CIAC Newsletter

Issue 4, May 2012

Editorial

Louise Allcock

As usual, I would like to thank everyone for their contributions to this newsletter. It is your newsletter and it would be nothing without your articles. I can only apologize for the long period (a year) between this and the last newsletter and I would like to sing Marcelo Rodrigues' praises for making this issue possible. Marcelo put the entire newsletter together and then put it in a dropbox for me to write the editorial!

I'm also delighted that Marcelo chose to feature Sigurd von Boletzky in the 'Old Faces' section. I've said before that you don't have to be old to feature here - you just have to have served the cephalopod community for a long time and Sigurd certainly meets this criterion! It is particularly fitting that Sigurd is featured here because of his love for the history of science, and because of his help in compiling copy for previous 'Old Faces'.

Finally, I would like to say how much I am looking forward to seeing old friends and new in Brazil later in the year. I cannot believe that it is nearly 3 years since we were all gathered in Vigo!

Best wishes to you all and thanks again to Marcelo!

Louise Allcock

What's on?

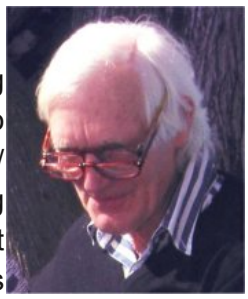
27th October- 2nd November

CIAC 2012
Florianopolis, Brazil

July 2013

Unitas Malacological Conference
Azores, Portugal

Advertisiment



Dr. Andrew Packard is looking for a bright young (or not so young) teuthologist / physiologist interested in taking over any of the abundant experimental material he has on the dynamics of the skin. Mostly Loligo video (macro). People interested could contact him at: andrew@packards.de

What's out?

Special Issue Alert

As a courtesy to Sigurd von Boletzky here is information regarding a special issue on "Cephalopod Behaviour" edited by Michael Kuba, Tamar Gutnick, and Sigurd v. Boletzky. This special issue covers the major subjects of behaviour mechanisms and methodological approaches and is now appearing in the journal VIE ET MILIEU - Life and Environment.

People interested in this special issue will find the address for ordering a hard copy (for 35.- Euro, postage included) at http://www.obs-banyuls.fr/Viemilieu/ . Incidentally, the above site will soon also provide an online version with abstracts and author's email addresses, to allow people to ask for individual pdf copies of articles (additional information in the page 16).

CIAC Symposium 2013

What to expect from the forthcoming CIAC Symposium in Florianópolis (27th October- 2nd November, 2012), Brazil?

Érica Vidal

The CIAC Symposium is considered the most traditional event within the teuthologist's community. Some would say that it is also a warm "get together" event, where new and life-long friends can meet every three years, talk and exchange ideas on cephalopod-related stuff. Whichever one's favourite reason to attend the conference, CIAC Symposia have the tradition to periodically deliver the most interesting and cutting-edge knowledge in the field. This seeds new ideas, motivation and encouragement for prospective students and researchers to continue pursuing studies on the Class Cephalopoda, and make new partnerships.

After being held in Europe, North America, Asia, Africa and Australia, this will be the first CIAC Symposium in South America. Brazil is the host country and we are representing the enthusiasm and expectation of our colleagues from all over Latin America. It is a huge honour and, at the same time, a challenge that arrives at the right time. Several acting groups of young teuthologists are at work along the 8000 km long Brazilian coast in subjects as diverse as taxonomy, functional anatomy, ecology, behaviour and fishery management. This reflects the hard early work and encouragement received from former Brazilian researchers in the field, the steady development of marine sciences in our country in general, and the increased interest and greater investment of the Brazilian government for better management of fishery resources exploited by the national fishing industry.

Bearing this in mind, the CIAC 2012 Organizing Committee is preparing a world class conference aiming to keep CIAC's tradition of scientific excellence, as well as to improve the exchange of ideas and research efforts between teuthologists from South America and the rest of the world. The opening and closing talks will be given by two highly renowned authorities in the field: Ángel Guerra and Ron O'Dor. They are expected to brief the community with the main achievements of the last years and the challenges in cephalopod research for the future concerning interdisciplinary research. Given that the theme of the CIAC '12 Symposium will be "Interdisciplinary approaches to cephalopod biology", the Organizing Committee agreed it would be interesting to have both the opening and closure talks focusing on this theme, but from different points of view.

We have also organized four relevant pre-conference Workshops, which were chosen democratically by a poll circulated within the cephalopod community through the fastmoll email list last year. These were "Cephalopod culture: recent advances and challenges" (Chairs: Érica Vidal and Roger Villanueva), "Biology, ecology and biodiversity of deep-sea cephalopods" (Chairs: José Angel Perez and Henk-Jan Hoving), "Habitats and behaviour of cephalopod key life-stages" (Chairs: Jean Paul Robin and Mike Roberts), and "Cephalopod species dynamics and environmental effects, stock assessment and management" (Chairs: Paul Rodhouse and Yasunori Sakurai).

During the conference, 14 thematic sessions will be available to be chosen from by the attendees, covering diverse themes, ranging from early life history to fishery management and every related subject in between. Finally, two broad discussions panels: ("Perspectives on cephalopod evolutionary studies" and "Perspectives on cephalopod research in Latin America", are expected to fulfil the general and local interests and expectations in cephalopod research. Detailed information on all the aforementioned subjects will be available at the CIAC'2012 web site (www.ciac2012Brazil.com.br) soon.

But remember that CIAC events are not only strictly scientific meetings. They are also an opportunity to have some leisure and enjoy the natural scenery and culture of the host country – which is fully justifiable; after all, some people literally cross the planet to attend the conference! In Brazil this tradition will not be different. Bear in mind that you will be visiting one of the most beautiful parts of the country, with breath-taking scenery, excellent gastronomy, and many cultural options. The organization selected six very pleasant options that will certainly meet the expectations of the attendees. From short trips around Santa Catarina Island to enjoy the spare time on the many stunning beaches available, to rafting in crystal clear streams less than a one hour trip away from the conference venue, everyone will have plenty of options to just relax or to experience short exciting adventures for leisure.

On behalf of the CIAC 2012 Organizing Committee, we would like to welcome you to Brazil!

Please, feel at home, and enjoy our hospitality.

New Faces

Rita Melo Franco Santos

M.Sc. student at the Laboratory of Cephalopod Culture and Experimental Ecology (LaCCef), Centre for Marine Studies
Univeristy of Parana, Brazil
Email: ritinhamf@hotmail.com

Thesis title: Comparative description of the beak of paralarvae of *Chiroteuthis* sp., *Liocranchia reinhardti* and *Doryteuthis opalescens* (Cephalopoda: Teuthoidea): Inferences of environmental adaptations
Supervisor: Dr. Érica A. G. Vidal

The buccal structure of cephalopod paralarvae can provide important and basic information on their early life cycle, and yet this is a theme underexplored in cephalopod research. As an undergraduate student I did a

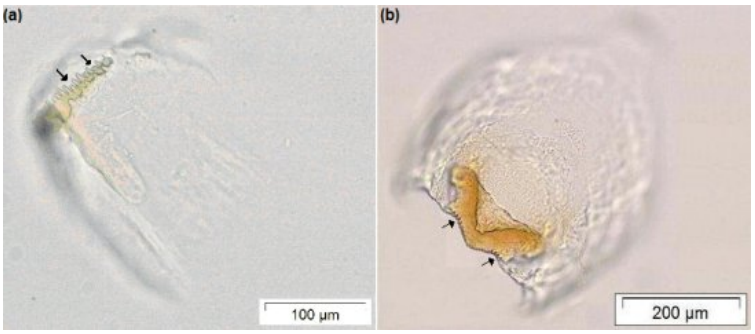


Fig. 1. Teeth found in lower (a) and upper (b) jaws of paralarvae of *Octopus vulgaris*. (a) 2.06 mm ML; (b) 3.28 mm ML.

comparison of the beak (and its structures) of two octopod paralarvae, *Argonauta nodosa* and *Octopus vulgaris*, and tried to relate the differences found to the distinct environments occupied by them, oceanic and neritic, respectively. The results indicated that there were significant differences between the species, for both jaws, according to individual size, and this raised further questions concerning other cephalopod species. Additionally, some results obtained were intriguing because these paralarvae displayed characteristics also found in fossil beaks, such as the presence of teeth on both upper and lower jaws (Fig. 1), and also an uncollapsed slit on the lower jaw (Fig. 2). Thus, for my master's degree, I am again looking at paralarval beak structures for three squid species, *Chiroteuthis sp*, *Liocranchia reinhardti*, and *Doryteuthis opalescens*, and attempting to relate them to previous octopus results. I will try to infer about differential beak development between species. The Chiroteuthidae and Cranchiidae families were chosen because they are key in understanding morphological changes between paralarvae and juvenile/adult phases, for they go through the closest thing to a metamorphosis that there is in cephalopods.
In order to compare the beaks I am extracting and photographing them and will measure their structures, such as rostrum length and hood length. I will also quali and

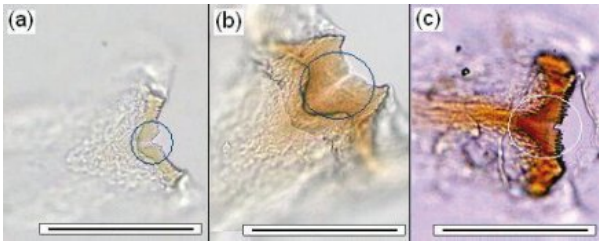


Fig.2. Uncollapsed slit (delineated by circles) present on the lower jaw of paralarvae. (a) *Argonauta nodosa* 1.18 mm ML; (b) *A. nodosa* 2.60 mm ML; (c) *Octopus vulgaris* 3.40 mm ML. Scale: 200 µm.

quantitatively describe the beaks as mantle length increases, paying attention to the relative growth of individuals and beak structures. Beaks will also be compared quantitatively to check for differences between them. These results will later on be compared with those obtained for *A. nodosa* and *O. vulgaris*.
I expect to find significant differences between neritic and oceanic species, and am especially eager to take a look into these "ancient" characteristics, which should be more intense in chiroteuthids and cranchiids, given the degree of morphological change these families go through. I believe that with this information on the beak's functional morphology we may be able to take a closer look at feeding in early life stages of cephalopods, and better understand paralarval ecology.

Roxana de Silva-Dávila

Ph.D. student at the Department of Development and Sustainable Studies of Coastal Zones, "Centro Universitario de la Costa Sur (CUCSUR)".
University of Guadalajara, Mexico
Email: rdesilva@ipn.mx

Thesis title: Cephalopod paralarvae in the Gulf of California, Mexico

Supervisors: Dr. Eric Hochberg, Dr. Carmen Franco-Gordo

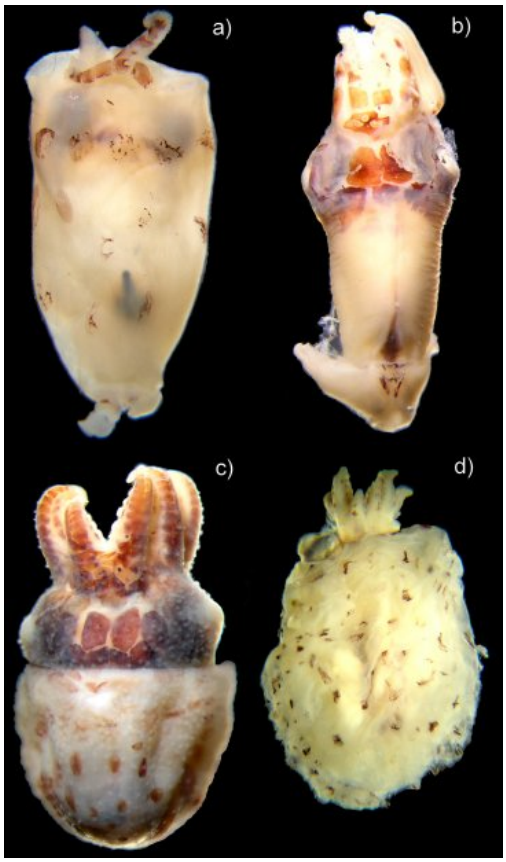
My research proposal is oriented to the study of planktonic cephalopod paralarvae collected during eight oceanographic cruises in the Gulf of California, Mexico. Although this area has been extensively studied with regard to oceanography, plankton, marine mammals, fisheries, there is only limited information on its cephalopod community.

In this area there are practically no studies on the presence, early development, and ecology of squid and octopus paralarvae. One of my objectives is to identify and describe the paralarvae, based on systematic observation of the specimens at different sizes, and the combined use of morphological, morphometric, and meristic criteria. These, along with drawings of the described specimens may provide a substantial advance in the study of cephalopod diversity in the Gulf of California, and a practical taxonomic base for future studies.

Paralarval ecology is another important task in my research. Some environmental factors such as temperature, salinity, Chlorophyll, zooplankton biomass, and oceanographic features (some of them determined through satellite images), will be analyzed to determine what factors could be influencing the distribution and abundance of the paralarvae. I also plan to determine reproductive activity of adult cephalopods and hatching areas based on the presence of the smallest sized paralarvae at least in some of the more abundant/commercial species.

In the pictures, my advisor Dr. Eric Hochberg and I working at the Santa Barbara Museum of Natural History, California, USA, and a) *Gonatus pyros*, b) *Pterygioteuthis hoylei*, c) *Octopus sp.* 2, and d) *Japetella heathi* paralarvae from my PhD research in the Gulf of California.

This project has been funded by the "Secretaría de Investigación y Posgrado of the Instituto Politécnico Nacional" through several research projects and COFAA and EDI grants, and by a grant from the Consejo Nacional de Ciencia y Tecnología (CONACyT).



Isobel Bloor

Ph.D. student at the Marine Biological Association of the United Kingdom and the Marine Institute, University of Plymouth
Email: isblor@mba.ac.uk

Thesis title: Benthic habitats, spawning and recruitment in the common cuttlefish (*Sepia officinalis*) within the English Channel.
Supervisors: Martin Attrill, Emma Jackson and David Sims

My PhD project is funded by the EU Interreg IV scheme and is part of a larger project known as Cephalopod Recruitment from English Channel Spawning Habitat (CRESH). This is a cross channel collaboration between French and English researchers and fisheries managers to examine recruitment to a shared fisheries resource.
The major focus of my studies is on the shallow, coastal water, spawning habitats of the common cuttlefish (*Sepia officinalis*) within the English Channel. Whilst the main migratory patterns of this species are already well known, we still have a lot to learn about the spawning habitats and structures that female cuttlefish use to lay their benthic eggs on and the fine-scale movements and behaviours of these sexually mature adults on and between different spawning grounds.

For this purpose I have been conducting in situ observations of natural spawning habitats with the use of SCUBA. This has allowed us to identify a wide range of structures and habitat used by spawning female and to investigate potential preferred habitats such as seagrass beds, providing information on their relative value as spawning habitats for this species.
In addition I have also been using electronic tags (archival and acoustic) to monitor both the short-term, finer-scale and long-term ,larger-scale movements and behaviours of both adult and juvenile cuttlefish during their lifecycle, using a 'lifetime' tagging technique developed by the Ecology group at the Marine Biological Association.
As part of this research I am also undertaking laboratory studies to examine the impact of heterogeneous conditions in early life stage (ELS) habitats, with a specific focus on how the physical complexity of different habitats may impact on growth and survival rates of ELS in their natural environments.

Michael Amor

Ph.D. student at La Trobe University and Museum Victoria (Melbourne, Australia)
Email: mamor@museum.vic.gov.au

Thesis title: Deciphering the taxonomy of the common octopus, *Octopus vulgaris* Cuvier, 1797; A global cryptic species complex?
Supervisors: Dr Jan Strugnell, Dr Mark Norman

My name is Michael Amor, a marine biologist who graduated from James Cook University in 2010. I recently completed my honours year in 2011 at La Trobe University under the supervision of Drs Jan Strugnell and Mark Norman. During my honours year I investigated the evolutionary relationships of a cryptic species complex of Australasian octopods closely related to *Octopus vulgaris*, the most widely studied and economically important cephalopod species world-wide. This project focused on the common Sydney octopus, *Octopus tetricus*, and its disjunct western relative the common Perth octopus, *Octopus cf. tetricus*. Using five mitochondrial

genes and morphological characters, the western *O. cf. tetricus* was found to be a distinct species, for which we are currently preparing a formal taxonomic description. Furthermore, a third species previously thought to be a distinct species endemic to New Zealand, *Octopus gibbsi*, was found to be synonymous with eastern Australian *O. tetricus*.

In March 2012 I commenced my Ph.D. at La Trobe University, again under the supervision of Drs Jan Strugnell and Mark Norman. This research will focus on elucidating the taxonomic and evolutionary relationships of the common octopus, *O. vulgaris* and will also apply a combined morphological and molecular approach. Preliminary results of my honours work agree with one hypothesis that global populations currently treated under the name '*O. vulgaris*' are likely a complex comprising multiple species. Given the wide distribution of this 'species' this project relies on collection of tissue samples and the loan of specimens from global collections. Consequently, this research will not be possible without the help and collaboration of international colleagues. If anyone is able to offer assistance with obtaining fresh specimens or provide loan material for molecular and morphological data collection, please contact me at mamor@museum.vic.gov.au.

Please also feel free to email any advice or questions relating to this project. Your assistance and comments will be greatly appreciated. I look forward to discussing my research plans and hopes with more of the cephalopod community at the CIAC conference later this year.

Old Faces

Sigurd von Boletzky

developmental and evolutionary biologist

by Marcelo Rodrigues

It is impossible to talk about teuthology and not to mention the surname Boletzky. Although most people guess Sigurd von Boletzky is French (because he developed his research in southern France), he is not. Sigurd was born in 1942 in Frankfurt-am-Main. Yet, in his childhood, for family reasons, he moved to Basel, where later he obtained Swiss nationality and started his scientific life. After finishing high school he started Zoology Bachelor studies at the University of Basel. Although he defended his thesis in 1967 at the University of Basel, during his Ph.D. studies he moved to Banyuls-sur-Mer to work under the supervision of Professor Adolf Portmann (Basel University) at the Laboratoire Arago (Faculté des Sciences de Paris). His thesis was titled: Untersuchungen über die Organogenese des Kreislaufsystems von *Octopus vulgaris* Lam. (Studies on the organogenesis of the circulatory system of *Octopus vulgaris*); which was published later in 1968 in Revue Suisse de Zoologie, 75(4): 765-812, which became an essential reference for any teuthologist interested in development. Anyway, his thesis was not the first contribution of his endeavours to the attention of the scientific community, since he started publishing as early as 1966, and always on cephalopods.

After graduation, the freshly promoted “Dr. Boletzky" did a posdoc year in the USA, where he had the opportunity to go aboard “RV John Elliott Pillsbury” for a research expedition. During this scientific cruise he got the material to re-evaluate/describe two genera (Semirossia Steenstrup, Neorossia) from the Subfamily Rossiinae Appellöf 1898. In remote relation to this early work on the Sepiolidae, I had the opportunity to spend two internships with Sigurd during my Ph.D. Studies on sepiolid squids.
From the beginning in the 1960s Dr. Boletzky never stopped working on cephalopod development and evolution. In 2011 he had more than 170 publications on his list, and for at least 110 he was the first and/or only author. He acted as a co-editor of several journals, encyclopaedias and translations. His contributions as a teuthologist go beyond publishing; he was a member of the first Executive Council of the Cephalopod International Advisory Council (CIAC) founded in 1983. In recognition of his efforts, Dr. Boletzky was nominated CIAC Honorary life member in Vigo, Spain in 2009. Already retired but not out of work, he is still participating in the activities of the teuthology community.
Everyone likes Sigurd. The ladies say he is a gentleman and the gentlemen say the same. Everybody around Banyuls-sur-Mer knows at least his name, and many talk about him with enthusiasm. As an example of the affection the people have towards him, during my internship I did lots and lots of photocopies, but when I tried to pay for that, the lady in charge of the copy service told me: if you are with Sigurd you have “open bar”.

New Resource

Recent Cephalopod Primary Type Specimens: A Searching Tool

by Louise Allcock

As a taxonomist, one of my favourite all-time papers is Sweeney & Roper, 1998. It's not so much the list of currently valid names that I appreciate: it's the vast literature resource in the bibliography and the list of type specimens and their repositories. It has, over the last 14 years, saved me so much time tracking down literature and specimens. Even better, much of the information was made available by Mike Sweeney through ITIS: the Integrated Taxonomic Information System - available at www.itis.gov but now somewhat outdated.

Mike has now gifted another great resource to the cephalopod community: a list of cephalopod primary type specimens. For now, it is hosted on the file area of fastmoll: the same file store where issues of this newsletter are hosted. You can find it by going to https://www.jiscmail.ac.uk/cgi-bin/filearea.cgi?LMGT1=FASTMOLL. In Mike's own words (as written in his introduction to the document):

"This document was first initiated for my personal use as a means to easily find data associated with the ever growing number of Recent cephalopod primary types. (Secondary types (paratypes, etc) are not included due to the large number of specimens involved.) With the excellent resources of the National Museum of Natural History, Smithsonian Institution and the help of many colleagues, it grew in size and became a resource to share with others. Along the way, several papers were published that addressed some of the problems that were impeding research in cephalopod taxonomy. A common theme in each paper was the need to locate and examine types when publishing taxonomic descriptions; see Voss (1977: 575), Okutani (2005: 46), Norman and Hochberg (2005: 147). These publications gave me the impetus to revive the project and make it readily available.

I would like to thank the many individuals who assisted me with their time and knowledge, especially Clyde Roper, Mike Vecchione, Eric Hochberg and Mandy Reid."

Completed Thesis

Bioecology of Sepiola atlantica (Cephalopoda: Sepiolidae) in Galician Waters

Ex Ph.D. candidate Marcelo Rodrigues

Supervisors: Prof. Jesús S. Troncoso, Prof. Ángel Guerra

On16th March last, at the Faculty of Marine Sciences of the University of Vigo (Spain) the defence of the Doctoral dissertation by Marcelo Rodrigues, Bachelor in Marine Biology by the University Santa Cecília (Brazil), took place. The committee entrusted to evaluate his doctoral dissertation was composed of the Doctors: Victoriano Urgorri, acting as President (University of Santiago de Compostela); Juan Moreira, as Secretary (Autonomous University of Madrid); Michele K. Nishiguchi, as vocal (New Mexico State University); A. Louise Allcock, as vocal (National University of Ireland Galway); and Ángel F. González, as vocal (IIM-CSIC). As of the thesis defence the committee unanimously decided to award to the Ph.D. candidate the title of "European Doctor" with the maximum calcification that a Spanish Institution can award.

The thesis by Marcelo Rodrigues constitutes an excellent treatise on the little bobtail squid *Sepiola atlantica* D`Orbigny 1839-1842, that inhabits Northwest Atlantic waters from Norway and Iceland to North Africa. This thesis fills many gaps in the knowledge of this interesting species in a range of aspects, such as its culture, its population structure, temporal dynamics, behaviour, and the ultrastructure of their spermatozoa.

From left to right: Ángel A. González, Louise A. Allcock, Ángel Guerra, Jesús S. Troncoso, Victoriano Urgorri, Marcelo Rodrigues, Michele K. Nishiguchi, and Juan Moreira

The work leading to the development of this thesis started in October 2007, and its results have led articles in prestigious scientific journals as: Invertebrate Biology, Marine Biology Research, Helgoland Marine Research, Italian Journal of Zoology, and Vie et Milieu. Moreover Marcelo published a book chapter in the book Methods and Techniques in Marine Research (Métodos y Técnicas en Investigación Marina - Editorial Tecnos), and attended a number of diverse conferences.

Dr. Marcelo Rodrigues intends keep studying cephalopods whenever funding is provided to him in order to undertake his postdoctoral studies. We would like to give congrats to Marcelo for the excellent work he did, and wish a lot of luck to our freshly crowned doctor and all the best on that new phase that is just starting for him.

Jesús S. Troncoso

Marcelo Rodrigues: publications derived from his thesis

RODRIGUES M, Guerra A, Troncoso JS. 2012. Reproduction of the Atlantic bobtail squid *Sepiola atlantica* (Cephalopoda: Sepiolidae) in northwest Spain. Invertebrate Biology, 131: 30-39

RODRIGUES M, Garci ME, Troncoso JS, Guerra A. 2011. Seasonal abundance of the Atlantic bobtail squid *Sepiola atlantica* in Galician waters. Marine Biology Research, 7: 812-819

RODRIGUES M, Guerra A, Troncoso JS. 2011. The embryonic phase and its implication in the hatchling size and condition of Atlantic bobtail squid *Sepiola atlantica* (Cephalopoda: Sepiolidae). Helgoland Marine Research, 65(2): 211-216

RODRIGUES M, Garci ME, Troncoso JS, Guerra A. 2011. Spawning strategy in Atlantic bobtail squid *Sepiola atlantica* (Cephalopoda: Sepiolidae). Helgoland Marine Research, 65(1): 43-49

RODRIGUES M, Garci ME, Guerra A, Troncoso JS. 2011. Técnicas de mantenimiento y cultivo de sepiólidos (Mollusca, Cephalopoda). En: García-Estévez JM, et al. Métodos y Técnicas en Investigación Marina. Tecnos, Madrid. pp 173-183

RODRIGUES M, Garci ME, Troncoso JS, Guerra A. 2010. Burying behaviour of the Atlantic bobtail squid *Sepiola atlantica* (Cephalopoda: Sepiolidae). Italian Journal of Zoology, 77(2): 247–251

RODRIGUES M, Garci ME, Guerra A, Troncoso JS. 2009. Mating behaviour of the Atlantic bobtail squid *Sepiola atlantica* (Cephalopoda: Sepiolidae). Vie et Milieu, 59 (3/4): 271-275

News & Projects

Atlantic Islands as of Key Ecological Importance

Ángel Guerra

The Spanish National Research Council (CSIC) has started to sample the seabed of the *Islas Atlánticas de Galicia* as part of the research project "Identification and characterization of adequate habitats for spawning and early stages of development of commercially important cephalopods (CEFAPARQUES)". A team of scientists and technicians from the CSIC has made the first visual underwater census. Already found are egg masses of octopuses and cuttlefishes as well as the typical fauna of these waters (wrasses, sole, skates, etc).

From left to right: Francisco de la Granda, Manuel E. Garcí, and Ángel Guerra

During the dives, which will take place around thirty-five meters depth, the habitats and the eggs of octopus, cuttlefish and squid will be filmed in order to obtain information about the reproductive activity of these species. In addition, the flora and fauna of these areas will be filmed. All this audiovisual material will be used to produce a documentary.

The aim of this project is the characterization and identification of adequate habitats for spawning and early stages of development of commercially important cephalopod species, which lay their egg batches in benthic substrates within the *Islas Atlánticas de Galicia* (PNIA) and *Archipiélago de Cabrera* (PNAC) National Maritime-Terrestrial Parks. The visual census will be undertaken by diving in transects previously established and delimited according to the different substrates present in these areas, and considering the spawning season of the species studied during two years: quarterly in PNIA and every two weeks in winter, spring and summer in PNAC.

Every egg mass will be photographed and situated in a map using a geographic positioning system. Temperature, salinity, oxygen, pH, fluorescence and turbidity will be collected using CTD at the

maximum and minimum depths. The number of eggs strings in each transect will be counted to test their presence in the following census. The location of spawning areas for the common octopus (*Octopus vulgaris*), cuttlefish (*Sepia officinalis*) and common squid (*Loligo vulgaris*), the identification of temporal variations within the spawning season for each species, as well as the definition of the suitability of the topographic, hydrographic and biological conditions for preference spawning and settlement habitats (the former only for octopus and cuttlefish), will allow the team to elaborate a contingence plan to protect and preserve the spawning and early juvenile areas. This is the first time that such a study has been undertaken in European National Park waters which allows the management of fisheries according to an ecosystem approach. The CSIC research professor, Dr. Angel Guerra, is the leader of this project and he is in contact with other European researchers lead projects related to Marine Protected Areas as MAIA or CRESH.

This project is funded by National Parks (Ministry of Agriculture, Food and Environment) and lasts for three years, so it is expected that the final results will be published in 2014. The final project results will be compared with the results obtained by a team of scientists from the Mediterranean Institute of Advanced Studies (Imedea) in the Archipiélago de Cabrera. This will determine the kind of environments where these cephalopods spawn in two different marine areas and two National Parks in which protective measures are different.

"The Great Leap Forward in Brazilian Cephalopod Research" – or a Glance at The Current Achivements in the Field

Rodrigo Silvestre Martins

This has been the guiding concept of the whole biology in the last 150 years. This concept also changed the hitherto Aristotelic-immutable world to a new cosmovision. Things change. Life evolves. Nothing is unchallengeable.

Evolution, or at least the spirit behind this concept, is extending its influence on Brazilian marine science in general. We have transcended the purely descriptive science of the last half a century to a more experimentally-directed approach, in line with the worldwide tendency. With the teuthologists it is no different. Local cephalopod research has experienced great advances in the last 10 – 15 years. We now know not only the distribution patterns of the indigenous species, but we have also refined our knowledge of the taxonomy of the species occurring in our shores. For instance, the long mistaken octopus species previously assumed as the cosmopolitan *Octopus vulgaris* has shown to be a completely distinct species, *Octopus insularis*. Further, many aspects of the biology and ecology of this newly-described species have been investigated and new research is currently ongoing. That is a stunning achievement, since this species was described just four years ago! We have now improved knowledge on one the most charismatic and elusive cephalopods: the giant squid *Architeuthis*. Those giant squid roaming along Brazilian shelf were shown to be similar to their counterparts elsewhere. Also, the curious skin sperm storage system was detected for the species for the first time in the southwestern Atlantic. Leaving these oceanic leviathans and coming back to small squid that live nearshore: the biology, ecology and behaviour of the "famous" low salinity-tolerant squid *Lolliguncula brevis* have been investigated in detail. Also, new insights on its taxonomy will challenge its taxonomic classification, and refine our comprehension of the phylogenetic relationships within Loliginidae.

Further, we have improved the knowledge on the biology and ecology of the tropical arrow squid *Doryteuthis plei* to levels never reached before, even in the north hemisphere. New insights on the reproductive biology and sperm transfer that were carefully described in this species have evolutionary ramifications that will improve our understanding of the reproduction of the Cephalopoda and the origins of sperm transfer mechanisms within Teuthida. Further, the relationships between the availability and abundance of the species and the environmental conditions in nearshore locations had been established and it is a promising path toward an ecosystem and community-based management of this social, economical and cultural fishery resource for the traditional artisanal fishing communities scattered along the southeastern-southern Brazilian coast.

We learnt more in the last decade about the Argentine short-finned squid (*Illex argeninus*) off southern Brazil than ever. This squid arguably sustains the largest invertebrate fishery in the world in terms of tonnage and revenue: the only fishery activity visible from outer space from orbiting satellites. This is an important issue because all evidence seems to confirm an old established hypothesis that at least part of northern Argentinean stock migrates upstream toward southern Brazil to spawn, and the egg balloons are carried downward to Uruguay/Argentina.

This calls attention to international effort for joint management of the Argentine short-finned squid caught off southern Brazil: an authentic case of shared fishing resource.

The distribution and taxonomy of cephalopod paralarvae off the Brazilian coast is not an unknown issue anymore, and the old and disturbing gaps we used to see in the distribution maps published in papers and text books along the South American coast are being filled at a steady and fast rate – and with a high level of quality. Even the often difficult paralarvae maintenance in aquaria is being intensely researched– opening new avenues for taxonomic and physiological studies, and the development of culture protocols for economically important species, namely octopuses. As well as all those efforts, the role of coastal circulation patterns on *D. plei* paralarval dispersal is currently being investigated off São Paulo coast through biophysical modelling. In the long run, this will highly enhance our understanding on the dynamics and biology of squid early life stages off the southwestern Atlantic.

All the achievements described above comprise a proof of the developing Brazilian marine science potential and expertize at the same time. This assertion is even more compelling if one considers that cephalopods have never been a major fishery resource in the history of our country. However, this recent boost in cephalopod research results from the endeavour and, why not say?, the authentic passion of new and old Brazilian scientists involved in cephalopod research. We are proudly contributing to a better understanding of part of our outstanding biodiversity. That is what the world expects from people of the 6th largest world economy – and we are doing our job well.

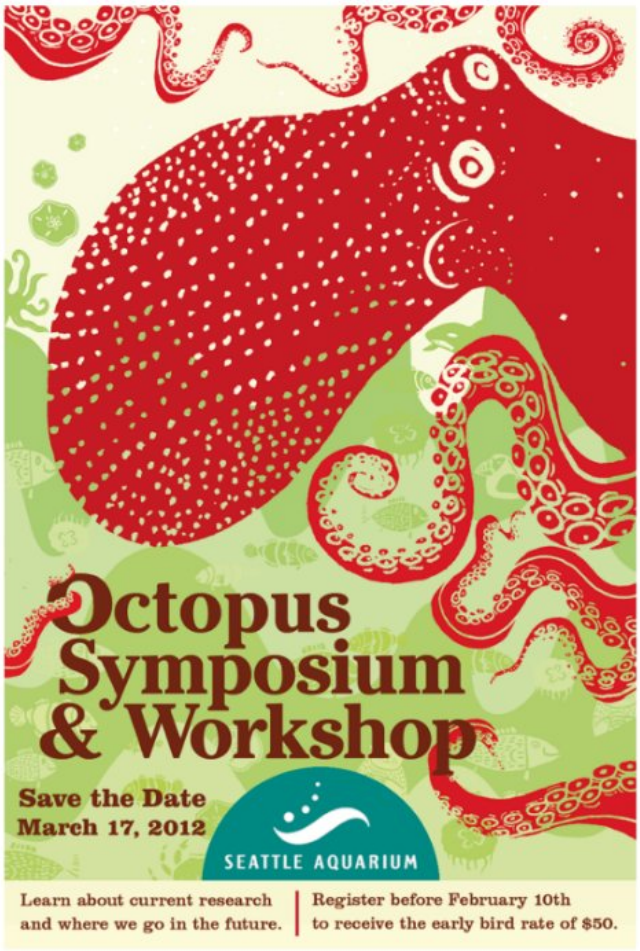
The forthcoming CIAC'2012 Symposium – the first ever to be held in South America – will be an important milestone for the current cephalopod research efforts in Brazil. It is encouraging to Brazilian teuthologists to receive colleagues all over the world to share knowledge and build the path for future research here and elsewhere. We are working hard and expecting that the cephalopod research community find not only a lovely country, with happy people and breath-taking scenery but, most importantly, a productive, prolific scientific arena that will leave its mark on CIAC Symposium history.

See you soon!

Big Suckers in Seattle

Ian Gleadall

The Seattle Aquarium was host to the world's first symposium and workshop on the Giant Pacific Octopus (GPO) on Saturday 17th March, 2012. It was a long time in coming, as Seattle Aquarium Biologist Emeritus Roland Anderson related in his opening address. Bill Summers of Western Washington University proposed 25 years ago that he and Roland should organize a Pacific Northwest cephalopod meeting. This was finally it, and what an interesting and successful meeting it was.



It started bright and early at 7:30 with an hour-long breakfast networking session, lubricated by plenty of great Seattle coffee, allowing the participants to get to know each other right from the start. The mix was broad, with people of all ages and experience, ranging across researchers and aquarium staff (well established, retired, or just starting their careers), youngsters still at college, and people from other walks of life, all with a passion for the stars, past and present, of Seattle Aquarium: the GPO's, currently known by the scientific name *Enteroctopus dofleini*. The opening formalities were performed by Aquarium Director Robert Davidson, followed by addresses from the organizers, Shawn Larson (Curator of Research) and Roland Anderson. The event then continued to run super-smoothly, thanks to Bob Davidson, the efforts of Special Projects Coordinator Becky Bingham, backed up by Vivian Gross, Nick La Haye's flawless technical support and the cakes and refreshments provided by the Aquarium cafeteria.

The first presentation began promptly at 9 o'clock, with Jennifer Mather reviewing our present knowledge of *E. dofleini*, comparing it with *Octopus vulgaris* and other shallow-water species in terms of its life and natural history, general morphology, behaviour and intelligence. She noted, for example, that like other octopuses, the GPO is probably limited in its distribution by the availability of shelter: found mainly in rocky habitats, but sometimes using structures such as concrete moorings or piers to extend its range into other habitat types. Like other octopuses, it consumes much of its prey at home, leaving a midden of shells outside; and is nocturnally active, though we don't know whether this activity pattern is flexible as in *O. vulgaris* or more fixed like some octopuses in the *macropus* group. It has clear periods of sleep; locates prey animals by chemotactile exploration of likely habitats; prey penetration includes pulling the valves of clams apart with the arms and suckers, drilling with the radula and salivary papilla and chipping with the beaks. Colour patterns and changes may be less variable than those of other species. Finally, Jennifer talked about their intelligence in terms of personalities, play, and ability to solve problems such as gaining access to clams, taking jar lids off to get access to prey inside, and using water jets from the funnel as tools. GPO's also show evidence of spatial memory for returning home, as does *O. vulgaris*, and Jennifer noted that development of such ability may form a basis to make cross-phylum comparisons of the evolution of intelligence.

The programme continued at a steady pace, each talk allocated 20 minutes, including questions. This was not always enough time, unfortunately, but room availability dictated that the schedule was adhered to carefully, and extra questions were skillfully postponed until the lunch and coffee breaks by Becky and Roland, who kept friendly but firm control over the proceedings.

David Scheel reviewed his experiences with anaesthesia, temperature and movements in *E. dofleini*. These are all tied in with fisheries management issues, since immobilizing octopuses for tagging has involved the use of anaesthetics or hypothermia, and the tags attached have been used to monitor GPO movements. In the late 1990s, cold-water anesthesia (4°C to -1.9°C) was regarded as best practice for routine tagging but David found that octopuses from Alaskan waters remain responsive at 2°C to some stimuli, such as manipulation of the free edge of the mantle, and were unresponsive only when chilled to <1.5°C. Following this treatment, though, recovery was slow and the octopuses showed abnormal posture and coloration. Rather than chilling and prolonged handling, it was concluded that the best strategy is to minimize all handling and avoid anaesthesia (which, while intended to lower stress, takes time). This was supported by subsequent tracking data from attached sonic transmitters, indicating equivalent or lower incidence of abnormal respiration, coloration, posture, and fleeing behaviours.

Concerning movements, David noted that movement ecology is central to defining populations, a concept key to fisheries policies. [Note: Fisheries policy for North American GPO's (NAGPO's) is currently under urgent development because monitoring at present relies only on by-catch statistics from crustacean pot fisheries, which have led to bureaucracy-based restrictions on fisheries for both crustaceans and NAGPO's, to the annoyance and frustration of local fishers]. Assumptions have been made until recently that NAGPO's behave similarly to Japanese GPO's in Hokkaido waters (JAGPO's), which migrate inshore in early summer and early winter and offshore to deeper water in later summer and late winter, movements coinciding with seasonal inshore temperature fluctuations from too cold (in late winter) to physiological optimum (in early summer) to too hot (in late summer) and back again. For NAGPO's in Prince William Sound, David's team found (for temperatures between 5 and 11°C) a correlation between variable but warmer mean June temperatures and increased density and recruitment of juveniles (<2 kg) into the study area. However, den use and tracking studies in British Columbia and Alaska have failed to support the occurrence of a twice-yearly onshore-offshore migration for NAGPO's, so it seems that NAGPO's and JAGPO's have different patterns of movement.

During the period of variable temperatures, David related that records also indicate higher incidence of Cancer productus in octopus middens from British Columbia to Alaska, and trends of octopus densities recorded in Alaska paralleled those in Puget Sound (the Seattle Aquarium annual octopus survey conducted each winter by scuba divers). This suggests an eastern North Pacific-wide signal, possibly affecting survival of meroplanktonic life stages of both crabs and octopuses, and leading to greater recruitment during years of warmer than average June temperatures. This change is reflected in greater NAGPO densities, and shifts in octopus diet toward larger prey species.

Kirt Onthank gave a fascinating talk about the association of sponges (*Myxilla incrustans* and *Mycale adherens*) with the valves of scallops (*Chlamys hastata* and *Chlamys rubida*), which is possibly maintained by octopus predation. Kirt found that *C. hastata* comprises up to a third of the NAGPO diet and that sponge-free scallops are more than twice as likely as sponge-covered scallops to be chosen for predation. He also found that the Pacific red octopus (*Octopus rubescens*) is five times as likely to consume sponge-free scallops. This is presumably because they can be easily gripped and pulled

open: sponge-covered scallop shells are mostly drilled, presumably because suckers cannot grip well enough for pulling successfully. Sponges benefit from occupying the surface of scallop shells because they are kept clear of sediment and live longer.

An equally fascinating talk was given by Stavros Hadjisolomou, who skillfully summarized his recent investigations in terms easy for the audience of non-mathematicians to understand. He is working with Frank Grasso, investigating inter-sucker coordination in octopuses based on computer analysis of sucker movement patterns. He has been able to demonstrate neighbourhoods of coordinated movement both locally and at distant intervals along the arm. The patterns of arm-independent sucker activity seem to be generated by local circuitry and vary according to the task the octopus is performing with the arm. Stavros is continuing investigations of the mechanisms underlying sucker functionality, which will help to provide a better understanding of both octopus behaviour and the phylogenetic differences among octopus, squid and cuttlefish.

Diver and Seattle Aquarium Volunteer Guy Becken provided an interesting account of the natural history of some of the local GPO's, based around a now famous individual called Olive (you know, Popeye's gal), which was the nickname given to a GPO who took up residence among some pilings just off the fishing pier at Sea Crest's Cove 2 in West Seattle, part of Seattle's harbour. Olive's life, mating, guarding of the eggs, and finally the hatching of her brood were little different from those of many other octopuses who had occupied the site over the years. However, this particular octopus became a phenomenon as she was watched and talked about by the hundreds of individual divers who visited her as word spread, along with her adopted name. Her legacy lives on as large numbers of divers continue to go octopus watching in the harbour.

Shawn Larson's talk took us into the realm of endocrinology, with an account of a research project conducted recently at the Seattle Aquarium. Steroid hormones, well known in vertebrates, are also present in octopuses. Since little is known about their function in octopuses, experiments were devised to find out whether or not endocrine signatures are similar to those found within vertebrates in response to reproductive activity and stress. Steroid levels were measured in faeces released by five female and three male GPO's. A sustained pattern of elevated progesterone was detected during ovarian development and estrogen was seen at elevated levels only in females during mating behaviour. Corticosterone levels rose in association with three different kinds of stress, one of which was the administration of an injection of ACTH (which was compared with control injection of saline). Conclusion: there is evidence that steroids may indeed have similar functions in octopuses as in the vertebrates.

The remaining three talks were concerned with the phylogeny of GPO's and their relatives. Annie Lindgren, working with Eric Hochberg, has been trying to tie down the various lineages within the incirrate octopuses, finding a high degree of polyphyly and recognizing the following main groups: (1) the Argonautidae; (2) the Octopodinae (*Octopus*, *Amphioctopus*, *Cistopus*, etc.); (3) the Bathypolypodinae (*Bathypolypus*); (4) *Eledone cirrhosa* and the species of *Enteroctopus* and *Muusoctopus* ('*Benthoctopus*'); (5) the Bolitaenidae and Vitreledonellidae; and (6) the remaining single-sucker genera (*Adelieledone*, *Megaleledone*, *Graneledone*, etc.). One of the biggest surprises is this study's controversial placement of *Eledone cirrhosa*, grouping it with the GPO genus, *Enteroctopus*, and *Muusoctopus* with 100% bootstrap support.

Ian Gleadall has been looking in more detail at the *Muusoctopus* group, among the closest relatives of GPO's. In his talk, he presented evidence that *M. normani* is a junior synonym of *M. januarii*, and proposed that recent divergence in cephalopods can be calibrated within the *Muusoctopus* group by the timing of two vicariance events. One is the rising of the Panamanian Isthmus, which is proposed to have separated the ancestors of *M. januarii* in the Atlantic from most of the other (Pacific) members of the *Muusoctopus* group between 3 and 15 million years ago. The other is the separation of the two subspecies of *M. longibrachus* by extreme conditions during the Last Glacial Maximum in the Cape Horn province of southern Chile between about 15,000 and 33,000 years ago.

Becky Toussaint, working with David Scheel and colleagues, has been investigating the population structure of GPO's over the northern Pacific coastal range from Dutch Harbor at the end of the Alaskan Peninsula to Prince William Sound. Becky has developed 18 novel microsatellite markers and also used 5 other genes for her study. The results demonstrate a more or less homogeneous population across the 1300 km range except for the apparent presence among Prince William Sound individuals of a possible cryptic species (with COI gene haplotypes differing from others, including all those reported previously, by 3-4%). This is under further investigation and demonstrates that our current understanding of the population biology of GPO's is still based on limited data.

After a specially discounted lunch in the aquarium cafeteria, the presenters were seated together as a discussion panel who answered questions from the audience, but also a good few from the coordinator and GPO Enthusiast-in-Chief himself, the irrepressible Roland Anderson. Questions ranged across the entire gamut of presentations and anything concerned with GPO's, and were addressed evenly to each of the

panelists. It should have been recorded on video, if only to witness the fascinating breadth of content and the spirit of good-natured imparting of opinions and knowledge. As with all good discussions, the end approached far too quickly, limited by another booking for the conference room for aquarium event preparations. The conference thereafter moved appropriately en masse to watch the feeding of the GPO's in the public aquarium. As Roland Anderson reminded us, Henry Lee began exhibiting octopuses at his aquarium in Brighton, England, in 1867 and is credited with saying, in 1875, that an aquarium without octopuses is like a plum pudding without plums. Of course, we all think he was right. After a quick look around the aquarium, many of the participants found their way to a restaurant close by to continue discussions until it was time to catch buses and planes back home.

Well, what a great event, and all credit to Roland Anderson, whose inspiration was matched by his shrewdness in acquiring and providing funds to help with travel expenses, lubricating the wheels necessary to gather a critical mass of presenters to ensure a successful event. I am sure everyone came away with far more than they arrived with - I know I did. It was not only enjoyable but fruitful in terms of finally meeting people I have known and corresponded with for years but never or rarely met. The future will surely show that this meeting helped greatly to stimulate ideas and collaboration for further research on these fascinating giants. So a big "Thank you" to Roland and we also wish him well in recovering fully from a horrendous back injury he sustained last year. I would like to think that this is just the first in a long series of such well-organized and focused meetings in the future, not only on GPO's but on other topics in cephalopod research, too. The recently established CephRes organization might help provide the impetus to see this happen.

World Fisheries Congress in Edinburgh

Graham J. Pierce

The 6th World Fisheries Congress in Edinburgh this month (May 2012) was attended by around 1000 delegates, with plenary speakers including Ray Hilborn, James Anderson (World Bank) and Prince Charles, and up to 10 parallel scientific sessions running at any one time. There was a strong emphasis on fishery management and governance, including sessions on management strategy evaluation, fishery certification schemes, adaptive management and CFP reform. A good number of talks focused on the challenges presented by small-scale fisheries, including some examples from the world of cephalopods.

CIAC was represented by several current and former Council members and reserve members (Sasha Arkhipkin, Greta Pecl, Begoña Santos, Felipe Briceño, Bronwyn Gillanders and myself – although only Sasha was presenting work on cephalopods). Other familiar faces included Paul Shaw, Mary Gasalla, Angel Perez, David Agnew, Simeon Hill and Matt Dunn, although again none were presenting work on cephalopods.

Cephalopod research was however alive and well, and represented by both young and established scientists. I did not get to see all the cephalopod talks but they included work on both squid and octopus, mainly focused (as you might expect) on fishery-related questions.

Two talks focused on *Doryteuthis* (formerly *Loligo*) *gahi*, concerning fishery management and predicting recruitment (by Sasha and Andreas Winter respectively, both from the Falkland Islands Fishery Department). Carlos Robinson (Universidad Nacional Autonoma de Mexico) described hydroacoustic survey for jumbo squid (*Dosidicus gigas*) in the Gulf of California. John Manderson (NOAA/NMFS) talked about habitat modelling for butterfish, as a way of helping squid fishermen to reduce by-catches of this species. Kohei Kurosaka (Fisheries Research Agency, Japan) talked about ways to avoid *Ommastrephes bartramii* falling off jigs. The final squid paper was by Sanae Kato, who talked about assessing the health of captive *Todarodes pacificus* by measuring haemocyanin concentrations in the haemolymph.

Several presentations concerned small-scale octopus fishing in the Iberian Peninsula. Javier González (University of Oviedo) presented a talk on an integrated management model for artisanal fisheries of northern Spain, focused on octopus fishing. Gonzalo Rodriguez (University of Santiago de Compostela) spoke on stakeholder perceptions about IUU fishing activities in the *Octopus vulgaris* fishery in Galicia. There was also a poster (technically an ePoster) by Carlos Pombo (University of the Algarve) on mapping of octopus fishing grounds in southern Portugal.

The conference was a reminder of the worldwide importance of cephalopod fisheries and I hope we can attract some of the fishery and aquaculture research community to the CIAC conference in October. Registration and the call for abstracts are now both open so please don’t delay!

Teutho Game

Cephalopod

INTRODUCTION Cephalopod is a two player game which employs a 5x5 board, 24 dice of one color, and 24 dice of another color. The board starts out vacant as shown in Figure 1.

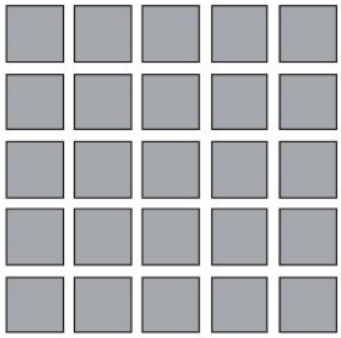


Fig. 1 - Initial Setup

BASIC PLACEMENT Players take turns adding dice of their own color to the board, one die per turn. A newly placed die must show a one, unless it's a capturing placement, in which case it must show a two or higher. Each player will always have a placement available and must make one. Players cannot pass on their turn.

OBJECT OF THE GAME Once the board has been completely filled, the player whose dice occupy the majority of the squares wins. Draws and ties cannot occur in Cephalopod.

CAPTURING PLACEMENT If a die is placed horizontally or vertically adjacent (hereafter "adjacent") to two dice, and the sum of the pip counts (number of spots on the top surface of a die) on those two adjacent dice is six or less, then the currently played die must show the pip sum of its two adjacent dice, and the player must remove those two adjacent dice from the board immediately, while it is still his turn. In Figure 2 White places a two in the center of the board, and thereby captures the two ones. Captured dice are returned to their owners. Similarly, if a die is placed adjacent to three or four dice, and if two, three, or four of its adjacent dice have a pip sum of six or less, then two, three, or four of those adjacent dice (whose pip sum is six or less) must be removed, and the played die must show the pip sum of the removed dice. In Figure 3, Black plays a six in the center of the board and thereby captures all four adjacent dice whose pip sum is six (1+1+1+3=6). In Figure 4 Black decides to capture the two white ones. So he places a two in the top center square adjacent to the two ones, and removes them. Captures are mandatory only when placing a die onto a square from which captures are possible.

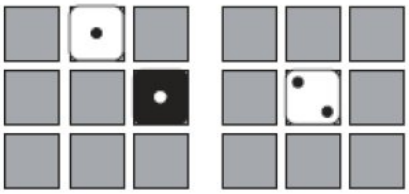


Fig. 2 - Capture

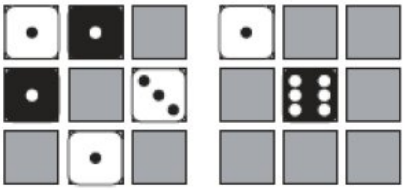


Fig. 3 - Capture

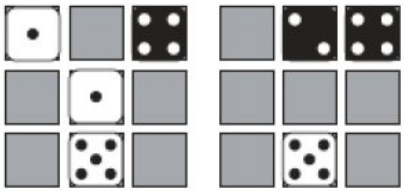


Fig. 4 - Capture

NON-CAPTURING PLACEMENT A player can make a non-capturing placement simply by adding a die to a square from which no captures are possible. A non-capturing placement must show a single pip. In Figure 5 Black places a die in the right center square. The only adjacent dice are a five and a two. The five and two cannot be captured since their sum is greater than six (5+2=7). Black's placement is therefore non-capturing and must show a one. Players always begin their turn by adding a die. Only dice which are adjacent to the currently added die, and whose pip sum equals the pip count of the currently added die may be removed during the current turn.

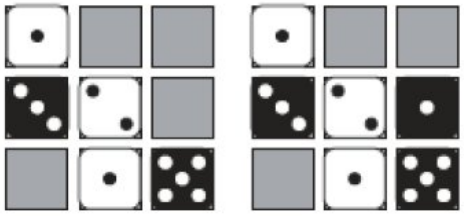


Fig. 5 - Non-capture

Additional information

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Life & Environment

Behaviour in cephalopods: underlying mechanisms and methodological approaches

Edited By M. Kuba, T. Gutnick, S. V. Boletzky

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