SOUTHERN CALIFORNIA ASSOCIATION OF MARINE INVERTEBRATE TAXONOMISTS

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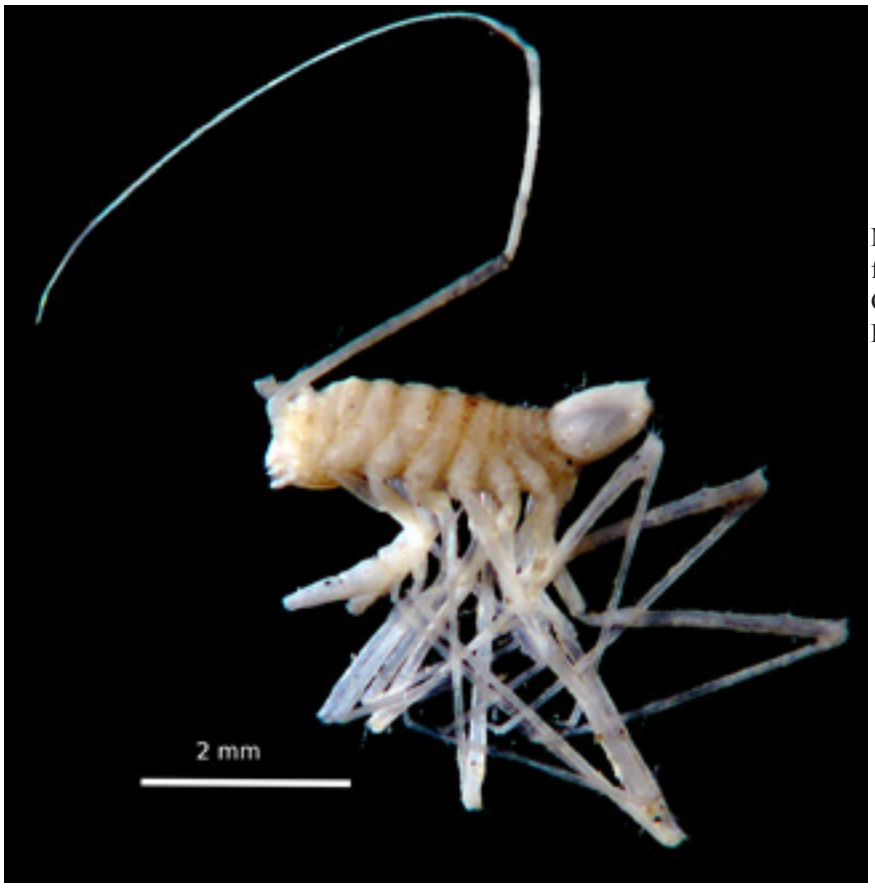

Munnidae (*Zoromunna* sp.nov) from the Juan de Fuca - Gorda Ridge region. Photo by Dr. G. (Buz) Wilson

This Issue

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SCAMIT Vol 32, No. 2: *No meetings were held in July or August 2013 in order to accommodate the Bight'13 Regional Monitoring Program field coordination and sampling efforts. Consequently, there are no minutes for these months, which would have formed Vol. 32, No. 2 of the SCAMIT NL series.*

13 SEPTEMBER 2013, ANGEL VALDÉS, NHMLAC, OPISTHOBRANCH MOLLUSKS

Attendees: Larry Lovell, Terra Petry, Don Cadien (LACSD); Kelvin Barwick, Erica Jarvis (OCSD); Wendy Enright, Ron Velarde (CSD); Leslie Harris (NHMLAC); Angel Valdés (Presenter: Cal Poly Pomona).

UPCOMING MEETINGS

Visit the SCAMIT website at: www.scamit.org for the latest upcoming meetings announcements.

Business:

The SCAMIT Executive Board will hold its annual meeting later this month (9/28; minutes included in this NL). No meetings were scheduled for July or August 2013 to accommodate the Regional Bight Survey field sampling schedules.

Monday, December 9: Tony Phillips will provide a review of Cnidarians based on the collections and images of the late John Ljubenkov. The meeting will be held at the Orange County Sanitation District Laboratory. Anyone interested in attending the meeting should contact Kelvin Barwick at kbarwick@ocsd.com prior to the meeting.

Trawl invertebrate FIDs. Meetings are expected, but currently unscheduled, in November and December 2013 to address identification of B'13 trawl invertebrates. One meeting will deal with crustaceans, the other with mollusks, cnidarians, urochordates, etc. Another is planned for late January 2014 covering echinoderms and focusing on *Brisaster*.

Other upcoming meetings – CERF (Coastal and Estuarine Research Federation) Annual Conference in San Diego, November 3–7. SCAMIT efforts will be represented in presentations dealing with the development of a national AMBI.

There will be a Malacology meeting in Mexico City in June 2014. This will be a joint meeting with WSM, AMS, SMM, and ALM (the Mexican and Latin American counterparts). Paul Scott is President of both American organizations this year. The Malacological Society of South America will hold their annual meeting concurrently, making this a meeting of the Americas.

Larry introduced Dr. Valdés who began with a presentation of some recent research conducted by himself and his students. In particular he discussed their work on species complexes and the biogeography of "widespread" species. All this is right up SCAMIT's alley since we have come to distrust most reports of multi-ocean distributions. All of the work involves some measure of molecular analyses of specimens from various spots around the globe.

The first problem tackled was the reported distribution of *Doriopsilla areolata* in the Atlantic. Valdés and Orea Rato (1997) suggested segregation into subspecies, which has now been rejected based on molecular analysis (Goodheart and Valdés 2013). While there were interesting localized differences in haplotype frequency, no real reproductive isolation was indicated in the analysis, and the subspecific taxa could not be supported. Specimens identified as *D. miniata*

from South Africa proved to nest within *D. areolata* in the cladogram, raising the possibility that they might prove to be synonymous. *D. areolata* is distributed through much of the Indo-Pacific, and specimens from other areas were not included in the study. It was premature to propose the synonymy, since the specimens sequenced might prove misidentified rather than characteristic of the species as a whole. Broader sampling is needed before a definitive conclusion can be reached.

The cephalaspid genus *Navanax* was the next problem area visited. We have *N. inermis* here in southern California, while *N. aenigmaticus*, a more southern species, is fairly common in the Gulf of California and rarely reported from the Southern California Bight (SCB) though it may come into the area during El Niño current flows. Within this radula-less group morphological characters to distinguish taxa are elusive. The internal shell, for example, has proven largely uninformative for species separation. Consequently external color and color patterning have sometimes been used to separate species. The value of this was tested by molecular analysis and found relatively unreliable. *Navanax aenigmaticus* has been considered circum-tropical in the past, with populations in the NEP, tropical west Africa, and the Caribbean. The analyses of Orneles-Gatdula et al (2012) demonstrated that there are actually three species, one in each geographic area. *N. aenigmaticus* is the Pacific species, *N. gemmatus* is found in the Caribbean, and *N. nyanyana* is found in tropical west Africa. This latter species has recently been suggested to be synonymous with the earlier *N. orbignyanus* (see Ortea et al 2012).

Another supposedly circum-tropical species, the sea hare *Aplysia dactylomela* was discussed next. It is widespread in the tropics (Hawaii, China, Atlantic) but representative of two clearly different genetic groups, one in the Atlantic and one in the Indo-Pacific. It was first reported as an invasive species from a small island in the southwest off Tunisia in the Mediterranean in 2002. Subsequent reports showed a rapid and steady spread to the east, a pattern at odds with the normal pattern of Lessepsian invasion through the Suez Canal. In an effort to see just where the Mediterranean species originated, Angel examined the genome. Specimens were collected from various locations for sequencing. Angel hypothesized that the invasion was from the Atlantic into the Mediterranean, rather than along the usual Red Sea-Canal pathway. His hypothesis was supported by genomic data. He found lots of genetic structure in the Atlantic, but not much in the Indo-Pacific. Oceanographic barriers such as the Canary current and strong upwelling off several parts of west Africa have become weaker with climate change, making the previously difficult invasion of the Mediterranean from the Atlantic easier. With continuing climatic shifts, such barriers will become sieves allowing the more optimally invasive taxa through, but may fail entirely with time. Once that occurs free interchange will become possible in areas formerly separated, and the homogenization of the planet's oceans will accelerate.

Our next discussion involved a nudibranch living at the ocean surface with the potential for a very broad distribution throughout entire oceans and possibly between oceans. Angel showed video of *Glaucus* feeding on Portuguese Man-of-War collected in collaboration with the University of Michigan and the National Geographic Society. Angel studied two species living in different ocean gyres. *G. marginatus* (the stouter species) is actually a complex of four cryptic species. The issue proved to be a good example of sexual selection at work since *G. marginatus* have a bursa copulatrix and regular copulation, while *G. atlanticus,* injects sperm via a penile spine. Using molecular clocks, Angel found that differences in the Atlantic vs. Indo-Pacific populations were established about 1.2 million years ago. This coincides with the onset of the Agulhas leakage around the Cape of Good Hope in South Africa. Prior to that date there had been an impervious

barrier at the Cape preventing interchange between the Atlantic and Pacific populations. The leakage has varied with glacial events, currents, and temperature allowing pulses of mixing between the two oceans. The current hypothesis is that this history is reflected in the genomes of the animals affected. Investigations testing this hypothesis are in the process of publication.

Angel then went on to discuss Caribbean diversity in another cephalaspidean genus; *Chelidonura,* a coral sand dwelling form, which demonstrates a wide range of color variations in the Caribbean. Genetic analysis showed that there were two clades – one only in the Bahamas, the other throughout the Caribbean – with wide color variation in each clade. Color could not be used to separate the clades, but internal shell morphology did separate morphs. It turned out that the protoconch growth patterns reflect feeding differences and larval life style: widespread species were planktotrophic, while endemics were lecithotrophic. These data were partially presented by Orneles-Gatdula et al (2011).

Philinopsis has the same pattern of habitat with cryptic coloration; although internal shell variation was evident. A study of two different color morphs of *Philinopsis pulsa* from the same habitat showed no difference in haplotypes or burying behavior. There was no genetic basis for the color variation, and no indication of the potential source of the variation (Orneles-Gatdula and Valdés, 2012). This pattern repeats with some cryptic species of saccoglossans as well.

Angel also discussed several new species. A new *Chromodoris* from the Gulf of Mexico is aposematic, using its dorsal color pattern as a warning and defense mechanism. It feeds on red sponge, against which its coloration can clearly be seen. He also mentioned that description of the first species of *Melibe* known from Florida is underway. This is an extremely transparent member of the genus, which is virtually invisible underwater. While most species of *Melibe* have cryptic coloration and dermal elaboration, no other species has been this difficult to see.

Going back to problems with existing described species, the aeolid genus *Dondice* was addressed. Members of *Dondice* are cnidarian feeders, and *D. banyulensis, D. occidentalis*, and *D. parguerensis* look very similar but are genetically distinct. The first two species feed on hydroids, as do most aeolids, while D. *parguerensis* feed on the jellyfish *Cassiopeia*. This medusa lives upside-down on the sediments, farming symbiotic algae in its tentacles on shallow sun-lit bottoms. Why this dietary difference, and its possible consequences, are subjects of interest. Angel hopes to perform some lab experiments to test (1) if the two species that co-occur in the tropical west Atlantic (*D. occidentalis* and *D. parguerensis*) are inter-fertile, and (2) if switching prey between the two species is an option.

As an aside, Angel mentioned that although studies focused on the Aglajidae (*Aglaja*, *Navanax*, and *Chelidonura*) have shown these taxa nest together, their synonymy has not been performed. Reviewers won't support the idea of synonymizing these genera, and efforts to do so have been rebuffed.

Research on the Philinidae has been spurred locally by the invasion of several species, most notably *Philine auriformis*. In California, *Philine* have proven to be a complex in Northern California – particularly in Bodega Bay. This complex includes three fusiform species: *P. aperta*, *P. auriformis,* and *P. orientalis* (similar gizzard plates to *P. auriformis* but with tiny holes). This complex was confirmed by Pat Krug and his students. The endemic *P. alba*, a lenticular species that is also large and white, is not part of this complex. All three members of this complex

are invasive; *P. aperta* from the North Atlantic, *P. orientalis* from the South China Sea, and *P. auriformis* from New Zealand.

In addition, *Dendronotus frondosus,* now *D. venustus*, was found to represent more than one species. Molecular investigations indicated that the reputedly wide-ranging *D. frondosus* should be restricted, and previously synonymized species such as *D. venustus* recognized (Stout et al 2010). Angel thinks that there may be more cryptic species locally under this name. It is an interesting group because they seem more specious in temperate areas, whereas most nudibranchs reach maximum diversity in the tropics. Five taxa are listed in SCAMIT Ed 8. *D. patricki*, not on the list, is a vent species found on whale skeletons (Stout et al 2011).

Under-reported diversity may also reside in *Polycera*. Members of the genus *Polycera* are typically shallow water species that occur in embayments. *P. atra* is the same up and down the coast, but *P. alabe* is represented by three clades with overlapping ranges that show some minor radular differences. Investigations of this situation continue.

Another interesting story, *Haminoea japonica* was first detected in Canada, down to San Francisco. It has a distinctive deep notch in the cephalic shield, along with a distinctive radula when compared to the native species. All the invaders to both Europe and North America came from one small area of intense oyster farming in northeast Japan (Hanson et al 2013). When first detected in the NEP they were described as a new species, *H. callidegenita*, by Gibson and Chia (1989). The North American populations show a different haplotype than Europe, but not enough to qualify as a different species. *H. japonica* has displaced *H. vesicula* in bay and estuaries in North America. In Europe, it has invaded several coastal lagoons previously occupied by endemic species such as *H. fusari*, *H. templadoi*, *H. orteai*, etc. In its non-native habitat, it is found in estuaries associated with bivalve aquaculture. It is not in southern California yet, but expected eventually.

Angel described a project that Jeff Goddard is pursuing (see Goddard et al 2013), and he could use help finding specimens. *Felimare californiensis* is a small opisthobranch that feeds on sponges of the genus *Dysidea*. The species has historically been found on the mainland and Channel Islands. In the mid-1980's it disappeared from the mainland, although it was recently found in Mission Bay and La Jolla. *F. californiensis* has a history of variable abundance; its congener species *F. porterae* is doing fine. Jeff is interested in seeing if the genetic diversity has changed over time, or if there are links to pollution/runoff, or variability in the availability of prey. Jeff could use specimens of *F. californiensis* for genetic analysis, BUT do not kill the specimens, a clip from the tail preserved in 95% EtOH is just fine!

Angel is also interested in members of *Melanochlamys*, *M. diomedea* being our local representative. Nine species worldwide have very tight, restricted ranges, but initial analysis showed a distinct species, *M. ezoensis* (identified as that, but actually a new species) in San Francisco Bay and Japan. Angel is still working on teasing apart the exact story. Specimens are morphologically falling out along the same lines, but he needs more material if you come across it.

He has also found a *Parvaplustrum* and *Philine* from a whale fall; their identity still unknown. The *Philine* gizzard plates were not calcified, so their purpose is rather obscure. Just another conundrum awaiting more work.

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SCAMIT EXECUTIVE COMMITTEE ANNUAL MEETING, SATURDAY, SEPTEMBER 28, 2013

Attendees: Cheryl Brantley, Don Cadien, Dean Pentcheff, Megan Lilly, Larry Lovell, Dean Pasko, and Leslie Harris.

Larry Lovell began the meeting by thanking Cheryl Brantley and Megan Lilly for their many years of service to SCAMIT, and presented each with a card signed by members of the executive committee and a gift certificate of appreciation.

He then commented on SCAMIT's successful 31st year that ended with a record number of members (170), and included a full schedule of meetings, a SCAS symposium, organizing and hosting two EPA/USGS workshops, and releasing edition 8 of the SCAMIT Species List.

SCAMIT organized and co-hosted two EPA/USGS-sponsored CBRAT workshops to evaluate potential target species that could be impacted by the effects of Global Climate Change, such as warming water temperatures and changes in pH**.** These workshops covered crabs, bivalves, and chitons, and netted approximately $3,700.00 in 2012/13 and $4,000 for 2013/14. Several SCAMIT members were among the invited experts: Mary Wicksten, Doug Eernesse, Don Cadien, Ron Velarde, and Paul Scott. Future CBRAT workshops on annelids, arthropods, and other phyla are possible depending on EPA needs and budget demands. SCAMIT is likely to be approached to play a similar role.

Larry also mentioned that the Taxonomic Database Tool (TDT) V1 is nearly ready for release in anticipation of Bight'13 sample processing. The database tool will link taxa to SCAMIT voucher sheets, images, and keys from the SCAMIT Toolbox. The Committee discussed the fact that the Toolbox has its share of problems that need to be cleaned-up, such as duplicate voucher sheets, voucher sheets with old names, etc. The Committee suggested that each monthly meeting could dedicate a small amount of time to reviewing the information in the toolbox that relates to the taxon being covered at the meeting. In addition, these meetings could be mechanisms by which notebooks and computers could be mined for documents that could be added to the toolbox.

The discussion then migrated to SCAMIT's effort to build an image library, which was to be linked to the Taxonomic Database Tool. SCAMIT has $3,200 remaining from the OCSD funds that could be used to hire an intern to search POTW lab computers for images. Several people commented on the difficulties associated with continued submittal to Morphbank and the fact that it is not user friendly. Dean Pentcheff described Morphbank's intended use as a background repository of images that could be accessed through something like the SCAMIT Database, noting that Kelvin's aplacophoran images in the toolbox are stored in Morphbank. Despite this example of successful usage, there was much discussion about whether Morphbank would be there in the future, the complexities involved in loading images, that some of our TDT development partners at SCCWRP are not happy using Morphbank, whether there was some other option to meet our needs, and whether maintenance of a database of this type is beyond SCAMIT's area of expertise or funding. Still, the need to pull together the images was clear, and the Committee discussed hiring an intern to find material from the various agencies for potential uploading to the TDT or Morphbank. Support from SCCWRP for this effort may be on hold and Larry argued that SCCWRP needs to recognize their history with taxonomy and continue to maintain the TDT. The two organizations are linked in many ways, such as AMBI development, development of the BRI tools, the BATMAN group to maintain data consistency, DNA barcoding efforts, etc. and SCCWRP should reciprocate by supporting the TDT.

Vice-President Leslie provided a summary of the year's meetings. SCAMIT held meetings every month of the year, with two meetings in some months. There will not be a December Party since we held the summer beach party instead. Leslie is hoping to get increased support from the local museums when various experts are visiting. It would be great if during their visits these scientists could provide summaries of their work to SCAMIT.

Leslie is now looking to fill the 2014 meeting schedule which will include a fair amount of Bight-related taxonomic problems. We will likely deal with problem FID trawl animals at the beginning of the year since some Bight'13 consultants are continuing to work on their specimens post-collection. Additional discussion focused on the problem that there are fewer qualified people to perform FIDs within the agencies and consulting firms. One suggestion was that SCAMIT could fill the need for training during the trawl FID meeting(s) by facilitating the transfer of information among agencies. However, there are a lot of FIDs yet to be resolved and all of the data needs to be pulled together before they can get to the FID effort. The Committee suggested calling meetings at the end of January 2014 to get past the inertia. Plans for this meeting will be forthcoming.

Leslie then described the upcoming October meeting that will include presentations by several visiting scientists including Russell Carvalho (Texas A&M), Orlemir Carrerette (Universidad São Paulo, Brazil), Eric Stein (SCCWRP) and Ken Halanych (Auburn University). Ken will attend primarily to describe his work with WormNet, a large $4-5 million grant dedicated to the evolutionary development of polychaetes. One goal of WormNET is to reach out to polychaete workers worldwide for projects that would benefit from DNA work. The October 14 SCAMIT meeting at the museum will be followed by a separate meeting to discuss collaborative opportunities between WormNET and the various barcoding efforts that SCAMIT and its member agencies have been involved in. Ken is willing to consider any interesting project.

Megan Lilly and Dean Pasko provided the Secretary's report. The transfer of responsibilities is taking place with Dean having produced the minutes for the May and June meetings, and Megan helping get those rough drafts into production-ready format. Megan spent the day showing Dean the ins-and-outs of producing the Newsletter and graciously volunteered to continue to help with editing, etc. as the year progresses.

Because the transition will involve Dean publishing the 2013 and future meeting minutes in issues covering 2-month periods, and Megan publishing the Volume 31 backlog of 2012-13 issues, the Committee discussed and agreed to add a publication date to each newsletter.

In addition arrangements were made to have Dean Pasko purchase the required publication software (InDesign) through TechSoup, an organization that provides access to software for non-profit organizations. Once Dean has access to his own version of the software, Megan will continue working on the back issues and Dean will attempt to keep pace with current meetings. The first issue of Volume 32 should be available soon.

Treasurer Laura Terriquez's report (presented by Larry) showed that SCAMIT is healthy financially. SCAMIT's modest Operating Budget of $22,396.81 (as of June 15), not including the $3,267 remaining in the database-specific fund, leaves $5,599 available for publication grants (25% of the Operating Budget). Over the course of the year SCAMIT generated $5,723 in income. SCAMIT spent $767 on Newsletter production and distribution, meetings, and travel, and $3,382.50 of our database funds on improving the toolbox content.

The Committee discussed the desire to spend the grant money, and wished to encourage members to apply for publication support. Megan mentioned requesting support to produce a guide to the mega-benthic trawl invertebrates collected by the monitoring programs. There was discussion about whether such an effort would overlap the SCAMIT TDT, and how might the issue of photo copy-write and release be handled since many of the photos would come from public agencies. This brought the discussion back around to the issue of the SCAMIT TDT and discussion of designating the proceeds from the EPA Workshops for the specific purpose of funding the database project.

Finally, we discussed the idea of continuing to set aside some of the operating balance in certificates of deposit. Currently, SCAMIT holds a 9-month $10,000 CD that has generated $7.17 in interest. The Committee will ask Laura to shop around for the best interest rate to roll these dollars into once the current holding expires.

Dean Pentcheff provided the Webmaster report. Dean described the Advancing Digitization of Biodiversity Collections (ADBC) grant to encourage museums to digitize their collections. Gustav Paulay (Florida Museum of Natural History) is leading the effort with Regina Wetzer and Dean Pentcheff as the PIs for the Natural History Museum of Los Angeles County. Other major participating museums include the Santa Barbara Museum of Natural History and the California Academy of Sciences (CAS). The effort is being run through the CAS and is in need of taxonomic scaffolding for the listing. Dean requested that SCAMIT provide a letter of support and offer the use of the SCAMIT Species List. Dean also suggested that SCAMIT encourage ADBC grantees to work with POTWs to get data on occurrence, etc. Larry and Don mentioned that CBRAT has the entire list of invertebrate fauna from the entire coast with distributional information that might also be helpful to the ADBC effort.

We concluded the meeting with Don Cadien's report noting that SCAMIT Ed 8 was done and posted to the website, and that the planning for Ed 9 was almost ready to start. The goal for Ed 9 is a July 1 "Publication" date. The effort will likely include a lot of new information from Tony Phillip's work with John Ljubenkov's cnidarian collection and images.

SEPTEMBER 30, 2013, DR. BUZ WILSON, ASELLOTE ISOPODS

Attendees: Don Cadien, Larry Lovell, Chase McDonald (LACSD); Katie Beauchamp, Greg Welch, Paul Mattson, Ron Velarde, Andy Davenport, Tim Stebbins (CSD); Ken Sakamoto, Danny Tang (OCSD); Dean Pasko (Private Consultant); Regina Wetzer, Adam Wall (NHMLAC); George (Buz) Wilson (Australia Museum of Natural History, presenter).

Business:

The upcoming meetings (see the SCAMIT website) were briefly summarized, including discussion of SCAMIT getting more involved in the Bight'13 trawl identifications via a January 2014 Trawl FID meeting. The meeting will likely be driven by a Bight'13 Trawl Committee due date.

Larry also summarized the Executive Committee meeting, the minutes of which are included in this NL.

Some of the agencies encouraged members to watch for upcoming job openings that will be posted to the website.

Tim Stebbins then introduced Dr. George (Buz) Wilson for the presentation on asellote isopods. Buz distributed several hand-outs for the meeting, all of which are available at the SCAMIT website under the Taxonomic Toolbox: Species Listing of Munnopsidae listed in Osborn (2009), Marine Asellotes from California and adjacent regions, Key to the Superfamily Janiroidea (Asellota), Anatomical Glossary of Isopoda Asellota, and a handout including the presentation slide set: Isopod Crustaceans Suborder Asellota Superfamily Janiroidea. Tim listed several taxa that people had brought for later review.

Isopod Crustaceans Suborder Asellota Superfamily Janiroidea (presentation).

Buz's presentation covered a variety of topics including Janiroidea diversity and morphology, phylogenetic relationships among the taxa, collection techniques, what to expect to find in California, identification of asellotes and a survey of the common families, and a demonstration of a Key to the Families using the interactive DELTA INTKEY.

Buz started by saying that most Janiroidea specimens can be identified to species without dissection, at least for the purpose of pragmatic identification. All Janiroideans have a peculiar sperm transfer organ; a bent (geniculate) pleopod 2. Transfer occurs from pleopod 1 to 2 and then to a mate. The pleopods are covered by an operculum consisting of 3 segments (male) or one segment (female). Pleopod 2 of males is like a hypodermic needle, it can be a long whip-like thing or a crazy spiral.

Buz reviewed the known species richness by families. Janiroideans are primarily deepwater organisms, but there are likely many asellotes above 100 m that are simply unknown as of yet. The highest asellote diversity is sampled below 100 m with a 0.3mm screen. For example, some of the most diverse families (e.g., Munnopsidae, Desmosomatidae, Haploniscidae, Ischnomesidae, Janiridae, Munnidae, and Paramunnidae) occur almost exclusively in deep water, or both deep and shallow shelf. Buz's specialty is deep sea Munnopsidae, Paramunnidae, Dendrotionidae, Desmosomatidae, Macrostylidae, and Ischnomesidae. He estimates a possible diversity of 400,000 species in the deep sea if he were to extrapolate his data from the North Pacific to the area of the deep sea. In shallow waters, the Microparasellidae, Pleurocopidae, Munnidae, Santiidae, Janiridae, Joeropsidae, and diverse Paramunnidae predominate.

He maintains a list of isopods that can be accessed via the Smithsonian Institution website: http://invertebrates.si.edu/isopod/about.html. The list was transported to WoRMS but it is not edited well. He recommends caution when using the WoRMS listing.

We then reviewed some of the interesting adaptations of deep sea isopods. Many of these adaptations, such as body and leg type, are useful for separating families without dissection. Some of these include long legs to walk over substrate (*Munnopsurus*: Munnopsidae), or a large abdomen that inflates with water (*Paropsurus:* Munnopsidae).

Isopods have been around for a long time. The oldest known isopod fossil, *Hesslerella*, represents a fairly derived isopod. An analysis of Janiroidean relationships suggests that deep sea taxa derived from multiple ancestors, with the Janiridae likely being made up of multiple family groups.

Asellotes can be found in shallow marine habitats, on plants, or as epibiotes on sponges and tunicates. They can be successfully collected by divers, especially on algae, and bucket washes of rocks and cobbles can produce many specimens that are not easily seen otherwise. In general,

asellotes tend to be highly abundant on their prefered habitat. So if one can get to the correct substrate, the collection of quality specimens is fairly certain in shallow waters. On the other hand, the success rate changes when sampling from abyssal habitats via box cores. Successful sampling in the deep sea is limited to only a few families (Ischnomesidae, Nannoniscidae, Desmosomatidae, Haploniscidae, Macrostylidae, and Munnopsidae).

When preserving specimens for analysis, sodium bicarbonate seems to work best for buffering to reduce the acidity of formalin, whereas sodium borate can macerate material, especially if its concentration is too high. Pure ethanol and cold storage works great for genetic work, but makes specimens brittle. Adding glycerin helps keep tissues more pliable and minimizes brittleness. Buz found that 85–95% ethanol and 5% glycerin worked well for nearly all groups, and DNA can still be recovered.

In general, one doesn't have to dissect Janioideans. Many can be classified by leg morphology, and even when legs are lost one can use the basis as a proxy of leg size/robustness. Munnopsids can be placed into genus by characteristics of the head. Unfortunately, many species were described by taxonomists with little asellote experience, so taxonomic characters are not well illustrated.

Some of the more important characters are summarized below. (See examples on slides 17 – 25 of Buz's presentation)

- The frontal margin of the head is important taxonomically. The presence of a rostrum – projection of dorsal surface of head – is distinct from a frontal projection or "pseudorostrum" which emanates from below the dorsal margin and may or may not project anteriorly.
- The antennulae and their direction of attachment, as well as the distance between antennulae, is of value. The basal article of antennulae and direction of emergence from head anteriorly, dorsally, or antero-dorsally is also important.
- The antennae and whether or not they are geniculate (knee-like, bent) is helpful. In Paramunnidae, article 1 is difficult to see, whereas article 3 is enlarged, and article 4 is geniculate. The Janiridae have no bend (i.e., not geniculate); whereas the Joeropsididae have geniculate antennae with a large 5th article against which distal articles can nest. Haploniscidae have a slightly geniculate juncture, but have a large dorsally directed spine.
- The relative size of the distal three articles (carpus, propodus, dactylus) of pereopod I (thoracopod 2), setation, spination, etc. is helpful. Asellidae, Stentriidae, Pseudojaniridae show primitive form with a large and prehensile propodus-dactyl and small triangular or quadrate carpus. In Munnidae and Janiridae by contrast, the carpus has become quite enlarged, representing more advanced conditions, and the grasping portion becomes the link between carpus-propodus rather than propodus-dactyl.
- The dactylar claws require a compound scope to view, but provide good clues. Note the presence and shape of sensillae (small, elongate modified seta(e) between claws). The presence of a 3rd claw, derived from spine-like seta of the Stenetriidae, is indicative of Janiridae.

- The position of coxae and how they fit into the body (i.e., do they fit "into" the body; can you see them in dorsal view, ventral view only) and setation. Deep sea isopods tend to have a narrow, elongate 4th pereonite with an anteriorly positioned coxa vs. the wider, narrower pereonite IV and a centrally positioned coxa of shallow species.
- The mouthparts, particularly the mandibular palp, which is lost differentially within families and genera. Its presence/absence can be used to narrow species search. The size of the mandible can also separate groups.
- The pleotelson shape, dimensions, and margin structure.
- The uropod shapes and relative sizes. If the uropods are broken off, it typically means that they are large and elongate, so don't try to place the specimen in a family that has small uropods, for example the Munnidae.

Buz then reviewed some of the more common eastern Pacific families and their representatives. He recommended that local workers consult the multivolume monograph by Kussakin (1979, 1982, 1988, 1999, 2003), which covers North Pacific species. All these volumes are available on-line at the Los Angeles Co. Museum Crustacea section webpage (http://research.nhm.org/publications/). Within the Janiridae, *Janiralata* is common in Eastern Pacific waters. It is a shallow-water group with sexual dimorphism of pereopod I, and characteristic notches in the coxae. The male pleopod can be helpful. All described NEP *Janiralata* are covered by Kussakin (1988). Several additional provisional species are described in Wilson (1997). *Ianiropsis*, another common taxa, has a large male maxilliped, and uropods are typically biramus, large, and easily visible; the rami are in the same plane, and the anntenna and annula are positioned pointing forward (primitive status). Adult male members of the genus *Caprias* have enormous carpus of pereopod I. Several Janirids listed in the world list are probably not among the Janirid clade: *Ectias*, *Caecianiropsis*, *Microjanira*, for example.

In species of *Joeropsis*, pigmentation can be helpful as a quick visual cue for grouping specimens for identification, especially when dealing with high numbers of individuals. In general, Joeropsids have geniculate antennae and conjoined flagellar articles, and most of the legs are maintained upon collection. Their legs, antennae, and (often) hooked uropods are all valuable taxonomic characters. Representatives of *Joeropsis* and *Rugojoeropsis* noted for the distal hooks present on the uropods, and *Scaphojoeropsis* with its anterolateral projections medially between antennae, will likely not be encountered in the SCB.

The Acanthaspidiidae have elongate biramous uropods that distinguish them from *Janiralata*. Acanthaspids represent a transitional group between shallow and deep water. They have lappets (which resemble coxae, but are actually projections of the tergites) on pereonites that are long pointed lateral projections, and the first pereopod appears to be a walking leg.

The Janirellidae are deep sea species that often have large bodies. They have large antennae and highly variable lateral lappets of the pereonites. All have broad heads with projecting lateral margins, tiny uropods, and grasping, pre-hensile pereopod I.

The Munnidae are common in the SCB. They tend to live on hard substrates, as well as sponges, plants, and soft substrate. They have long legs, large pedunculate eyes, and operculate male pleopod 1. Munnids and Paramunnids are quite similar and both are present in SCB samples.

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Munnids have the anus directed posteriorly, towards the back of the pleotelson where it is covered. The anus is ventral in Paramunnidae. Paramunnidae have pereopods VI and VII sticking out laterally vs. Munnidae, which have them directed posteriorly due to compressed pereonites VI and VII. Among the common Munnids, two genera, *Munna* and *Uromunna*, can be separated by their respective presence or absence of a mandibular palp, for the most part (exceptions occur!).

We broke for lunch during which we had a vigorous discussion about *Munnogonium tillerae* (specifically from San Diego) vs. *M. erratum* (from off Palos Verdes) vs. *M. waldronense*. Buz convinced us all that they are distinct and therefore the SCAMIT Ed 8 listing synonymizing the three is incorrect. [Buz subsequently explained that he has started work on this suite of taxa. Stay tuned.]

After lunch Buz continued his summary of the major families, starting with the hard substrate Santiidae (Syn = Antiasidae). Representatives of this taxon have a propodo-carpochelate pereopod I distinctly different from pereopods II – VII, straight antennae, and unexposed anus, and large, biramus uropods. The pedunculate eyes, short antennula that is typically shorter than the head is wide, and setose dorsum, also help distinguish this group.

Paramunnids are a speciose group that include some of our common taxa (*Munnogonium tillerae* and *Pleurogonium californiense)*. In this group, pereopod I is fundamentally propodus-carpus-dactyl chelate, and the male first pereonite is enlarged – Buz likened them to having "football player shoulders." Paramunnid species are distinguished by spine/projection pattern of body, serrations of telson, and proportions of the pereonites.

The Dendrotionidae are transitional to deep sea. The genus *Dendrotion* contains eyeless, long-legged species whose antennae are on stalks, but the uropodal endopod is highly reduced. *Acanthomunna tannerensis* is the SCB species found by the City of San Diego staff and has huge biramous uropods that are generally lost during sampling.

The Haplomunnidae are deep sea taxa related to the Dendrotionidae, that are rare in most areas. They are a heavy-bodied lot, so that they are often collected with the body fully intact. The uropods are tiny! *Haplomunna* sp has been recorded in the SCB, but it is too deep for the typical ocean monitoring programs that make up the SCAMIT species list.

The Pleurocopidae is a monotypic family, represented in southern California by *Pleurocope* sp A. They are an interesting taxon; the uropods are dorsomedial and located proximally on the pleotelson, the pereonites have lateral projections with paired setae, the body also has several long dorsal setae, while the eyes are situated on long, laterally projecting peduncles.

The Munnopsidae are good swimmers with paddle-like pereopods. Five species are represented in SCAMIT Ed 8 and most can be separated by head characters alone, such as the relative size and projection of the rostrum in *Eurycope.*

Nannoniscidae is another deep sea family that is not often found in our SCB samples. The antennule and biramous uropods are typically short, and the head has a projecting frons with cephalic keels present laterally alongside the projecting frons. All coxae are ventral and coxa VII is rotated inwards.

Desmosomatidae are also deep water, but may be found as shallow as 90 m. Two species are represented in SCAMIT Ed 8 (*Momedosa symmetrica* and *Prochelator* sp A). They have

uniramous uropods and powerful anterior limbs with robust setae that are used for burrowing. The genus *Desmosoma* has a small first pereonite but is not taken locally. Reported local members have been reallocated to other genera.

Ischnomesidae are a deep sea family recognizable by their elongate pereonites IV – V, but especially pereonite V. Some genera have lost pereonite VII entirely.

The Haploniscidae have legs that are all similar and generally have the appearance of true "isopods", or pillbugs. They have a large spine on the 3rd article of the antenna, the details of which can be used to identify species. Suture lines of posterior pereonites are visible, but the pereonites are actually functionally fused.

The deep sea Macrostylidae have a large stylet-like, stiff uropod, and a large sternal spine on pereonite I behind the maxilliped. The ischium of pereopod III is diagnostic for the family and species. The Family is under revision by Torben Riehl.

Buz also briefly discussed a new family being described in Riehl et al. (in press). They look a little like members of the Macrostylidae, but differ in structures of telson and uropods, but have mandibles that are virtually identical.

Next Buz discussed DELTA and ran through an example of DELTA using IntKey. Using *Ianiropsis* as an example, the group selected character states for eyes (presence/absence), head margin (projecting/not), etc. It took nine character states to get to family Janiridae. Buz mentioned that you can also get distance matrix, and develop interactive keys via IntKey. DELTA has not been re-compiled for over 13 years, so there are some problems with the site, but it remains a useful tool. Open-source DELTA is available for all platforms, but also has some problems. Use of Buz's key requires that you know it is an Asellote because there is no hierarchical key in DELTA.

After a short break we jumped into specimen reviews:

Matt brought representatives of Desmosomatidae from the Mediterranean. They were probably *Mirabilicoxa* species. We reviewed and confirmed the City of San Diego's specimen of *Pleurocope* sp A SCAMIT 2012, which is likely to be the same as Buz's species.

Dean brought a specimen of *Munnogonium tillerae* that was confirmed, thankfully!

Tim Stebbins brought specimens of *Belonectes* and *Eurycope* from Bight'13. We initially thought Tim had a male of *Eurycope californiensis* but we found differences in the shape of the rostrum (truncate in present specimen(s) vs. rounded in *E. californiensis*). The specimen(s) seemed more similar to *E. complanata* complx from the Atlantic (See comment Wilson 1997). In all likelihood, Tim's specimens probably represent a new species because of the truncate rostrum and length of basal antennal article, which exceeds lateral projections, and length of article 2 is longer than in *E. californiensis*. The specimens were from 850 m off San Diego, the same depth range as *E. californiensis*.

The *Belonectes* sp. is also likely a new species due to do the different uropodal endopod which is long, the shape of the keel of the operculum which was sinuous and projects forward with an acuminate corner, and the more denticulate head and anterior pereonites. In addition, the pereopod basis and antenna seemed longer.

Caecianiropsis sp A specimens from LACSD and CSD were reviewed and confirmed as being distinct from *C. psammophila.* [Buz subsequently reported that his review of *Caecianiropsis* specimens from the NHMLAC suggest at least three species present in their collections.]

Ilyarachna profunda from Stebbins Bight'13 was compared to *I. acarina* from Pasko Bight'03 (334 m off SCB). Dean's "*I. acarina"* may be different. It has pedestal setae, but several subtleties seemed to distinguish it. For example, the shape of the pleotelson was similar to illustrations of *I. profunda* (not *I. acarina*), but pedestal setae were fewer and smaller. We considered whether or not this difference may be a size-related issue since we were dealing with a juvenile female. In addition, the lateral margins of pereopods V – VII were of different shape with the anterolateral margin of pereopod V being rounded. Tim brought out other *I. acarina* specimens from 260+/- m from San Diego Regional station 8038 collected in 2010. Both were determined to be different from true *I. acarina* due to the lack of regular setae between pedestal setae, relative to specimens from San Diego Regional station 2147 (1997, 638 ft), which did have both setal types. Buz confirmed these differences, but none of us were sure what to do about them since we could not be sure if any of this variability was associated with development or gender.

Dean pulled a specimen of *Janiralata* sp B from Bight'03 for review. It was also confirmed.

Don brought out several specimens of *Microcharon* sp A collected off Catalina Island that were confirmed.

A specimen identified as *Munnogonium tillerae* from 1372 m off Oregon prompted a strong "NO" from Buz, since this was way too deep and too far north for this species. His examination confirmed this was a new *Munnogonium* distinguished by, among other things, elongate abdominal somites and pleotelson.

OCTOBER 13, 2013, DRS. CARRERETTE, CARVALHO, HALANYCH, AND STEIN, NHMLAC, POLYCHAETES AND DNA BARCODING

Attendees: Ron Velarde, Kathy Langan, Veronica Rodriguez (City of San Diego); Larry Lovell (LACSD); Victoria Gray, Lindsay Fitzgerald, Tania Asef (Endemic Environmental Services); Emmanuel Riclet (CLA-EMD); Ernie Ruckman, Kelvin Barwick, Rob Gamber (OCSD); Terrance Champieux, Christine Whitcraft, Jessica Lee (CSULB); Leslie Harris (NHMLAC); Dean Pasko, Tony Phillips (DCE); Russell Carvalho (Texas A&M, presenter); Orlemir Carrerette (Universidad São Paulo, Brazil, presenter); Ken Halanych (Auburn University, presenter); Eric Stein (presenter), David Gillett (SCCWRP).

Business:

The upcoming meetings (see the SCAMIT website) were briefly summarized [again!]. Most of the 2014 meetings will likely focus on Bight'13 taxonomic issues.

Larry also noted that there are many members who have still not paid their 2013 membership dues, and some are several years behind. SCAMIT will soon drop from the email listing and general discussion list server those members who do not pay their requested dues.

Orlemir Carrerette (Universidade de São Paulo, Brazil)

Leslie Harris introduced Orlemir Carrerette, PhD. student of Dr João Nogueira from Universidade de São Paulo, Brazil. Orlemir started out describing his work on the diversity of polychaetes occurring in the intertidal zone of sandstone reefs off the states of Paraíba and

Pernambuco, northeastern Brazil, with a special focus on Terebelliformia and Sabellidae. Collections were made at low tide from reefs off fifteen beaches along these states. Algae, sponges, ascidians, and other organisms from mussel beds and similar substrates were scrapped from the rocks then examined under stereomicroscope. Polychaetes were removed from the samples, relaxed in menthol solution, preserved in 10% formalin solution and later rinsed in fresh water and transferred to 70% ethanol. He found ~5,000 specimens distributed among 13 genera and 22 species of terebelliforms and 8 genera and 13 species of sabellids. 23 of the total species found are new to science.

After a short and general explanation of his work, Orlemir presented an amazing animated slide show on some of the important morphological characters of the family Polycirridae.

The Polycirridae are a well-known group of polychaetes characterized by the absence of branchiae, presence of a circular upper lip, at least two types of buccal tentacles, and segment 2 distinctly narrower than following segments, constricting the body posterior to the mouth and separating the body into 'head' and 'trunk' regions. The trunk is further divided into an anterior part with paired ventro-lateral glandular pads, frequently densely papillated, with pairs separated by a mid-ventral groove extending posteriorly from segments 2-3, and a posterior region which only has neuropodia or is achaetous.

Polycirridae contains six genera: *Amaeana* Hartman, 1959; *Biremis* Polloni, Rowe and Teal, 1973; *Enoplobranchus* Webster, 1879; *Hauchiella* Levinsen, 1893; *Lysilla* Malmgren, 1866; and *Polycirrus* Grube, 1850.

The most important characters used in the taxonomy of the group are:

- Anterior end characters of prostomium and peristomium – Location of prostomium; Shape of distal part of prostomium; Prostomial buccal tentacles; Peristomial palps; Shape of both upper and lower lips
- Anterior segments – Glandular ventral surfaces; Paired glandular pads; Nephridial/genital papillae – number and placement
- Notopodia – Number of pairs of notopodia; Notopodia shape; Digitiform expansion on post-chaetal lobes; Notochaetal characters
- Neuropodia – Start of neuropodia relative to notopodia; Neurochaetae
- Pygidium – Smooth or papillate

Orlemir's presentation generated a discussion on the difficulty of identifying species of polycirrids, mainly due to loss of the anterior region of body and regeneration in most specimens collected. Also there was another discussion about tube-building by some species of Polycirridae. Although most of the publications on polycirrids consider that members of this family do not produce tubes, it is possible to find some individuals inhabiting tubes, probably tubes produced by other species of polychaetes. Leslie commented that at least one undescribed west coast species preferentially lives in old isopod-burrows in *Macrocystis* holdfasts. Kelvin Barwick and others mentioned that another local species was almost always found in soft sediment tubes and would rapidly rebuild their tubes when placed in petri dishes with sediment.

Larry introduced Dr. Russell Carvallo, student of Dr Anja Shultze and recent PhD candidate from Texas A&M. Russell started out describing his work at Texas A&M. He worked on the

Deep Gulf of Mexico Benthos (DGoMB) program macrofauna and analysis, with a special focus on factors affecting macrofaunal polychaete communities in the deep Gulf of Mexico. He looked for variation in the functional diversity of the benthos, since functional diversity plays a key role in community structure and species diversity. The DGoMB collected sediment and water samples from 51 stations from 200 m to 3700 m using a box corer. Russell used the feeding guild categories from Fauchald and Jumars (1979) to characterize the polychaetes into functional group and test two hypotheses: (1) Distinct species communities would be constructed of distinct feeding guilds; and (2) The level of food supply would manifest as differences of guild structure. Russell characterized 17,881 specimens and 532 species into 16 guilds. He found three distinct groups using species composition and the number of guilds declined sharply with depth. Interestingly, he did not find a parabolic diversity curve with mid-depth-max (MDM) using species compositions, but did find an MDM using the feeding guild analysis. Russell believes that functional diversity may show the same MDM in other oceans but a large data set is required to perform the analysis.

Russell's presentation generated a nice discussion during which other tid-bits of interesting information came forward. Russell found no strong correlation between species diversity and guild diversity, however guild diversity was a good estimator of functional redundancy. As found by many of us who have looked at such things before, "depth" showed the highest correlation with diversity; but diversity was also highest at mid-depth where the diversity of habitat structure was greatest.

There was some additional discussion about whether or not categorizing species into feeding guilds is legitimate. Russell explained that the process was laborious. He went through a fair amount of trouble to expand upon Fauchald and Jumars by emailing various experts for species-specific information whenever categorization of a taxon wasn't known or multiple feeding modes were possible. Since the data set was so large, he felt that issues of uncertainty or slight mis-categorization were likely to be drowned out by sheer scope. David Gillett suggested using "interface" feeders for those taxa that show multiple feeding types. Overall, however, Russell felt that Fauchald and Jumars (1979) provides a good breakdown of species and guilds and that by determining the number of species that form a feeding guild, we can estimate the degree of functional redundancy that may be important to ecosystem resiliency. He strongly feels that the analysis of feeding guilds provides insight into food sources for polychaetes and other interactions with their environment (e.g. burrowing, bioturbation). Additionally, feeding guild diversity can be used as a proxy for ecosystem function when assessing the impact of natural and anthropogenic disturbances on benthic communities. Russell's work has been published in the research journal Deep-Sea Research I (Carvalho, et al. 2013).

Dr. Ken Halanych next spoke about Morphology, Genes, and Taxonomy Collaborative Possibilities. WormNetII is a project dedicated primarily to the evolutionary development of polychaetes and is in year 2 of its 5-year $3 million grant funding. The Project poses several questions: What is the phylogeny of Annelida? Which lineages are basal? It aims to generate a database of 2000 annelid transcriptomes, including analysis of 10 nuclear loci for >400 annelids; coordinate community-wide programs that will facilitate research in recent annelid evolution and ecology; and provide resources to all levels of annelid research.

The effort to look deep into annelid phylogeny via the use of transcriptomes is a collaborative work. Anja Shulze and Andy Anderson are tasked with the Community Sequencing Effort (outreach) in order to resolve phylogeny among closely related annelid taxa. The initial findings

suggest that magelonids and oweniids are falling out at the base, along with chaetopterids. They are focusing on mitochondrial markers because they are easy to use.

They have already data based a large number of specimens and their genetic information. Ken provided the following examples of research topics that benefited from WormNetII projects.

- Investigations into and resolution of species complexes. *Neanthes acuminata* (Nereididae) – This is a large species complex that has been used historically in various toxicological studies beginning with Dr. Reish in the early 1970's. Using morphological data informed by genetic data Andy Anderson's group found that *N. acuminata* represents up to five separate taxa (work in progress). The morphology results indicate that eye color may distinguish two SCB taxa.
- Research into species boundaries. *Hermodice carunculata* (an amphinomid). – Ahrens et al. (2013) have used data from *H. carunculata* to investigate species boundaries. Eight species were synonymized under the name *H. carunculata*, but one Mediterranean species was subsequently re-instated. Ahrens et al. (2013) found very little COI diversity; although the Mediterranean species did come out as being different, it also co-occurred with other groups. The results suggested that *H. carunculata* is one taxon with a wide distribution across the Atlantic.
- Genetic variability and reproductive strategies. *Boccardia proboscidea* (Spionidae) – Oyarzun et al (2011) looked at reproductive variation in this poecilogonous species compared to geographic distribution. They examined *B. proboscidea* specimens collected from Mexico to northern Washington that showed some morphological differences and crossed known biogeographic breaks (e.g., Point Conception). Results from analyses of cytochrome b and 16S rDNA did not show distinct taxa. Though there were some genetic differences between populations by geographic region the differences supported the natural variability in reproduction of *B. proboscidea*.
- Invasive species. – Simon et al (2009) looked at impacts of *B. proboscidea* on African abalone aquaculture. When Simon et al looked at specimens of *B. proboscidea* found in South African abalone farms, they found that the worms had originated from southern California, most likely the result of oyster imports.
- Cryptic species/unrecognized species. *Diopatra* (Onuphidae) – Berke et al (2010) found an undescribed species of *Diopatra* mistaken for *D. neapolitana* while investigating *Diopatra* range shifts in western Europe. It was later described as *Diopatra biscayensis* Fauchald, Berke & Woodin (2012).
- Determining taxonomic characters. Eunicidae – Zanol, Halanych, and Fauchald (2013) first used phylogenetic analysis to establish monophyletic groups as well as the utility of both traditional and new physical characters, and were able to demonstrate which characters were the most useful for taxonomy.

After the conclusion of Ken's wonderful examples demonstrating the excellent use of genetic work, we dove into many interesting discussions about how SCAMIT members and SCAMIT member agencies could collaborate with WormNetII. SCAMIT members can provide the taxonomic expertise to resolve poor taxonomy, but many members (at least those present) work for government agencies that for a variety of reasons cannot release the resources to support the necessary work (collection, identification, storage, transport of specimens, and cost of supplies). Regina Wetzer reiterated the idea that if the agencies could participate in the collection of

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representative samples fixed in 95% EtOH the museum could hold them for eventual use by staff or visiting researchers. The issue is gathering the bulk samples, then figuring out the processing that would come later. Larry mentioned that SCAMIT member agencies are already working with SCCWRP to resolve different fixation techniques (such as short-term formalin exposure before transfer to 95% EtOH versus initial preservation in 95% EtOH) and argued that even the collection of special samples remains an issue because just maintaining the EtOH-preserved specimens takes time and resources. Another problem is that soft bodied creatures such as worms need special handling during fixation to maintain their shape. Polychaetes coming out of bulk-fixed 95% samples are typically too contorted and shrunken to be easily identified and may not be identifiable past genus or even family.

The group discussed several different possible goals. Regina again expressed the museum's desire to simply collect bulk samples, an approach better suited to animals with exoskeletons such as crustaceans (her particular specialty). Ken would like SCAMIT to help find interesting problems for collaborative projects. The various monitoring agencies would be grateful for help in species resolutions (e.g., *Leptochelia*, Cirratulidae, cryptic species). SCCWRP has an interest in developing a store of correctly identified and vouchered representative specimens with genetic data. We also briefly discussed how the SCAMIT Newsletter and website could be used to communicate the need for and/or availability of material that needs taxonomists or money. The challenge of WormNetII (or similar projects) reaching out to members of SCAMIT (or other consultants) is that grant money is generally restricted to in-house use, and it is often difficult to bring in outside experts after the fact. Even if the money could be written into a grant, the question still comes down to why is this taxon in southern California more important than others.

After a break for lunch, **Dr Eric Stein shared information about SCCWRP's research interests** in the use of DNA Barcoding as a tool for Marine and Freshwater Bioassessment. They are looking at Mitochondrial CO1 (cytochrome oxidase) gene as a marker. It is not excellent, but it represents a good start. SCCWRP has teamed with BOLD to establish a reference library of vouchered specimens with corresponding genetic information. However, even when complete, there remains the question, "How do we move from research to routine bioassessment?" Currently, the investigations focus on developing standard methods (preservation, reference library, efficacy of molecular approaches, test performance indices, standardization of species delimitations). Freshwater investigations have provided some good results with 20% variability. SCCWRP currently has a suite of marine samples fixed with 95% EtOH with 5% glycerin, 95% EtOH with 15% glycerin, and straight 95% EtOH. The samples have been sorted and identifications are in progress. The question is whether we can find a fixation/preservation method that works for both monitoring and DNA assessment.

SCCWRP is also building reference library through regional monitoring. In the freshwater system there are currently 3,800 recognized southern California taxa, but only 600 are actually used in the various indices. Of those, 260 are registered in BOLD. In the marine environment, 4,400 species are recognized in SCAMIT, and 1200 have been used in index development, but only 180 species are housed in BOLD. Some of the goals are to aid in marine benthos identifications to potentially streamline the assessment process and to help resolve cosmopolitan and cryptic species. For example, in their freshwater investigation of three stream types they found an increase in species richness using genetic technique vs. morphological identification (181 recorded taxa vs. 101, respectively). Part of this difference is simply a matter of some taxa being distinguishable to species by molecular methods that are routinely left at genus or family when using morphology-based taxonomy. The genetic data provided an increased resolution of

differences between impacted and non-impacted sites relative to morphological data alone. In the marine environment, SCCWRP has found that some indexes (e.g., BRI and AMBI) yield similar results whether using a full data set of species and abundance or species presence/absence alone. They are also developing new Bioinformatics tools (e.g., data queries to perform specific analysis). The areas ripe for additional research include: finding additional genetic markers, improved primers, next generation sequencing, methods for processing bulk samples, evaluation of environmental DNA (surrounding contaminations), species delimitation, revised bioassessment scoring tools, additional taxonomic groups, adequate vouchering, data management and analysis.

There was some follow-up discussion about the need to have a minimum amount of replication of individuals (minimum of 10) representing each individual taxon. David Gillett raised the issue of scoring the taxa for the test of the different preservation methods. How do you rate a sample as a whole, and how do you rate the different taxa types (polychaetes in tubes vs. arthropods vs. molluscs, etc.). We also delved into issues surrounding where to take this information moving forward, and how does it get down to the taxonomy and resolutions. Concern was also expressed about the huge need to curate the regional product. There are few freezers and ultra freezers on the west cost to store the tissues and samples even if we were able to collect and analyze them.

LITERATURE – ASELLOTA

Kussakin, O. G. 1979. Morskye I solonovatovodnye ravnonogie rakoobrasnye (Isopoda) cholodnix I umerennix vod severnogo polushariya. Podotryd Flabellifera. Nauka, Leningrad.

Kussakin, O. G. 1982. Morskye I solonovatovodnye ravnonogie rakoobrasnye (Isopoda) cholodnix I umerennix vod severnogo polushariya. Podotryadi Anthuridea, Microcerberidea, Valvifera, Tyloidea. Nauka, Leningrad.

Kussakin, O. G. 1988. Morskye I solonovatovodnye ravnonogie rakoobrasnye (Isopoda) cholodnix I umerennix vod severnogo polushariya. Podotryad Asellota. Part 1. Cemeistva Janiridae, Santidae, Dendrotionidae, Munnidae, Paramunnidae, Haplomunnidae, Mesosignidae, Haploniscidae, Mictosomatidae, Ischnomesidae Nauka, Leningrad.

Kussakin, O. G. 1999. Morskye I solonovatovodnye ravnonogie rakoobrasnye (Isopoda) cholodnix I umerennix vod severnogo polushariya. Podotryad Asellota. Chast 2. Semeistva Joeropsididae, Nannoniscidae, Desmosomatidae, Macrostylidae). Nauka, St. Petersburg.

Kussakin, O. G. 2003. Morskye I solonovatovodnye ravnonogie rakoobrasnye (Isopoda) cholodnix I umerennix vod severnogo polushariya. Podotryad Asellota. Chast 3. Semeistva Munnopsidae. "Nauka", Leningradskoe otd-nie, St. Petersburg.

Osborn, K. J. 2009. Relationships within the Munnopsidae (Crustacea, Isopoda, Asellota) based on three genes. Zoologica Scripta 38: 617-635.

Riehl, T., G.D.F. Wilson, and M. Malyutina. (in press). Urstylidae – A new family of abyssal isopods (Crustacea: Asellota) and its phylogenetic implications. Zoological Journal of the Linnean Society.

Wilson, G. D. F. 1997. The Suborder Asellota. pp. 59-109 in R. Wetzer, R. Brusca and G. D. F. Wilson (eds.), Taxonomic atlas of the benthic fauna of the Santa Maria Basin and western Santa Barbara Channel. Santa Barbara Museum of Natural History, Santa Barbara, California, USA. [Note from Buz: do not use the key! It has errors.]

LITERATURE – OPISTHOBRANCH

Gibson, G. D. and F.S. Chia. 1989. "Description of a new species of *Haminoea*, *Haminoea callidegenita* (Mollusca: Opisthobranchia), with a comparison with two other *Haminoea* species found in the northeast Pacific." Canadian Journal of Zoology 67: 914–922.

Goddard, J. H. R., M. C. Schaefer, C. Hoover, and A. Valdés. 2013. "Regional extinction of a conspicuous dorid nudibranch (Mollusca: Gastropoda) in California." Marine Biology. Vol. 160 (6): 1497–1510.

Goodheart, J. and A. Valdés. 2013. "Re-evaluation of the *Doriopsilla areolata* Bergh, 1880 (Mollusca: Opisthobranchia) subspecies complex in the eastern Atlantic Ocean and its relationship to South African *Doriopsilla miniata* (Alder & Hancock, 1864) based on molecular data." Marine Biodiversity 43: 113–120.

Hanson, D., Y. Hirano, and A. Valdés. 2013. "Population genetics of *Haminoea* (*Haloa*) *japonica* Pilsbry, 1895, a widespread non-indigenous sea slug (Mollusca: Opisthobranchia) in North America and Europe." Biological Invasions 15: 395–406.

Ornelas-Gatdula, E., Y. Camacho-García, M. Schrödl, V. Padula, Y. Hooker, T. M. Gosliner, and A. Valdés. 2012. "Molecular systematics of the '*Navanax aenigmaticus*' species complex (Mollusca, Cephalaspidea): coming full circle." Zoologica Scripta 41(4): 374–385.

Ornelas-Gatdula, E., A. Dupont, and A. Valdés. 2011. "The tail tells the tale: taxonomy and biogeography of some Atlantic *Chelidonura* (Gastropoda: Cephalaspidea: Aglajidae) inferred from nuclear and mitochondrial gene data." Zoological Journal of the Linnean Society 163: 1077-1095.

Ornelas-Gatdula, E. and A. Valdés. 2012. "Two cryptic and sympatric species of *Philinopsis* (Cephalaspidea: Aglajidae) in the Bahamas distinguished using molecular and anatomical data." Journal of Molluscan Studies 78: 313–320.

Ortea J., M. Caballer, L. Moro, and J. Espinosa. 2012 "Notas en Opistobranchia (Mollusca, Gastropoda) I. Sobre la validez de la especie *Posterobranchus orbignyanus* Rochebrune, 1881 (Cephalaspidea, Aglajidae)". Revista `de la Academia Canaria de Ciencias 23(3): 39–44. [Journal issue for 2011; published April 2012]

Stout, C.C., M. Pola, and A. Valdés. 2010. "Phylogenetic analysis of *Dendronotus* nudibranchs with emphasis on Northeastern Pacific species." Journal of Molluscan Studies 76(3): 1–9.

Stout, C.C., N.G. Wilson, and A. Valdés. 2011. "A new species of deep-sea *Dendronotus* Alder & Hancock (Mollusca: Nudibranchia) from California, with an expanded phylogeny of the genus." Invertebrate Systematics 25: 60–69.

Valdés, A. and J.A. Ortea Rato. 1997. "Review of the genus *Doriopsilla* Bergh, 1880 (Gastropoda: Nudibranchia) in the Atlantic Ocean." Veliger 40(3): 240–254.

LITERATURE - POLYCHAETA

Ahrens, J.B., E. Borda, R. Barroso, P.C. Paiva, A.M. Campbell, A. Wolf, M.M. Nugues, G.W. Rouse, and A. Schulze. 2013. The curious case of *Hermodice carunculata* (Annelida: Amphinomidae): evidence for genetic homogeneity throughout the Atlantic Ocean and adjacent basins. Molecular Ecology. Vol. 22(8): 2280–91

Berke, S.K., A.R. Mahon, F.P. Lima, K.M. Halanych, D.S. Wethey, and S.A. Woodin. 2010. Range shifts and species diversity in marine ecosystem engineers: patterns and predictions for European sedimentary habitats. Global Ecology and Biogeography 19: 223–232.

Carvalho, R., C.L. Wei, G. Rowe, and A. Schulze. 2013. Complex depth-related patterns in taxonomic and functional diversity of polychaetes in the Gulf of Mexico. Deep Sea Research Part I: Oceanographic Research Papers, v. 80, p. 66-77.

Fauchald, K., S.K. Berke, and S.A. Woodin. 2012. *Diopatra* (Onuphidae: Polychaeta) from intertidal sediments in southern Europe. Zootaxa 3395: 47–58.

Fauchald, K., and P.A. Jumars. 1979. The diet of worms: a study of polychaete feeding guilds. Oceanography and Marine Biology Annual Review. Vol. 17: 193–284

Oyarzun, F.X., A.R. Mahon, B.J. Swalla, and K.M. Halanych. 2011. Phylogeography and reproductive variation of the poecilogonous polychaete *Boccardia proboscidea* (Annelida: Spionidae) along the West Coast of North America. Evolutionary Development. Vol. 13(6): 489–503.

Simon, C.A., D.J. Thornhill, F. Oyarzun, and K.M. Halanych. 2009. Genetic similarity between *Boccardia proboscidea* from Western North America and cultured abalone, *Haliotis midae*, in South Africa. Aquaculture 294: 18–24.

Zanol, J., K.M. Halanych, and K. Fauchald. 2013. Reconciling taxonomy and phylogeny in the bristleworm family Eunicidae (polychaete, Annelida). Zoologica Scripta. http://onlinelibrary.wiley.com/doi/10.1111/zsc.12034/abstract

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