet was used as a high-throughput screening tool for fresh fish flesh inspection. Flatfish and coastal species are free of anisakids or have no significant infection values. However, the blue whiting and the European hake, which are known to be keystones in trophic webs of fishing grounds, showed by far the highest demographic infection values. For these fish species, densities of anisakid infection up to 104 larvae/kg exceed FAO standards for accepting fish products, which means that those fish lots have substantive weaknesses in health prognostic factors. Compared results with previous seroprevalence data outline the great importance of prophylactic measures at the consumer level, and the need for a monitoring programme for unhealthy and anaesthetic anisakids in the flesh of *Merluccius merluccius* and *Micromesistius poutassou,* which guarantee consumer acceptance of both seafood products.

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DIGENEAN PARASITES FROM *OTOLITHES RUBER* IN NORTH WEST OF QESHM ISLAND, IRAN

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In this study 94 specimens of *Otolithes rubber* were caught in summer and winter (2008-2009) by bottom trawl in northwest of Qeshm Island (Chahoo Sharghi region) and immediately deep frozen. All samples were transferred to laboratory of Shahid Beheshti University. The fish were examined for the presence of parasites based on parasitology methods. They were 10.1-37.5 cm in total length and 10.7-621.3 g in body weight. Digeneans were observed in gill, intestine and stomach. The prevalence of infection in intestine and gill were %68.3 and %9.8, respectively. A total of 94 specimens only 22 fish were infected by digenean. The trematodes belong to families: Acanthocolpidae Luhe, 1906; Hemiuridae Looss, 1899 and Opecoelidae Ozaki, 1925. The genera *Stephanostomum* sp., *Pleorchis* sp., *Erilepturus* sp. are the first report in Iran.

TAYLOR'S POWER LAW FOR MARINE PARASITES: THE IMPORTANCE OF TAXONOMY AND ECOLOGY OF TRANSMISSION

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Abundance-occupancy and abundance-variance relationships are two of the most general macroecology patterns. They capture essential fundamentals of the structuring of species distributions that are widely documented for free-living animal and plant species populations at different spatial scales. However, empirical data for parasites have been gathered using appropriate sampling designs only recently. We have carried out a comparative analysis based on original data from individual fish to document the degree of spatial heterogeneity for a large set of parasite populations replicated in time and space. We used a large dataset for most widespread parasites of a marine sparid fish *Boops boops* across seven localities of two marine biogeographical regions (the North East Atlantic and the Mediterranean) and performed assessments both intraspecifically and interspecifically, across taxonomic and ecological groupings. We observed that a power function, relating spatial variance to mean abundance, represents a suitable model for the spatial distribution of the species. Additionally, our results revealed that prevalence, abundance and the degree of spatial heterogeneity are true species characteristics and differ consistently between higher level taxonomic groupings. Infection parameters and abundance-variance relationship appear to be dependent on host specificity and regional distribution patterns of the parasites. Finally, we have shown that the observed infection parameters agree well with the predictions from the epidemiological negative binomial abundance-occupancy model built on parameters of Taylor's power law both within- and across species.
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EFFECT OF WATER TEMPERATURE ON PARASITE COMMUNITIES OF BROWN TROUT, *SALMO TRUTTA FARIO*, IN CENTRAL EUROPE

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The sensitivity of parasites to changes in temperature, the key driving force behind many ecological processes, suggests that they can provide the society with a novel early warning

tool to monitor the ecological impact of climate change. The aim of the study is to assess the effect of small differences in water temperature on parasites and free living organisms using parasite communities of the brown trout, *Salmo trutta fario*, and macrozoobenthic invertebrate communities as model systems. We performed a comparative assessment of the spatio-temporal patterns in parasite and macrozoobenthic community structure in relation to different ambient temperatures in Ruhr and Lenne rivers (Germany). Macrozoobenthic communities showed variable patterns of general degradation depending on the river sampled. However, no drastic changes were detected in relation to different water temperature regimes. In contrast, parasite infracommunity composition and structure exhibited significant differentiation between impact cold and reference cold sampling sites at both Ruhr and Lenne rivers. This suggests that parasite communities in trout may have reflected an effect of the cold water input on communities of free living animals acting as intermediate hosts for parasites at these two rivers. This could be related to differential occurrence and abundance of the intermediate hosts of a few species which we identified as key discriminating species. Thus, parasite communities revealed patterns that are not detectable at the community level in the macrozoobenthic system.

APO has benefited from a Marie Curie Intra European Fellowship within the 7th European Community Framework Programme (FP7/2007-2013) under grant agreement PIEF-GA-2009-236127.

THE DESCRIPTION OF FIVE NEW SPECIES OF *GYRODACTYLUS* NORDMANN, 1832 (MONOGENEA: GYRODACTYLIDAE) PARASITIZING AFRICAN CATFISHES

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Gyrodactylus infecting catfishes from the African continent are reported, including new data from Sudan, Senegal, Kenya and Mozambique. Haptoral sclerite morphometry and nuclear ribosomal DNA sequences revealed the presence of eight *Gyrodactylus* species. On Senegalese *Synodontis nigrita* (Valenciennes), *Gyrodactylus synodonti* sp. n. and *Gyrodactylus nigritae* sp. n. are described. These are the first records of gyrodactylid parasites from mochokid hosts. From the fins of North African catfish, *Clarias gariepinus* (Burchell) collected in Mozambique, *Gyrodactylus alekosi* sp. n. and *Gyrodactylus rysavyi* Ergens, 1973 were identified. *Gyrodactylus rysavyi* was also identified from Kenyan *C. gariepinus* and Senegalese *Clarias anguillaris* (L.). From the fins of *C. anguillaris* studied in Senegal, two more species, *Gyrodactylus transvaalensis* Prudhoe et Hussey 1977 and *Gyrodactylus gelnari* sp. n. were recognised. In addition, *Gyrodactylus turkanaensis* sp. n. from the gills of Kenyan *C. gariepinus* was described and an undescribed *Gyrodactylus* sp. was recorded from Sudanese representatives of the same host. The study highlights the

hitherto understudied diversity of viviparous monogenean parasites throughout the African continent.

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BIOCHEMICAL OBSERVATION OF THE ENZYMATIC ACTIVITY IN FISH PARASITES

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Biochemical analyses of enzymatic activities in three different monogenean parasite genera of both marine and freshwater hosts were conducted. Parasite models chosen for this study were the following: *Paradiplozoon bliccae* Reichenbach-Klinke, 1961, gill parasite of *Blicca bjoerkna* L., *Diplectanum aequans* Wagener, 1857 gill parasite of *Dicentrarchus labrax* L. and *Neobenedenia girellae* (Hargis, 1955) Yamaguti, 1963 skin and fins parasite of pomacanthid fishes. Remarkable activities of glutathione-S-transferase, p-nitrophenilacetate-esterase, acetylcholinesterase, alcaline phosphatase, acid phosphatase and sialidase were observed. Weak activity of leucine-aminopeptidase was detected in capsalid parasites only. Significant differences in enzymatic activities between the studied parasite models were recorded.

This study was supported by the Ichthyoparasitology Research Centre – Project no. LC522. and by the research project of Masaryk University (MSM 0021622416).

NEW OCCURRENCES OF METACERCARIE OF *AUSTRODIPLOSTOMUM COMPACTUM* (LUTZ, 1928) (DIGENEA: DIPLOSTOMIDAE) IN FISH OF PARANAPANEMA RIVER BASIN, SÃO PAULO STATE, BRAZIL

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Austrodiplostomum compactum metacercariae is a parasite of several fish species. The high infection intensity of this parasite can cause swelling of the eyelids, displacement of the retina, opacity of the crystalline lens and blindness or even death. The aim of this study was to evaluate the occurrence of *A. compactum* metacercarie in eyes of fish from Chavantes reservoir, municipality of Ipaussu, São Paulo State, Brazil. Thirteen fish species were found infected with *A. compactum* metacercariae *Eigenmannia trilineata* (Gymnotiformes): *Hoplosternum littorale*, *Hypostomus regani, Iheringichthys labrosus* and *Pimelodus maculatus* (Siluriformes); *Hoplias malabaricus, Leporinus amblyrhynchus*, *Piaractus mesopotamicus* and *Schizodon nasutus* (Characiformes); and *Cichla piquiti*, *Crenicichla britski*, *Geophagus brasiliensis* and *Plagioscion squamosissimus* (Perciformes). Seven of the native species were new host recorded for *A. compactum* metacercariae (*E. trilineata* (n = 11), *H. littorale* (n = 11), *I. labrosus* (n = 17), *P. maculatus* (n = 34), *L. amblyrhynchus* (n = 11), *P. mesopotamicus* (n = 3), and *S. nasutus* (n = 17)). The mean intensity of infection and prevalence for these hosts were lower (*E. trilineata* = 0,73; *H. littorale* = 0,09/9%; *I. labrosus* = 0,11/12%; *P. maculatus* = 0,11/6%; *L. amblyrhynchus* = 0,18/9%; *P. mesopotamicus* = 2/33%; *S. nasutus* = 0,11/6%) except for *E. trilineata* in which the prevalence was 55%. All these species can feed of aquatic and terrestrial insects in littoral zone of reservoir, where *A. compactum* metacercarie can infect these fish by active penetration. The lower intensity and prevalence can indicate an accidental infection and also demonstrate a low specificity of this digenean parasite.

COMPARISON BETWEEN INFECTION LEVELS OF *AUSTRODIPLOSTOMUM COMPACTUM* METACERCARIAE IN *PLAGIOSCION SQUAMOSISSIMUS* FROM CHAVANTES AND NOVA AVANHANDAVA RESERVOIRS, SÃO PAULO STATE, BRAZIL.

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This study aimed to compare the infection levels of *Austrodiplostomum compactum* metacercariae in *Plagioscion squamosissimus* from Chavantes reservoir (CH, n = 109), Paranapanema River and Nova Avanhandava reservoir (NA, n = 378), Tietê River, both located in São Paulo State, Brazil. High prevalence and mean intensity infection were observed for both reservoirs (CH: P = 77%; MI = 11 ± 25 and NA: P = 94%; MI = 21±1.5). The number of metacercariae collected ranged from 1 to 170 in CH and 1 to 232 in NA and the condition factor did not differ between parasitized and non-parasitized fish for both reservoirs, demonstrating that *P. squamosissimus* status can be unaffected by *A. compactum* metacercariae infection. A statistically significant positive correlation was observed between intensity of infection and the host standard length (CH: p = 0.0284; NA: p <

0.0001) and weight (CH: p = 0.0197; NA: p < 0.0001). The results demonstrate that *P. squamossimus* has high infection levels by *A. compactum* metacercariae in both reservoir, although in the NA fish present high values in relation CH. This difference can be related with limnological conditions, because NA is a reservoir with trophic state ranged from meso to eutrophic while CH range from oligo to mesotrophic, which can increase the abundance of mollusks utilized as intermediate hosts of *A. compactum*. Thus, the different nutrient concentrations at the reservoirs may interfere in the infection levels of *A. compactum* in *P. squamosissimus*.

METACERCARIE OF *SPHINCTERODIPLOSTOMUM MUSCULOSUM* (DIGENEA, DIPLOSTOMIDAE) IN EYES OF *STEINDACHNERINA INSCULPTA* (CHARACIFORMES, CURIMATIDAE)

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The genus *Sphincterodiplostomum* is a parasite of the intestine of Neotropical birds. The life cycle includes metacercarie encysted in fish and this larval stage has been reported from Neotropical freshwater fish (*Steindachnerina brevipinna, Cyphocharax gilbert, Hoplias malabaricus, Prochilodus lineatus and Hemisorubim platyrhynchos*). The number of fish hosts is low compared to other Diplostomidae parasite, *Austrodiplostomum compactum,* which was previously reported in approximately 21 fish species. This study aimed to evaluate the infection by *S. musculosum* metacercarie in the eyes of *Steindachnerina insculpta* from Chavantes Reservoir, medium Paranapanema River, municipality of Ipaussu, São Paulo State, Brazil. The parasites were collected from vitreous humor, fixed in AFA solution under cover slip pressure, stained with carmine and cleared with eugenol. The morphometric analysis was performed using a computerized system for image analysis (QWin Lite 2.5, Leica). Thirty *S. insculpta* specimens were collected and 28 were infected with *S. musculosum* metacercarie (prevalence = 93%). Two thousand seven hundred eighty-three metacercarie were recovered, range from 1 to 846 in the studied specimens. The mean intensity of infection was 12 ± 1.6. A statistically significant positive correlation was observed between intensity of infection and the host standard length (p = 0.0051) and weight (p = 0.0001). Thus, high infection levels and prevalence by *S. musculosum* metacercariae in *S. insculpta* and low register of infection in other fish species can be an indicative that fish is more vulnerable to infection, that probable act as intermediate host in life cycle of this parasite, and *S. musculosum* is a parasite with higher parasitic specificity than other Diplostomidae parasite such as *A. compactum*.

DEROPRISTIS INFLATA (DIGENEA: DEROPRISTIDAE), AN EEL PARASITE IN ITS PREY, *NEREIS DIVERSICOLOR* (POLYCHAETA: NEREIDAE) IN AVEIRO ESTUARY, PORTUGAL

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Deropristis inflata (Molin, 1859) is a Digenea parasite which infects the eel, *Anguilla anguilla* (L.) as final host. In Europe, this parasite has a complex life cycle, involving 2 more hosts. The first intermediate host are gastropods and the second intermediate host is a polychaete, *Nereis diversicolor*. In the later, *D. inflata* encysts (metacercariae) and is transmitted to the eel trough the food web. The aim of our work was to evaluate *D. inflata* level and site of infection in *N. diversicolor*, in order to better understand its transmission dynamic to the eel. In Aveiro Estuary *D. inflata* presence was evaluated from 191 specimens of *N. diversicolor* examined, 76 were infected (39.8%) with a mean ± S.D. intensity of infection of 4.1 ± 4.3 metacercariae per infected host. Trough out the year it was reported significant difference between the prevalence level in the winter (13.3%) compared with spring and summer (68.8% and 61.5%, respectively). But for the intensity levels, only in the spring (5.2 ± 4.6) were detected significant differences compared with winter (1.1 ± 0.3) and summer (2.0 ± 1.9). The autumn was not sampled. The metacercariae encystement site was the anterior part of the worm (20 firsts segments), with 62.2% of the total of the cysts recorded, and its posterior extremity (the lasts 20 segments), with 25% of the cysts. They were reported in the blood vessels, mainly the ones surrounding the pharynx and the ventral median blood vessel (in the posterior segments). Our results suggest that *D. inflata* infection in *N. diversicolor* had occurred mainly, in the spring, and during this season the eel is more prone to infection. The site of infection recorded, the worm extremities, seams also to be strategic sites that favour its transmission to the eel, while feeding and biting its prey.

PRELIMINARY RESULTS OF A POPULATION STUDY ON *CERATOMYXA COTTOIDII* FROM SOUTH AFRICA

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Ceratomyxa cottoidii is known to inhabit the gall bladders of the intertidal fish species *Clinus cottoides* along the coast of South Africa. A preliminary study on population structuring of this myxozoan in relation to its host population structure was investigated. Samples were collected from three localities, two from the east coast (Heralds Bay, De Hoop) and one from the west coast (Kalk Bay) of South Africa. The DNA of 38 *C. cottoidii* samples were isolated. The analyses of the 28S rDNA and ITS1+5.8S+ITS2 sequences showed that there are four major clades A – D that probably represents four *Ceratomyxa* species. Clade A contained the majority of obtained sequences and included sequences from all localities. Clades B and C contained only the sequences from Kalk Bay and clade D contained only one sequence from De Hoop. The presence of mixed infections was revealed by the different positions of some clones from one sample (PCR product) in different clades. These findings were verified by PCR screen of all samples with 28S clade-specific primers. The hypotheses based on these results are that the biggest clade A probably represents "true" *Ceratomyxa cottoidii* species with its natural range including all three localities and another ceratomyxan "species" (clades B, C, D) have probably evolved in the localities Kalk Bay and De Hoop due to speciation events. Initial findings do not support the correlation of population structure with the host (*Clinus cottoides*) population biogeography.

BLOOD OR YOLK: EARLY POST-LARVAL DEVELOPMENT OF THE DIGESTIVE SYSTEM OF *SPARICOTYLE CHRYSOPHRII* (MONOGENEA, POLYOPISTHOCOTYLEA)

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The development of the early post-larval stages of *S. chrysophrii* parasite of the gilthead seabream (*Sparus aurata*) was experimentally studied. Gilthead seabreams from a fishfarm off Murcia (Spain) were infected with *S. chrysophrii* eggs and oncomiracidia. Fish were periodically killed for 36 days post infection. Parasites were collected, and mounted on temporary slides with glycerine jelly. In the hooked and non-clamp bearing stages, as well as in those with one pair of clamps, four elliptical dark brownish spots, similar in size and with similar arrangement, were always observed at the gut level. The posteriormost dark spot was the only located within the haptor and the two anterior ones were always joined. These 4 spots could be observed associated to the caecum wall when it became visible. From stages with two pairs of clamps, the spots were more scattered and lighter, progressively increasing in number. The dark spots in non-clamp-bearing post-larval specimens of *S. chrysophrii* were interpreted by Euzet (1958, Bull. Soc. Neuchateloise Sci. Nat., 81:79-83) as blood within the primordia of the digestive saccular tract. However, our observations point to a different composition for these dark spots as: i) haematin was not observed in *S. chrysophrii* early pots-larval specimens. Moreover, ii) some *S. chrysophrii* oncomiracidia, which are supposed not to be eating, show dispersed small dark granules in the posterior half of body. The functionality of the early post-larval pharynx is questionable (iii) because it is not located in anterior position until the stages with one pair of clamps. Finally, iv) the shape, size and colour of these granules are very similar to the yolk in adult

vitelline follicles. Chemical analysis should be performed to elucidate the real nature of these dark spots.

NEW HOST AND GEOGRAPHICAL RECORD FOR *MOOLEPTUS RABUKA* (NEMATODA: GNATHOSTOMATIDAE) IN THE LARGENOSE CATSHARK *APRISTURUS NASUTUS* (CARCHARINIFORMES: SCYLIORHINIDAE) OFF JUAN FERNANDEZ ARCHIPELAGO, CHILE.

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Studies on the natural history of deep-sea Chondricthyes heavily rely on incidental catches and consequently knowledge is scarce in many aspects. Deep-sea parasitic fauna also remains poorly studied in several aspects, including the composition of parasite assemblages, species geographic distributions, life cycles and host relationships. Chondricthyes are highly diverse in Chilean waters, with at least 53 species. Among them, species of the genus *Apristurus* (Family Scyliorhinidae) are deep-water catsharks known to inhabit continental slopes, trenches and submarine ridges at depths of 500 - 2000 m in all Oceans except for Polar seas. Reports on parasites of elasmobranchs from Chile deal mainly with cestodes, and only four records of adult nematodes are known. Here we report for first time the adult stage of the gnathostomatid nematode *Mooleptus rabuka* from the stomach and intestine of the largenose catshark *Apristurus nasutus* off Juan Fernandez Archipelago, Chile. Morphology and morphometry is in accordance with previous reports from Japan. Our record enlarges the known geographical distribution of this parasite by ca. 12 thousand km.

PREVALENCE OF *TRICHODINA* SP. (PROTOZOA: CILIOPHORA: PERITRICHIA) AND MONOGENEAN (HELMINTH: DACTYLOGYRIDAE: MONOGENEA) OF NILE TILAPIA REARED IN CAGES PLACED IN HYDROELECTRIC RESERVOIRS, SÃO PAULO BRAZIL

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Fish culture is increasing in Brazil. In São Paulo State, there are around one million of hectares of water surface in hydroelectric reservoirs and in Norwest of São Paulo, this kind of fish production is increasing and farmers have had problems with diseases. The aim of this work was to evaluate the prevalence of *Trichodina* sp. and dactilogirids monogenea during dry and rainy seasons in Cooperative of Fish Farms from Santa Fé do Sul and Region (20°12'40" S; 50°55'33" W; altitude 370 m). Fish were collected between March/2009 and January/2010 and selected in small (17 g), medium (18 to 200 g) and large (200 to 800 g). They were evaluated at the Laboratory of Aquatic Animals Disease (LENAQ/APTA). During rainy season the water temperature was 29,2°C, pH was 7,2, dissolved oxygen was 5,6 mg/L and toxic ammonium was 0,13 mg/L. In the dry season, the

water temperature was 24,3°C, pH was 7,0, dissolved oxygen was 5,3 mg/L and ammonia was 0,30 mg/L. Monogenean prevalence was higher during the dry season in the three fish sizes (small, medium and large), while the prevalence of *Trichodina* sp. was higher in the same season only in medium and large fish. Small fish showed no difference on *Trichodina* sp. prevalence between seasons, however the overall prevalence was high (55,5%). The highest *Trichodina* sp. (88,8%) and monogeneans (66,6%) prevalence were observed in medium fish. These parasites, mainly *Trichodina* sp. have increased the mortality rate of juveniles and fingerlings of Nile tilapia in cages. The lower temperature and the lower water flow during the dry season have improved the prevalence of these parasites. The use of good management practices to avoid stress on fish must be adopted in intensives productions models, as in cage farms, to reduce mortality rates.

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LIFE STRATEGIES OF ADULT DIDYMOZOIDS (TREMATODA).

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The didymozoids (Trematoda) are parasites of pelagic fish, which adults live in unique habitats: host tissues (mainly connective). Didymozoids are found in skin, gills, mouth, fins, serous membranes..., niches that seem to ensure high protection for the parasites but, at the same time, impede to release the eggs to the water. Present study shows preliminary data on the life strategies of the gill didymozoids of the Atlantic bluefin tuna (*Thunnus thynnus*). Nine taxa were found in a total of 54 gills of *T. thynnus* caught in the Mediterranean and north eastern Atlantic Ocean. The specimens were found in cysts or pseudocysts in connective tissues of specific microhabitats in filaments, arches, rakers, teeth, epithelia, etc. Each species was found in specific arrangements (single, couple or several individuals), dispositions, types of capsules, etc. Little is known about the way to release the eggs. Some authors indicate that mature worms can perforate the surrounding tissues. Other authors reported active penetration of eggs through the capillaries. More accepted strategies are predation, skin rupture by trauma, dead fish decomposition. Host responses to didymozoids are normally low or inexistent, and parasites live in a friendly and secure area, sometimes even vascularised by hosts, what can be a source of nutrients. Infected tissues are swelled by increasingly more gravid worms, what makes tissues more fragile or evident for predators (e.g. cleaner fish in skin worms). At the same time, high gravidity allows releasing the high number of eggs to the open water, where intermediate host finding results difficult.

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PARATUN.

A NEW SPECIES OF *NEOASCAROPHIS* (CYSTILICOLIDAE), A PARASITE OF *MACROURUS CARINATUS* (GÜNTHER) FROM PATAGONIAN WATERS.

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Nematodes of the cystidicolid genus *Neoascarophis* Machida, 1976 are all parasites of macrourid fishes, comprising at present five species. Some other unidentified species have also been reported in several fish species from the North and South Atlantic Ocean, including one from *Macrourus carinatus* (Günther) (Macrouridae) in the Southwest Atlantic Ocean. During a parasitological survey carried out on samples of *M. carinatus* from Patagonian waters, nematodes referable to *Neascarophis* were found in ulcers in the gastric mucose of fish. These nematodes represented a new species which closely resembles *N. macrouri* by the posterior position of the vulva (being equatorial in other species) and the dilated posterior extremity in females. However the new species differs from *N. macrouri* by its larger size, a larger muscular esophagus, and by the absence of caudal alae in males. SEM study of cephalic structures also showed morphological differences between both species, especially in the morphology of the submedian labia and lateral pseudolabia. In view on these differences a new species is proposed.

RHABDOCHONA MEXICANA: A MEXICAN ENDEMIC SPECIES PARASITIZING A CHARACID FISH IN ARGENTINA**.**

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The genus *Rhabdochona* (Rhabdochonidae, Thelazioidea) includes 92 valid species distributed in all zoogeographical regions. Of the 24 nominal species known in the Americas, 21 have been found exclusively in North America and are primarily parasites of the cypriniformes; whereas only 3 species belong to the South American helminth fauna, namely *R. acuminata*, *R. fabianae* and *R. uruyeni*, all parasites of characiformes. The Cyprinidae seems to be the main host family in all biogeographical zones where species of *Rhabdochona* have been found, except for South America where there are no cyprinids. Moravec (2010) suggest that representatives of *Rhabdochona* migrated with characiforms from North America through the Panama Isthmus, since Pleiocene. *Oligosarcus jenynsii* (Characidae) is a widely distributed neotropical freshwater fish and it is one of the dominant pelagic fish in all lagoons of Pampasic region. During a parasitological survey carried out during 2008-2010, 62 specimens of *Oligosarcus jenynsii* were captured at Nahuel Ruca lagoon (Buenos Aires province, Argentina). Nematodes referable to

Rhabdochona were collected and examined under light and SEM microscopy. Morphology and morphometry of these nematodes fully agreed whit those of *R. mexicana*, known as an endemic Mexican species, parasite of *Astyanax mexicanus* (Characidae).Therefore, both the range of hosts and geographic distribution of this species are broadened. Zoogeographical implications of this finding are also considered.

INCREASING OF TEMPERATURE FOR *OODINIUM* DISEASE TREATMENT IN MARINE FISHES

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Now days with development of marine fish keeping technology there are many people that like to keep marine fish as pet. This fishes have variety of colors and shapes. *Oodinium* is the most common disease between this species. Use of chemical material in marine aquarium is really expensive and we have to use chipper pace for this disease. The best treatment for this disease is improving of temperature that could be a little hard because high temperature can kill some organism of water. The best temperature for marine tank is between 24-26ºC. But with increasing of temperature of water *Oodinium* parasites leave the surface of fish body and migrate between gravels. With this migration we can emit them with exchanging. We have to change water up to 10 cm of low level of water and use siphon for washing gravels and emit *Oodinium* parasites.

ARGULUS (*ARGULUS PELLUCIDUS*) PARASITE, USUAL DISEASE OF GOLD FISHES

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Argulus or fish louse is small crustacean that has circle and flat body with light green color. Adult females have about 5 mm to 4 mm and males have 2 mm to 3 mm size. This parasite (*Argulus pellucidus*) is special parasite of carps (Sarig S., 1971, Shuzo E., 1991). They have two sucker organs that used them to catch skin of carps. This parasite has organ that pull it to the body and use blood of fish body. Adult females live on stones and plants. They have two spermatophore bags to keep sperm. This parasite usually catches skin of under fins area. They injured body of fishes. Gold fish with this parasite doesn't have rational movement and day to day they become weaker. This disease usually starts in hatcheries and they transfer with fish transferring. Now days this parasite transfer with gold fish to another countries. Important sign of this disease is *Argulus* parasite that can be control by naked eye. There are ways to control this parasite but the best control would be done by breeder who breeds them. All tanks and aquarium that related to their culture have to washed and cleaned and dried. Any infection of parasite has to report and control seriously. This

parasite can transfer other diseases same as bacterial disease or cause them. Injuries that cause by them can be good placement for bacteria and molt infection.

INJECTION OF NANDERNON IN SIDE OF GOLD FISH BODY (*CARASSIUS AURATUS*) FOR SWIM BLADDER ROTATION

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Goldfishes are originated to Cyprinid family that now days have many variation. Hobbyist of ornamental fishes loves this nice and interesting fish. This fish is the first fish that trade as an ornamental fish. Cyprinids exist in all over the word. Some of their species breed as a human protein resource. In transferring of this species some times physical effect transfers the swim bladder and this cause bad form swimming and floating on the surface of water. For this problem we can use injection of Nandernon in to side of the body under swim bladder. This injection has to do perfectly true if not it will cause death of fish. This ampoule has oil form and this cause transferring of swim bladder in true location.

CONTRIBUTIONS TO KNOWLEDGE OF HELMINTHS OF *SPHOEROIDES ANNULATUS* (JENYNS, 1842) (TETRAODONTIFORMES) FROM MANGROVE, TUMBES, PERU.

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Sphoeroidesannulatus "tambourine" has a geographical distribution from San Diego, California, USA, to Pisco, Peru. Its habitat is located on the sandy bottom and sandy patches between the reefs. In countries like Japan have a high demand for human consumption, although the toxins that may have guts, skin and gonads. Parasitological studies in *S. annulatus* to date are limited to the United States, Mexico, Central America, Ecuador, Tasmania and Japan. The aim of this paper is to analyze the relationship of the helminth communities for height, sex and diet of the host. Forty –seven fish were collected of which 19 (40%) were parasitized with digeneans and nematodes and in the digestive tract. The collected worms were washed and preserved in alcohol 70 °. Digeneans subsequently were stained in carmine and mounted in Permount semichon. The nematodes were cleared in lactophenol for identification. Parasites collected in the stomach were 93 (91.2%) individuals of the species *Lintonium vibex* (Digenea, Fellostomidae) and *Sclerodistomum sphoeroidis* (Sclerodistomidae), the range of length for digeneans was 1 mm to 9 mm. In the intestine was collected 7 (6.9%) nematode species Hysterothylacium rhamdiae (Anisakidae) and 2 (1.9%) Capillaria carioca (Capillariidae).We analyze the host-parasite relationship for height, sex and diet of the host, and the prevalence, abundance and intensity. *Lintonium vibex* has been reported in species of the order Tetraodontiformes, China, Arabian Gulf, Europe, Mediterranean Sea, Adriatic Sea, United States, Mexico and

Central America. *Sclerodistomum splengeri*has been reported in *Sphoeroides sphoeroidis* and *S. testudineus*. *Hysterothylacium rhamdiae* is a species described in Mexico and *Capillaria carioca* was reported in Brazil. The four species described in this study are new records for helminths *Sphoeroides annulatus* for Peru.

PRELIMINAR STUDY OF THE INCREASED SUCCEPTIBILITY OF *SPARUS AURATA* TO THE MONOGENEAN *FURNESTINIA ECHENEIS* AFTER HYDROCORTISONE ADMINISTRATION

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Stress is one of the main arising problems in aquaculture; sublethal stress can compromise fish functions as immunity or reproduction. Plasma cortisol is a routine indicator of magnitude and duration of stress response. Very high levels of this hormone affect the main cellular innate immune responses of gilt-head sea bream (*S. aurata*). The diplectanid monogenean *Furnestinia echeneis* is a frequent pathogen of wild and cultured *S. aurata* in the Mediterranean. Host response to diplectanids is unknown, but recent studies have indicated a possible role of the complement in gyrodatylid infections. We report the effect of hydrocortisone administration on *F. echeneis* infection in *S. aurata*. Forty-five naive fish were divided in three groups of 15 fish. One group received hydrocortisone acetate (HA.) (Sigma) dissolved in warm saline solution to a final concentration of 20mg/ml. The solution was injected (100ul per fish) in the body cavity of fish anaesthetized. A 2nd group received injections of 100 ul of sterile saline (SS.) to control handling and injection protocols, while a 3rd group was not handled. One week after injections, the three groups were infected by cohabitation with infected fishes (48h). After the infection period, fish were returned to the experimental tanks for two weeks when fish were killed for analysis. Gills were examined and number total of parasites recorded. ANOVA and HSD Turkey were used to compare the number of *F. echeneis*-infected fish between different treated groups. The statistical analyses showed significant differences between groups of treatments, specifically between HA.-treated fish (more parasitized) and the two other groups, while no differences were found between the SS.-injected and the not handled groups.

Financial support N.S.-G. benefits from a V Segles PhD student grant of the University of Valencia

PRELIMINAR STUDY OF THE INCREASED SUCCEPTIBILITY OF *SPARUS AURATA* TO THE MONOGENEAN *FURNESTINIA ECHENEIS* AFTER HYDROCORTISONE ADMINISTRATION

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METAZOAN PARASITES OF THE STRIPED MOJARRA, *EUGERRES PLUMIERI*, IN THE CHETUMAL BAY AND TWO ADJACENT LAGOONS, MEXICO

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The Caribbean coast of Mexico is characterized by the presence of several commercially important fishes. One of these resources is the striped mojarra (*Eugerres plumieri*), which is widely used for human consumption in the region. Despite of its importance, surveys dealing with the parasites of this fish species are scarce. Therefore, the main goal of this investigation was to determine the metazoan parasite fauna and characterize the helminth

community structure of the striped mojarra within the Chetumal Bay and two adjacent lagoons. A total of 156 specimens were collected during June-December 2009 from three localities (Chetumal Bay, Guerrero Lagoon and Salada Lagoon). Twenty six parasite species were collected (3 Monogenea, 13 Digenea, 5 Nematoda, 3 Acanthocephala, 1 Hirudinea, 1 Copepoda). All fishes were infected by at least 1 parasite species. *Aristocleidus hastatus* and *Crassicutis cichlasomae* showed the highest values of prevalence, while *Crepidostomum* sp.2 was the most abundant and intense species. Richness was relatively higher in Chetumal Bay (23) in comparison with Guerrero and Salada Lagoons (19 and 17, respectively), although the species composition was practically the same in the three localities. At the infracommunity level, the highest number of species was 14. Digenea were the parasitic group with the highest number of species, followed by nematodes. Most helminths were larval forms (14 species) and autogenic (18) 3), although adults (12), and allogenic (8) species were also present.

CONFOCAL LASER SCANNING MICROSCOPY OF *GOTOCOTYLA ACANTHURA* (MONOGENEA: GOTOCOTYLIDAE)

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Gotocotyla acanthura is a frequent parasite of the gills of the bluefish *Pomatomus saltatrix*, a fish with a circumglobal distribution in tropical to subtropical waters, and which is commonly found along the Brazilian coast. The gills of 11 fish collected between November, 2010 and May, 2011 off Rio de Janeiro were removed in the laboratory, and monogenean specimens recovered were flat-fixed in 4% paraformaldehyde (PFA) (w/v) in 0.1 M phosphate-buffered saline (PBS, pH 7.4) for 5h and washed in PBS. These monogeneans were then transferred to TRITON X-100 0.5% (w/v) in PBS and subsequently incubated in Phalloidin conjugated with tetramethylrhodamine isothiocyanate (TRITC) 1:700 in PBS and mounted on slides with DABCO (1,4 diazabicyclo [2.2.2]octane). Specimens previously stained with Gomori's trichrome or Mayer's paracarmine, dehydrated in ethanol, cleared in clove oil and mounted in Canada balsam were also analyzed. Observations were made with a confocal scanning laser microscope (CLSM Axiovert 510, META, Zeiss, Germany), using a laser 420nm (filter LP 560) and laser 405nm (filter LP420). Projections of image stacks and colour-coded images displayed the detailed morphology of the clamp sclerites (median, median accessory, lateral and basal), including unilateral ribs. The anterior region of the body, including the buccal cavity, anterior suckers and pharynx, together with the male copulatory organ, are shown for the first time using confocal microscopy.

THE GENUS *ENCOTYLLABE* SP. (CAPSALIDAE, ENCOTYLLABINAE) IN FISHES FROM CHILEAN COAST WITH PROPOSAL OF TWO NEW SPECIES

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Thirty seven species of monogeneans have been registered in the Chilean coast; 10 of them belong to the Capsalidae.. Up now, there are not records of *Encotyllabe* genus; therefore this provides the first record of this genus for fishes from Chilean coast. The morphology and morphometry of 19 specimens collected from the pharyngeal plate of the teleost *Cheilodactylus variegatus* (Cheilodactylidae) and 10 collected from the pharyngeal plate of the teleos *Anisotremus scapularis* (Haemulidae) were studied to evaluate whether those specimens correspond to new species of *Encotyllabe* . Specimens were stained with Gomori's trichrome and mounted in entellan to describe its morphology and morphometric measurements. Morphological analyses suggest that *Encotyllabe* specimens of *C. variegatus* and A. *scapularis* correspond to different species. the cirrus of *Encotyllabe* from *Ch. variegatus* is in an oblique position, opening its genital pore at the level of the cup to left prohaptor, whereas the cirrus in specimens from *A. scapularis* shows a torsion, running for the left side of the pharynx in direction to the posterior end of the body. Morphometric differences in proportions between species are a long small hamuli, a larger opistohaptor, longer large hamuli and larger prohaptor in specimens from *A.scapularis* compared with specimens from *C. variegatus*. Our finding will be confirmed with molecular analysis (18S, 28S and COI).

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NEOBENEDENIA SPP. (MONOGENEA: CAPSALIDAE) IN FISHES FROM CHILEAN COAST AS A POTENTIAL PATHOGEN IN CULTURE OF *SERIOLA LALANDI*.

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Neobenedenia melleni have been described as a species complex, which in turn is considered as a widespread pathogen of many teleost fishes in aquaculture. Along the Chilean coast, *N. melleni* have been recorded on *Scartichthys viridis* and *Sebastes oculatus*; and specimens of *Neobenedenia* sp have also been recorded in *Pinguipes chilensis* and *Sebastes oculatus*. Currently, culture of *Seriola lalandi* is beginning in the northern Chilean coast. In parallel, a project to identify potential parasites that can become pathogens in *S. lalandi* culture is developing. Currently, we have recorded specimens of *Neobenedenia* cf *melleni* in eight fish species. These specimens were stained with Hematoxilin and their morphology was compared, showing not morphological differences between specimens. In

this context, molecular analyses to test whether species recorded in Chilean coast correspond to *N. melleni* are carrying out. For this, *Neobenedenia* samples of 4 littoral fish species: *Cheilodactylus variegatus, Paralabrax humeralis, Anisotremus scapularis* and *Pinguipes chilensis* will be compared with three genes: large subunit (28S) rDNA, V4 region of small subunit (18S) rRNA and COI mDNA. Then, the sequences will be compared with sequences of GenBank.

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SPOROGONIC STAGES OF AN *EIMERIA* SP. INFECTING CULTURED SEA BASS (*DICENTRARCHUS LABRAX* L.), IN SOUTH PORTUGAL

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An *Eimeria* sp. was recorded infecting aquaculture□reared sea bass (*Dicentrarchus labrax* L.), between 8 months and 4 years old, the fish having been collected from earth ponds in a culture system in Southern Portugal (Algarve). Strong growth retardation, but no mortality, was noted in association with the presence of this coccidian. It was considered that developmental delay was so severe that it could compromise the economic viability of production of this fish species. Sporogonic stages were recorded in the fish anterior intestine. In histology slides of infected tissue, oocysts were recorded mainly in the proximal portion of the epithelial lamina, within and among epithelial cells. In fresh smears, oocysts were spherical, measuring ~13.9x13.5 µm (n=14), each having 4 sporocysts of ~8.7x5.1 µm (n=34) and bearing a Stieda body, and containing two broadly gibbous sporozoites. This species is distinguished from known *Eimeria* species recorded in this host, namely *Eimeria dicentrarchi* Daoudi & Marquès, 1987 and *Eimeria bouixi* Daoudi & Marquès, 1987, mainly by the larger sizes of the oocyst and sporocyst stages. The other life cycle stages, namely those involving merogony or gametogony, are still being studied in detail.

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HELMINTHS OF ATLANTIC CHUB MACKEREL, *SCOMBER COLIAS* GMELIN 1789, AND ATLANTIC MACKEREL, *S. SCOMBRUS* LINNAEUS 1758, USEFUL AS BIOLOGICAL TAGS OF HOST FEEDING ECOLOGY

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Despite sharing the same geographic distribution, the scombrideans *Scomber colias* Gmelin 1789 and *S. scombrus* Linnaeus 1758 live in different habitats, with the first inhabiting greater depths. This difference is probably reflected in their feeding ecology, since different food items are available. Once helminths infect their hosts trough the food web, they might be used as biological tags of host feeding ecology, and this was evaluated. 40-42 fish, from each species, were collected (October 2009-June 2010) in Matosinhos, northwest Portuguese coast. The fish recorded a similar length (32.6 ± 3.6 cm - *S. colias* and 31.9 ± 2.3 cm - *S. scombrus*). They were surveyed for gut parasites and parasitological parameters (prevalence, P; abundance, A) of component species (P>10%) were compared between fish species. In total, 6 helminth taxa were found: 4 of them were common - *Anisakis* spp. (Nematoda), *Lecithocladium excisum* (Trematoda), *Rhadinorhynchus pristis* and *Telosentis tenuicornis* (Acanthocephala); the remaining 2 taxa belonged to the Trematoda and were host-specific: *Opechona* sp. 1 for *S. colias* and *Opechona* sp. 2 for *S. scombrus*. Although the qualitative approach showed a similar feeding ecology - the 4 most abundant taxa were the same in the 2 fish species - the quantitative analysis did not support it. Indeed, the comparison of the parasitological parameters shows that *S. colias* recorded higher values for *Anisakis* spp. (P=85%; A=18.4 ± 20.1), *R. pristis* (P=30%; A=1.4 ± 3.5) and *T. tenuicornis* (P=18%; A=0.6 ± 1.8), whereas *S. scombrus* recorded higher values for *L. excisum* (P=67%; A=4.7 ± 7.5). The results found suggest that *S. colias* and *S. scombrus* feed on the same kind of organisms but in different quantities. Actually, both fish populations are easily tagged by their endoparasites levels.

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THE ROLE OF MUSCLE-INVADING ANISAKID LARVAE ON BACTERIAL CONTAMINATION OF THE FLESH OF POST-HARVEST FISH.

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The intestine of fish has a rich and diverse microbial flora including specific seafood spoilage bacteria. Any parasitic nematode larvae that migrate from the intestinal tract of the fish host through the visceral cavity into the flesh may carry along bacteria on their surface or within their intestine. The aim of this study was to examine the role of the anisakid nematode species *Anisakis simplex* with regards to bacterial contamination of the flesh of

post-harvest pelagic fish. Tissue samples of *Anisakis*-positive and *Anisakis*-negative fish muscle, and intestine samples, were collected from freshly caught blue whiting and processed for subsequent histological investigation. Quantitative and qualitative bacterial analyses were performed by cultivation and PCR-DGGE. The number of colony forming units (CFU)/g in the *Anisakis*-infected muscle samples was three times higher compared to the uninfected samples. The CFU/g of the *Anisakis*-positive muscle samples was as high as the CFU/g of the intestinal samples, indicating that the larvae may act as a vector for the actual spoilage bacteria recorded in the fish flesh. The PCR-DGGE analysis of the bacterial populations showed that some identified taxa were found in both muscle samples, with and without anisakid larvae. The *Anisakis*-positive muscle samples had also some bacterial taxa in common with the intestinal samples from the fish. Identification of the bacterial taxa involved, indicates that shelf-life reducing bacteria may be introduced into the fish flesh by the parasite larvae. The histological investigations confirmed that bacteria associated with the *Anisakis* larvae are present in the muscle samples. The density of bacteria seems to decrease from the larval surface-fish muscle interface towards more peripheral areas around the larval infection site in the flesh.

MONOGENEAN PARASITES OF THE FISHES FROM LAKE GALA, TURKEY

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A parasitological investigation was performed on the monogeneans of the fish from eutrophic Lake Gala, between March 2010 and April 2011. Lake Gala is under protection as a wetland for a breeding area of native and immigrant birds and certified as National Park in 2005. Lake Gala is an important part of the Meric Delta with its 750 ha area and under the effect of irrigation, pesticides, anthropogenic deposits etc. Sixteen fish species belonging to 8 families; *Anguilla anguilla* (Anguillidae); *Esox lucius* (Esocidae); *Abramis brama, Aspius aspius, Scardinius erythrophthalmus, Vimba vimba*, *Carassius gibelio*, *Cyprinus carpio, Rutilus rutilus, Blicca bjoerkna* (Cyprinidae); *Silurus glanis* (Siluridae); *Mugil cephalus* (Mugilidae); *Perca fluviatilis, Sander lucioperca* (Percidae); *Lepomis gibbosus* (Centrarchidae); *Alosa fallax nilotica* (Clupeidae) from Lake Gala were examined for the presence of monogenean parasites. Thirty two monogenean parasite species were identified: *Dactylogyrus crucifer, D. difformis, D. difformoides, D. anchoratus, D. vastator, D. cornu, D. cornoides, D. vistulae, D. distinguendus, D. baueri, D. inexpectatus, D. extensus, D. auriculatus, D. zandti, D. wunderi, D. haplogonoides, D. sphyrna, D. tuba, Dactylogyrus* sp.*, Tetraonchus monenteron, Thaparocleidus vistulensis, T. siluri, Ancyrocephalus paradoxus, Pseudodactylogyrus anguillae, P. bini, Ligophorus* sp. I, *Ligophorus* sp II, *Paradiplozoon pavlovski*, *Paradiplozoon* sp., *Oncholeidus similis, Gyrodactylus* sp. I*,* and *Gyrodactylus* sp II. All parasite species were new records for Lake Gala.

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METACERCARIAE OF *LECITHOCLADIUM* SP. (TREMATODA; HEMIURIDAE) PARASITE OF FLOUNDER, *CITHARICHTHYS SPILOPTERUS* AT THE MOUTH OF THE SAO FRANCISCO RIVER, ALAGOAS, BRAZIL.

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Within the order Pleuronectiformes, the family Paralichthyidae is typically of marine environments, although some species occur in brackish and salt water, and *Citharichthys spilopterus* one of the most abundant. These fish are distributed throughout the Brazilian coast and are usually found in shallow water and preferably warm. Between March and July 2010 were collected by bottom trawl of 28 specimens of *Citharichthys spilopterus* in the city of Piaçabuçu, state of Alagoas, northeastern of Brazil, at the mouth of the Sao Francisco River. The fish weighed on average 3.6 (± 3.9) g and measured 7.4 (± 2.1) cm (TL). Metacercariae of *Lecithocladium* sp. were found in tegument and muscle in 89.1% of fish examined with a mean intensity of infection of 3.1 (± 2.6) worms / fish. Smaller fish were more parasitized (Spearman's rank coefficient correlation rs = -0,459147, p=0,0275), probably because they are more susceptible to predation favoring the parasite's life cycle. The presence of the parasite was detected through the observation of characteristic black spots of injuries caused by metacercariae. This is the first record of *Lecithocladium* sp. in *C. spilopterus.*

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MOLECULAR IDENTIFICATION OF *PSEUDOTERRANOVA CATTANI* AND *P. DECIPIENS* (NEMATODA: ANISAKIDAE) FROM FISHES OF THE AUSTRAL REGION: MORPHOLOGICAL AND ECOLOGICAL CHARACTERIZATION

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Larvae of the genus *Pseudoterranova* constitute a risk for human health due the severe pathology they can cause when are consumed with raw or undercooked fish. Adults of the *P. decipiens* species complex are world-wide distributed parasites of otariids and phocids and comprise six sibling species morphologically very similar, especially at larval stage. Third-stage larvae of *P. decipiens* have been reported in several fish species in Argentina;

however, there are still no studies dealing with their specific identification in this region. Here, we performed the first genetic and morphological characterization of larval *Pseudoterranova* from fish species caught off Argentine coasts (*Acanthistius patachonicus*, *Paralichthys patagonicus* and *Pseudopercis semifasciata*). Morphology of larvae was also compared with that of larvae obtained from *Notothenia coriiceps* from Antarctic waters. Genetic/molecular identification of larvae was performed by sequence analysis of the mtDNA *cox-2* gene, in comparison with all species of the *P. decipiens* complex, including adult forms of *P. cattani* collected from *Otaria flavescens* from Argentina and Chile and *P. decipiens* E from *Leptonychotes weddelli.* Larvae from Argentine waters were identified as belonging to the species *P. cattani*, while those from *N. coriiceps* to the sibling *P. decipiens* E. Multivariate comparisons showed that larval morphometry was similar between specimens of *P. cattani* from Argentina, but significantly different from those of *P. decipiens* E, indicating therefore that larval forms are morphologically distinguishable across species. It is also confirmed that the life-cycle of the sibling species of *P. decipiens* complex involve mainly demersal and benthic organisms, but with a marked preference by large-bodied benthophagous fish.

EFFECTS OF THE PARASITIC NEMATODE, *PHILOMETROIDES PARALICHTHYDIS*, ON THE SWIMMING AND BURYING PERFORMANCE OF THE SOUTHERN FLOUNDER, *PARALICHTHYS LETHOSTIGMA*.

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The southern flounder (*Paralichthys lethostigma*) is commonly parasitized by the philometrid, *Philometroides paralichthydis*. These nematodes embed themselves in place of the inclinator muscles of the dorsal and anal fin elements. We hypothesized that infection by these parasites impairs the fish use of these fins and we tested whether the swimming and burying performance of the infected fish is negatively impacted. Two groups of individuals (14 parasitized and 16 non-parasitized) ranging from 124 to 272 mm in total length were captured in the Charleston (South Carolina, USA) estuarine system. After acclimating in captivity for 24 hours, the fish were individually filmed with high speed video cameras to determine swimming velocity and acceleration as a measurement of swimming performance as well as the time to bury and percentage of body exposed as a measurement of burying performance. Fish were then euthanized and dissected to document the number, location, and stage of maturation of the worms. Tests showed that the swimming acceleration and both measures of burying performance did not differ between parasitized and non-parasitized fish whereas the swimming velocity of parasitized fish was significantly lower than that of non-parasitized fish. However this difference was not constant across the range of body size; smaller infected fish swam with significantly slower speeds than smaller non-infected fish whereas there was no difference in speed when comparing larger fish. Neither the position nor the number of worms had an effect on either swimming or burying performance. The decrease in swimming velocity in smaller

infected fish could be sufficient in rendering them more vulnerable to predation. This result could provide the
mechanism (i.e. mortality due to decreased swimming ability) that may explain a previous observation that larger fish (>300 mm) are rarely infected by this parasitic nematode.

WHAT FACTORS AFFECT THE GENETIC DIVERSITY OF A PROGENETIC TREMATODE AT A LOCAL SCALE? *PROCTOECES CF LINTONI* AS A STUDY MODEL.

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The characteristics of the life history of parasites are variable, having several reproduction types, life cycle patterns and population sizes, which could have evolutionary consequences, for example, influencing the subdivision of the genetic variation at different scales. Within host populations, parasites are patchly distributed and show a gregarious distribution, hence the gene flux among parasite populations might be reduced. In digenea, it has been suggested that the population genetic diversity can be more homogenous due to the dispersion capacity of the cercarie. To date, few studies have evaluated the possible factors generating genetic subdivisions in digenea and most of the studies have focus on a local scale, aiming to determine if genetic differentiation of the same parasite species between hosts is due to the dispersion capacity of the host and/or its internal environment. Another important factor is the reproduction type, because digeneans have asexual reproduction in the first intermediate host, thus producing the coexistence of clonal packages or genetically similar larvae homogenously distributed. In addition, some digenea can shorten their life cycle through progenesis which could enhance endogamy thus reducing genetic diversity and increasing homozygosity. *Proctoeces* cf *lintoni*, is the most studied digenea in the coast of Chile and it has been suggested to be an alternative progenetic digenean with no encysted metacercaria. In this study, we evaluate three factors affecting the genetic diversity of this parasite at local scale: sympatry, host dispersion capacity and the alternation of the life cycle of *P*. cf. *lintoni*, using nine microsatellites developed for this parasite.

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EXTENDING KNOWLEDGE ON MONOGENEAN FAUNA OF RIVERINE CICHLIDS TO THE HEART OF AFRICA

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The cichlid assemblages inhabiting African rivers and small standing waters have not received the same scientific attention as their Great Lakes' counterparts, who surpass them in morphological diversity and species richness. However, several primarily riverine cichlids are important to fisheries, aquaculture and aquaristics. Though widespread, Tilapiini reach their highest diversity in West Africa, also the stronghold of smaller tribes like Chromidotilapiini, Hemichromini, Tylochromini and Pelmatochromini. In terms of cichlid monogenean parasites, West-African tilapiines and some other ancestral cichlids are the best studied host groups. Many of these cichlid genera are not limited to the Nilo-Sudanese aquatic ecoregion but also occur in the Congo Basin, the ichthyodiversity of which is much lesser understood. A recent expedition surveyed ancyrocephalid Monogenea of the Middle Congo River (Democratic Republic of Congo). Parasites were characterised using morphometrics and genetics, and compared to their West-African congeners. They mostly represented unknown species. The attachment organ morphology of Ancyrocephalidae is known to be systematically informative. Host occupancy of genera and within-genus morphological groups (based on haptor configuration), described in West Africa, seemed to hold for the Congo Basin. While most of the parasite fauna of the Congolese *Hemichromis* cichlids was reminiscent of *Onchobdella* and *Cichlidogyrus* representatives typical to the host genus, the genus also harboured a *Cichlidogyrus* with a haptor type only found in Lake Tanganyika cichlids. Congolese *Pelmatochromis*, *Tilapia* and *Tylochromis* hosts were also infected by *Cichlidogyrus* morphotypes previously recorded elsewhere on the respective genera. This study is the first to report monogenean flatworms on cichlids from the Congo River.

DISTRIBUTION AND MOLECULAR CHARACTERIZATION OF ACANTHOCEPHALAN PARASITES FROM FRESHWATER FISH IN CROATIAN RIVERS

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Croatia freshwater fish fauna is characterized by diversity and richness of species, which are definitive hosts for many endoparasites. Although fish acanthocephalan parasites are worldwide distributed, their presence in fish from Croatian rivers was only occasionally reported. In this study, distribution and genetic characterisation of acanthocephala in fish from rivers: Krka, Sava, Sutla and Kupa watershed was investigated. For genetic variability determination, cytochrome c oxidase subunit I (COI), ITS regions and 18S rRNA were analysed. Species that were found are: *Dentitruncus truttae*, *Pomphorhynchus laevis*, *Pomphorhynchus tereticollis*, *Acanthocephalus anguillae*, and due to results of phylogenetic analyses presence of *Pomphorhynchus bosniacus* in Sava river was postulated. COI proved to be the the most effective molecular marker, although COI pseudogenes were found in *P. laevis*. Phylogenetic relationships were determined for the species *D. truttae* for the first time and they agreed with previously described identification based on morphology. Our findings should improve basic knowledge of acanthocephalan phylogeny and also present an important element for evaluation of aquatic ecosystems health in Croatia.

HELMINTH ENDOPARASITES OF *ODONTESTHES REGIA* (PISCES: ATHERINOPSIDAE) FROM THE CENTRAL COAST OF PERU

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Odontesthes regia is a pelagic-neritic fish that inhabits sandy bottoms and river mouths near the coastline. It is distributed from Piura in northern Peru to the XI Region of southern Chile and is important in commercial fisheries. This research had as objective quantitatively evaluate the helminth endoparasites in *O. regia*. We examined 68 individuals collected in August 2010, May and June 2011 from Callao Port in Lima, Peru, some fixed in AFA and the rest examined in saline. A total of 162 juveniles of *Proteocephalus* sp. (Cestoda) with a prevalence of 29.4%, and a mean intensity of 8.3 ± 8.1; 50 metacercariae of Haploporidae (Digenea) with a prevalence of 17.6% and a mean intensity of 3.4 ± 3.4; and 2 larval nematodes *Procamallanus sp*. and *Parasynodontisia* sp., each with a prevalence of 1.5% and a mean intensity of 1 ± 0, were found in the gastrointestinal tracts. Infracommunities ranged from 1 to 2 species and from 1 to 32 worms. The results show that *O. regia* is a paratenic host to *Proteocephalus* sp. and some marine fishes from the Central Peruvian Coast may be the definitive hosts. Moreover the two nematode larvae can

be considered as accidental parasites since they had very low prevalence. These are the first records of the genera *Proteocephalus, Procamallanus* and *Parasynodontisia*, and of the family Haploporidae in *O. regia* and in Peru.

KUDOA SEPTEMPUNCTATA (MYXOZOA: MULTIVALVULIDA) FROM THE TRUNK MUSCLE OF CULTURED OLIVE FLOUNDER (*PARALICHTHYS OLIVACEUS*) CAUSING FOOD POISONING OF HUMAN

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Recently, cases of a new food-borne disease of human associated with ingestion of olive flounder *Paralichthys olivaceus* have increased in Japan. The patients showed diarrhea and vomiting within 2-20 hours after intake of raw fish (sashimi), however the prognosis was usually good. Epidemiological analysis and toxicity tests with experimental animals indicated that the causative agent was *Kudoa septempunctata* infecting the trunk muscle of olive flounder (Kawai et al., 2011). In the present study, the prevalence and the intensity of infection with *K. septempunctata* in skeletal and opercular muscle of cultured olive flounder (ca. 30-35 cm in length) were investigated by microscopic observation and PCR assay based on the 28S rDNA. Prevalence of infection was 50% by light microscopy but 100% by PCR. Intensity of infection (number of spores/g-muscle) varied among individual fish, with a maximum of 10^6 spores/g, which would be high enough to cause food poisoning in human. Moreover, the infection in fish was subclinical (showing neither cyst formation nor myoliquefaction), suggesting that sashimi containing spores would be eaten without being noticed by consumers. Detection of spores from the muscle under the operculum was found to be a simple and practical diagnostic test (St-Hilaire et al., 1997). Early diagnosis of seedlings using the PCR assay and a large-scale screening of commercial-sized fish using the opercular muscle test are recommended to eliminate infected fish prior to their sale on the market.

COMMUNITY ECOLOGY OF HELMINTH PARASITES OF *GEOPHAGUS PROXIMUS* (PERCIFORMES: CICHLIDAE) FROM PARANÁ RIVER BASIN, ILHA SOLTEIRA RESERVOIR, BRAZIL

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The family Cichlidae is one of the major vertebrate families, with at least 1300 species and with estimates approaching 1900 species. *Geophagus proximus* is included in this family and it is commonly known in Brazil as "acará tinga". In Ilha Solteira reservoir, this fish species was introduced and has occupied a prominent place in commercial fishing, once occupied by endemic species of Paraná River. Studies estimating healthiness of species inhabiting aquatic ecosystems have expanded in Brazil and they are fundamental to ensure the health of such species, and human populations that consume these organisms. The aim of this study was to evaluate the helminth community structure of *G. proximus*. During the period from May 2006 to May 2007, 116 specimens of *G. proximus* from São José dos Dourados River, Ilha Solteira reservoir, State of São Paulo, Brazil were analyzed. A total of six different *taxa* of helminth parasites were found: cestodes of the order Proteocephalidea (plerocercoids), the trematodes *Austrodiplostomum compactum* and *Clinostomum* spp. (metacercariae), and the nematodes *Raphidascaris* (*Sprentascaris*) *hypostomi*, *Raphidascaris* sp. (larvae) and *Contracaecum* sp. (larvae). Proteocephalidean plerocercoids were the most prevalent parasites, and also considered the core *taxa*. The components of the parasite community showed the typical aggregated pattern of distribution. Only the weight of the host was positively correlated with species richness, and other parameters such as body length, condition factor (Kn), seasonality and sex of host did not influence the parasitism rates. Moreover, excepting the trematode *A. compactum*, all helminths found in this study were reported for the first time in *G. proximus*.

ECTOPARASITES OF "TILÁPIA-DO-NILO" (*OREOCHROMIS NILOTICUS*) CULTIVATED IN FISH CAGE IN GRANDE RIVER, ÁGUA VERMELHA RESERVOIR, BRAZIL

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Fish farming is becoming an important activity to production of protein for human consumption. The "tilápia-do-Nilo" (*Oreochromis niloticus*) stands out in production systems and is one of the most commonly used species in intensive culture in tropical regions. This system of fish culture is characterized as high population densities, favoring the occurrence of epizootic outbreaks, by the presence of different pathogens. This study aimed to report the ectoparasites found in *O. niloticus* from an intensive cultured system from Grande River, Água Vermelha reservoir, municipality of Mira Estrela, State of São Paulo, Brazil. During the period from March to September 2010, 36 specimens of *O. niloticus* from this reservoir were analyzed. Monogeneans and protozoans belonging to four *taxa* were found: *Trichodina* spp., *Ichthyophthirius multifiliis, Piscinoodinium pillulare*, and *Epistylis* sp. Excepting for *P. pillulare*, which was found in the gills, the other parasites were found on fish skin. *Trichodina* spp. showed the highest prevalence, mean intensity of infection and mean abundance. During the dry season, the abundance of *Trichodina* spp. ($U = 267$; $p = 0.038$) and monogeneans ($U = 240$; $p = 0.003$) were higher than in the rainy season. Water physico-chemical parameters as pH, dissolved oxygen, transparency,

ammonia, toxic ammonia and nitrite were found in the appropriate conditions to cultivation of *O. niloticus*. However, in dry season, the water temperature was below of the recommended values for the species, which ranges between 27-32ºC. Results obtained in the studied reservoir showed the occurrence of majority parasitic diseases that affect cultivation of *O. niloticus*, and also limnological characteristics and seasonality that seem to influence the occurrence of these organisms.

MOLECULAR DETECTION OF *MYXOBOLUS AMPULLICAPSULATUS* IN POND-CULTURED ALLOGYNOGENETIC GIBEL CARP, *CARASSIUS CARASSIUS GIBELIO* IN CHINA

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Myxobolus ampullicapsulatus is an etiological agent responsible for mass mortality of cultured *allogynogenetic* gibel carp, *C. carassius gibelio* in China. Development of a practical and rapid diagnosis method is prerequisite to understand and control the transmission and outbreak of the myxosporidiosis. In the present work, two molecule-based assays were developed to detect the parasites in fish host. Results showed that both loop-mediated isothermal amplification (LAMP) and nested-PCR can specifically amplify the targeted 18S rRNA gene of *M. ampullicapsulatus*, with sensitivity of the same level (1 spore/assay), but the former is obviously rapid and economic than the latter. Combined with the quarantine data and histopathological examination, it can be concluded that the pharynx of fish is the unique definitive infection site of the myxospore and the infective resources was limited in the existing extensive culture ponds investigated. The reported assays will facilitate to conduct molecular epidemiological investigation of the myxosporidiosis and to find the possible ecological and pharmaceutical control strategies to reduce economic losses.

AUTHORS INDEX