The Crustacean Society Summer Meeting

May 22-26, 2006       Juneau, Alaska

Program & Abstracts

Sponsors
The Crustacean Society
University of Alaska Southeast
University of Alaska Fairbanks: School of Fisheries and Ocean Sciences
Alaska Sea Grant College Program
Auke Bay Laboratory, NOAA
Alaska Fisheries Development Foundation
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The mission of the Crustacean Society is to advance the study of all aspects of the biology of the Crustacea by promoting the exchange and dissemination of information throughout the world.

For information on upcoming meetings see our website:
http://www.vims.edu/tcs/
# Schedule

**Monday May 22**

The Crustacean Society Executive Board meeting:
1:00–16:00 at University of Alaska, Southeast

<table>
<thead>
<tr>
<th>TIME</th>
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<tbody>
<tr>
<td>Ballroom 1 &amp; 2</td>
<td>Egan Room</td>
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<tr>
<td>16:00 - 18:00</td>
<td>Concert (not related to TCS)</td>
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<td></td>
<td>Registration and TCS Social</td>
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**Tuesday May 23**

Miller Room: Available all day for slide preview

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<th>TIME</th>
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<tbody>
<tr>
<td>Ballroom 3</td>
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<tr>
<td>7:30</td>
<td>Registration &amp; Light Breakfast</td>
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<tr>
<td>8:25</td>
<td>Welcome: Sherry Tamone &amp; Tom Shirley</td>
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<tr>
<td>8:30</td>
<td>Plenary Talk 1 Brad Stevens: The &quot;Catch-up&quot; effect: Blue king crabs Paralithodes platypus adjust embryo development rates and hatch timing to compensate for temperature effects</td>
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<tr>
<td>9:00</td>
<td>Plenary Talk 2 Jennifer Mondragon: Movement and distribution of Tanner crab in Glacier Bay</td>
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<tr>
<td>9:30</td>
<td>Plenary Talk 3 Tom Shirley: Does size matter? A long-term study in a high latitude MPA provides insights into the effects of commercial harvests on Dungeness crab populations</td>
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<tr>
<td>10:00</td>
<td>Coffee Break</td>
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<tr>
<td>10:30</td>
<td><strong>Session 1</strong>: Chionoecetes biology; Session Chair: Rachel King</td>
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<tr>
<td>11:10</td>
<td>Dan Urban: Use of morphometrics to determine size at maturity and instars in Tanner crab Chionoecetes bairdi in Marmot Bay Alaska</td>
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<tr>
<td>11:30</td>
<td>Kirsten Gravel: Sperm Reserves of Primiparous Female Snow Crabs From the Eastern Bering Sea</td>
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<tr>
<td>11:50</td>
<td>Discussion</td>
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<tr>
<td>12:10 - 13:30</td>
<td>Lunch</td>
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<td>21:00</td>
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### Wednesday May 24

**Miller Room:** Available all day for slide preview  
**Ballroom 2:** Poster Session Setup

<table>
<thead>
<tr>
<th>TIME</th>
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<tbody>
<tr>
<td>7:30-8:15</td>
<td>Light Breakfast</td>
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<tr>
<td>8:30</td>
<td>Plenary Talk 1</td>
<td>Joel Martin: Historical trends in crustacean systematics</td>
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<tr>
<td>9:00</td>
<td>Plenary Talk 2</td>
<td>Gary Poore: Reflections on crustacean systematics</td>
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<tr>
<td>9:30</td>
<td>Plenary Talk 3</td>
<td>Michel Hendrickx: Eastern Tropical Pacific crustaceans: What we know and what we don't</td>
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<tr>
<td>10:00</td>
<td>Coffee Break</td>
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<tr>
<td>10:30</td>
<td>Session 3: Evolution and Systematics; Session Chair: Frederick Schram</td>
<td>Ho Chee Lei: Four DNA markers for studying the systematics of Caridea</td>
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<tr>
<td>10:50</td>
<td></td>
<td>Rachael King: A newly arrived isopod in the eastern United States: <em>Synidotea laevidorsalis</em> or <em>S. laticauda</em>?</td>
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<tr>
<td>11:10</td>
<td></td>
<td>Christopher Rogers: Hypothesis concerning the origin of predatory behavior in fairy shrimp (Branchiopoda: Anostraca)</td>
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<tr>
<td>11:30</td>
<td></td>
<td>Michel Hendrickx: Preliminary Review of the <em>Dardanus sinistripes</em> Stimpson (Anomura, Diogenidae) species complex from the Mexican Pacific</td>
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<tr>
<td>11:50</td>
<td>Discussion</td>
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<tr>
<td>12:10 – 13:15</td>
<td>Lunch</td>
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<tr>
<td>13:30</td>
<td>Session 4: Alaskan Commercial Fisheries; Session Chair: Sarah Gerken</td>
<td>Katherine Swiney: Annual vs. non-annual egg extrusion and mating vs. utilization of stored sperm of Kodiak, Alaska Dungeness Crab, <em>Cancer magister</em></td>
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<tr>
<td>13:50</td>
<td></td>
<td>Joel Webb: Changes in embryonic development, hatching, and zoeae of the snow crab with varying incubation temperatures</td>
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<tr>
<td>14:10</td>
<td></td>
<td>M.S.M. Siddeek: Development of a length-based model to estimate a limit harvest rate for biennially spawning blue king crab in the Pribilof Islands</td>
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<tr>
<td>14:30</td>
<td></td>
<td>Doug Pengilly: A tagging study to estimate handling mortality of discarded red king crabs during commercial fisheries</td>
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<td>14:50</td>
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<td>Gretchen Bishop: Development of a pot survey for the spot prawn <em>Pandalus platyceros</em> in Southeast Alaska</td>
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<tr>
<td>15:00</td>
<td>Ballroom 2: Poster Session Setup</td>
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<tr>
<td>18:00 – 21:00</td>
<td>Ballroom 2: Poster Session Social</td>
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### Thursday May 25th

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<tr>
<td>7:30-8:15</td>
<td>Light breakfast</td>
<td>Ballroom 3</td>
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<tr>
<td>8:30</td>
<td>Plenary Talk 1: Sherry Tamone</td>
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<tr>
<td></td>
<td>Using biochemical assays to assess the</td>
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<td>population structure of Tanner crab</td>
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<td></td>
<td>Chionoecetes bairdi in Glacier Bay</td>
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<tr>
<td>9:00</td>
<td>Plenary Talk 2: Nora Terwillinger</td>
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<tr>
<td></td>
<td>Defense against the dark arts:</td>
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<td></td>
<td>Immune response and molting in crustaceans</td>
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<tr>
<td>9:30</td>
<td>Plenary Talk 3: Sook Chung</td>
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<td></td>
<td>An overview of the regulatory role of</td>
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<td>crustacean hyperglycemic hormone (CHH)</td>
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<td>neuropeptides in molting and reproduction</td>
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<td>in decapod crustaceans</td>
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<tr>
<td>10:00</td>
<td>Coffee Break</td>
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<tr>
<td>10:30</td>
<td>Session 5: Crustacean Growth and</td>
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<td>Physiology; Session Chair: Ray Bauer</td>
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<td></td>
<td>Raymond Bauer: Antennal flagellar setae of</td>
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<td>decapod shrimps; sexual dimorphism and</td>
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<td>possible role in detection of contact</td>
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<td></td>
<td>sex pheromones</td>
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<td>10:50</td>
<td>Jasna Strus: Formation and calcification</td>
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<td></td>
<td>of cuticular structures in molting</td>
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<td></td>
<td>terrestrial isopods</td>
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<td>(Crustacea: Isopoda)</td>
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<td>11:10</td>
<td>Jennifer Taylor: Scaling of the rigid and</td>
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<td></td>
<td>hydrostatic skeletons of the aquatic blue</td>
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<td>crab Callinectes sapidus, and the</td>
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<td>terrestrial blackback land crab, Gecarcinus</td>
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<td>lateralis</td>
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<td>11:30</td>
<td>Fernando Alvarez: The invasion of fresh-</td>
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<td>water by the prawn Macrobrachium</td>
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<td>tuxtlaense</td>
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<td>11:50</td>
<td>Antoneo Baeza: Extreme female biased and</td>
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<td>size dependent sex allocation in the</td>
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<td>simultaneous hermaphroditic shrimp</td>
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<td>Lysmata wurdemanni</td>
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<td>12:10 –</td>
<td>Lunch</td>
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<td>13:15</td>
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<tr>
<td>13:30 –</td>
<td>Egan Room: TCS Business Meeting; everyone</td>
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<tr>
<td>14:15</td>
<td>welcome</td>
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### Friday May 26

7:30: Meet at the Gold Belt Tours office across from Centennial Hall at 76 Egan Drive for the Tracy Arm Tour. The boat returns at 17:00.

11:00: Meet at the Mount Roberts Tram terminal at 490 S. Franklin St. for a tram ride and guided hike on Mt. Roberts.
Special Events

Registration social
There will be a social during registration on Monday May 22, 2006 in the Hickel room at Centennial Hall. Informal appetizers and a no host bar will be available from 16:00–20:00. Use this opportunity to sign up for the various outdoors events on the 26th as you pick up your registration packages.

University of Alaska Southeast (UAS) Reception
This barbecue reception on Tuesday May 23 at 18:00 will feature jazz music by the Fleet Street Band. The venue will be out-of-doors at the UAS Noyes Pavilion. There will be a no host bar. A bus will depart Centennial Hall at 17:30 to transport registrants to the University.

Poster session social
This social will be held on Wednesday May 24th from 18:00 – 21:00 in Ballroom 3 of Centennial Hall. The event provides an opportunity to socialize with colleagues while viewing posters. There will be a no host bar and generous appetizers. Two free drink tickets are included with your registration.

The Crustacean Society business meeting
The annual TCS business meeting will be held on Thursday May 25 at 13:30 in Ballroom 3 of Centennial Hall. Members and nonmembers alike are welcome.

Tracy Arm cruise
The M/V Spirit of Adventure, a 100-ft catamaran will depart from the Gold Belt Tours terminal across the street from Centennial Hall at 76 Egan Drive at 7:30 on Friday May 26th. Visit with other invertebrate biologists as you cruise leisurely down Stephens Passage and up the spectacular Tracy Arm, a geologically recently deglaciated fjord. A hearty lunch is available for purchase onboard this scenic tour and it is an excellent opportunity to view invertebrate predators—including marine mammals and seabirds. Terrestrial wildlife such as goats and bears are also often seen. Even without the wildlife the glaciers at the head of Tracy Arm are spectacular. The vessel returns to the Gold Belt Tours terminal at 17:00. Bring binoculars and wear warm clothes including a rain coat or wind breaker and warm hat for deck side viewing. The regular price of this unique tour is $147.89 but Meeting registrants receive a 15% discount.
Plenary Talk 1: The Catch-up Effect: Blue king crabs Paralithodes platypus adjust embryo development rates and hatch timing to compensate for temperature effects

Authors: Bradley G. Stevens and Katherine M. Swiney
Affiliation: NMFS- Kodiak Fisheries Research Center
Email: bradley.g.stevens@noaa.gov
Keywords: crab development, hatch temperature

The effect of temperature on embryo development and hatch timing of blue king crabs Paralithodes platypus was studied in the laboratory. Twelve female crabs were placed into three tanks at different temperatures (2, 4, and 6° C), 4 crabs per tank. Eleven crabs molted, mated, and extruded fertilized clutches of eggs. Embryo development was monitored at 2-week intervals by taking digital photographs at x50 magnification, and measuring the length, width, and area of embryos, eye length and width, and percent of area occupied by yolk. Hatching larvae were collected daily in fine-mesh nets at the outlets of holding tanks. Data were analyzed using a nested (eggs within crabs within treatments) repeated measures ANOVA. Development rates for the three temperature groups were significantly different. 6-degree crabs developed most rapidly but experienced a diapause-like slowing of development in the fall; 4-degree crabs caught up with 6-degree crabs and hatched almost at the same time, and 2-degree crabs hatched soon afterwards. Mean extrusion date was 25 January, and development duration averaged 416 days, and there was a non-significant trend toward later, and longer, respectively, with decreasing temperature. Mean hatch date became significantly earlier with temperature whereas duration of hatching increased with temperature. Degree-days required for development were a significant linear function of temperature. It appears that female crabs can compensate for different temperatures by altering the rates at which embryos develop and hatch, in order to achieve the best timing for larval release. Similar “catch-up effects” have been hypothesized in Economics and Medicine to explain the faster recovery of poor economies and sicker patients.
Plenary Talk 2: Testing the effectiveness of a high latitude marine reserve: the importance of integrating movement, distribution, and habitat data

Authors: Jennifer Mondragon\(^1\), S. James Taggart\(^2\), Julie Nielsen\(^2\), Alexander G. Andrews\(^3\), Jodi Harney\(^4\), Guy Cochrane\(^5\), & Lisa L. Etherington\(^2\)

Affiliations: 
\(^1\)NOAA Fisheries – Alaska Region
\(^2\)USGS- Alaska Science Center
\(^3\)University of Alaska Fairbanks
\(^4\)Coastal & Ocean Resources Inc
\(^5\)USGS-Pacific Science Center

Email: jennifer.mondragon@noaa.gov

Keywords: Tanner crab, marine reserve, sonic tracking, multibeam, habitat analysis

Recent fisheries closures in Glacier Bay created large high latitude reserves. We investigated the effectiveness of the reserves by integrating distribution, movement and habitat data. For Tanner crabs in Glacier Bay we estimated the distribution and patchiness by systematically sampling for crabs (1.5 km grid) throughout the Bay. We estimated the movement of male Tanner crabs by tagging 31 male Tanner crabs \((Chionoecetes bairdi)\) with sonic tags and tracking them with a combination of active tracking and “ultrasonic-gates.” We conducted habitat analysis (multibeam sonar) to determine the relationship between substrate and crab abundance. We found that Tanner crabs can move large distances; based on the movement data alone the crabs could easily move between Glacier Bay and the adjacent waters where commercial fishing continues. However, when movement data were combined with relative abundance and habitat data, it seems more likely that adult Tanner crabs are retained inside Glacier Bay.

Tanner crabs were widely distributed throughout the Glacier Bay; except for a large area at the entrance, which was devoid of Tanner crabs. Habitat analysis (multibeam sonar) revealed an abrupt change to a harder substrate in the area devoid of crabs. The lack of Tanner crabs in this area suggests that it might be a habitat barrier for adult Tanner crabs which could limit the exchange between Glacier Bay and nearby Icy Strait, splitting them into discrete patches of adults. Thus the closures in Glacier Bay are likely to be effective for protecting adult Tanner crabs.
Plenary Talk 3: Does size matter? A long-term study in a high latitude MPA provides insights into the effects of commercial harvests on Dungeness crab populations

Authors: Tom Shirley¹, S. James Taggart², Jennifer Mondragon³, and Alexander G. Andrews³
Affiliation: ¹Harte Research Institute, Texas A&M University-Corpus Christi
           ²USGS- Alaska Science Center
           ³NOAA Fisheries – Alaska Region
           ³University of Alaska Fairbanks
Email: Thomas.Shirley@tamucc.edu
Keywords: marine protected area, Cancer magister, commercial fishing effects

The abundance and size distribution of the Dungeness crab, Cancer magister, population was studied in six bays in or near Glacier Bay, Alaska, for seven years before and six years following the closure of commercial fishing. The abundance (catch per unit effort, CPUE) and size (carapace width, CW) of male Dungeness crabs initially increased dramatically each year at sites closed to commercial fishing. In the most recent survey year (2004), male size remained high but did not increase substantially, while abundance declined. Female crabs, which are not harvested, did not increase in size, and their CPUE declined following the closure. No change in size distribution or abundance of male or female crabs occurred in a control site that remained open to commercial fishing. The striking increase in size and shift in size-frequency distribution of male crabs emphasize the efficiency of the commercial fleet in removing legal-sized crabs. We hypothesize the decline in abundance of females is a sampling bias, in which females were less likely to enter pots now filled with large males. Large male crabs appear to have attained a size asymptote. However, the molting rate of large crabs decreases with increasing crab size; our sampling interval may not have been sufficiently long to encompass another molt, and the size distribution of males may have increased at our next sampling. The decline in abundance of males in the absence of fishing is more puzzling, and will be discussed. Marine protected areas are promoted as effective tools for managing fisheries while simultaneously meeting marine conservation goals and maintaining marine biodiversity. Our data demonstrate that the size of male Dungeness crabs markedly increase in the absence of fishing, which may affect both the percentage of females with eggs, and their fecundity. Marine reserves could help maintain genetic diversity in crab species subjected to size-limit fisheries.
Session 1: Chionoecetes biology; Session Chair: Rachel King

Talk Number 1.1: Ecological Determinants In Outbreaks Of Bitter Crab Disease In Snow Crabs From Conception Bay, Newfoundland, Canada

Authors: Jeffrey D. Shields, David M. Taylor, Steven G. Sutton, Paul W. Collins, Danny W. Ings, and Amanda L. Pardy
Affiliation: Virginia Institute of Marine Science
Email: jeff@vims.edu
Keywords: parasitism, ecology, disease, fisheries

The parasitic dinoflagellate Hematodinium sp. causes bitter crab disease (BCD) in snow crabs, Chionoecetes opilio, and Tanner crabs, C. bairdi. As implied, crabs infected with BCD are unmarketable due to their bitter flavor. We surveyed the distribution of BCD in Conception Bay, Newfoundland from 1997 to 2004. The disease has become firmly established, starting with a prevalence well below 1% in 1997 to an epizootic in 1999 that persisted through 2000 reaching prevalences of over 2% to 9% in trapped and trawled male crabs and from 19% to 26% in trawled and trapped female crabs, respectively. Infections were highest in females and small males. In 2004, there was a shift in the dynamics of the disease. An epizootic occurred primarily in adult males. This coincided with increased temperatures and mass molting events that had not occurred in previous years. Temperature, benthic substrate, depth, host size and sex were all correlated with prevalence of the BCD during outbreaks. Patterns in the molting cycle and prevalence of infection indicate that transmission occurs during the post-molt condition, and that overt infections probably develop two to four months after infection, lasting three to four months thereafter.
**Talk Number 1.2: Hematodinium: An emerging infectious disease of crustaceans and its potential impact on North Pacific Chionoecetes bairdi and C. opilio populations**

Authors: Pamela C. Jensen, J.F. Morado, L. Hauser, and D. Woodby  
Affiliation: National Marine Fisheries Service  
Email: Pam.Jensen@noaa.gov  
Keywords: Chionoecetes, Hematodinium, parasite, mortality

_Hematodinium_ is a genus of parasitic dinoflagellates that infects crustaceans worldwide. Until the mid 1980’s, _Hematodinium_ sp. was only sporadically encountered in crustacean populations but has since caused significant mortalities in a number of crustacean species. In the mid ‘80s, large mortalities of Tanner crabs were reported in Southeast Alaska and subsequent research identified the causative agent as _Hematodinium_ sp. The Tanner and snow crab fisheries in Alaska have been depressed and the data suggests that _Hematodinium_ sp. may play a key role in poor recruitment of _C. opilio_ and _C. bairdi_ with different effects. Significant mortalities due to _Hematodinium_ sp. in _C. opilio_ may be causing a reduction in abundance while significant mortalities in _C. bairdi_ may prevent the recovery of _C. bairdi_. We have developed a PCR-based assay to more accurately diagnose and monitor the prevalence of _Hematodinium_ sp. in snow and Tanner crabs. We have also sequenced the 18S and ITS1 DNA regions to determine whether one or more species of _Hematodinium_ exist in North Pacific crabs and whether it is the same species as in the Atlantic.

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**Talk Number 1.3: Use of morphometrics to determine size of maturity and instars in Tanner crab, Chionoecetes bairdi, in Marmot Bay, Alaska**

Authors: Dan Urban and David R, Barnard  
Affiliation: Alaska Department of Fish and Game  
Email: dan_urban@fishgame.state.ak.us  
Keywords: Tanner crab, Chionoecetes bairdi, size of maturity, Kodiak, Alaska

Size of maturity, as determined by the relative size of the chela to the carapace, has been widely used in crab populations in Alaska and world-wide. The technique has previously demonstrated variation in the size of maturity of Tanner Crab, _Chionoecetes bairdi_, in the Bering Sea on the scale of hundreds of kilometers. Significant variation on a much smaller scale was detected in Marmot Bay, on the northeast coast of Kodiak, Alaska. Measurements of 2,000 carapace widths and chela heights from male Tanner crab revealed that over a scale of 50 km, size of 50% maturity ranged from 110 in the outer bay to 133 mm in the inner bay. The average size of female maturity showed a similar pattern, ranging from 85 mm to 95 mm.
Talk Number 1.4: Sperm Reserves of Primiparous Female Snow Crabs (Chionoecetes opilio) From the Eastern Bering Sea – Preliminary Results

Author: Kirsten A. Gravel
Affiliation: Alaska Department of Fish & Game, Kodiak
Email: kirsten_gravel@fishgame.state.ak.us
Keywords: sperm limitation, snow crab, Chionoecetes opilio, eastern Bering Sea

Fisheries that utilize males-only harvest strategies and are considered overfished often result in unbalanced sex ratios which potentially leads to reduced fecundity and sperm limitation in females. Concerns over reduced fecundity coupled with declines to the current depressed levels of the eastern Bering Sea (EBS) snow crab stocks have pointed to the need to monitor adult females for sperm limitation. This monitoring program began in the summer of 2005 with the collection of 56 primiparous female snow crabs from the National Marine Fisheries Service annual EBS trawl survey. Spermathecae were extracted from each individual female. Sperm weight was recorded and sperm cells were enumerated. Sperm weight ranged from 0.004 g to 0.059 g and sperm cell counts ranged from 0 to 10,450,000. We compare these preliminary estimates with values from long-term monitoring of snow crab stocks from the Gulf of St. Lawrence in eastern Canada.
Talk Number 2.1: Spatial variation in Dungeness crab megalopae supply over a tidally mixed fjord shelf in Glacier Bay, Alaska

Authors: Heidi L. Herter and Ginny Eckert
Affiliation: University of Alaska Fairbanks
Email: h.herter@uaf.edu
Keywords: crab larva, Glacier Bay

Supply of Dungeness crab (*Cancer magister*) megalopae was compared among locations in lower Glacier Bay over two years. Sampling locations were separated by distances of 2 – 8 km and were within the area of highest adult crab abundance in Glacier Bay. Light traps were used to collect megalopae within 1 m of the surface and within 1 m of the bottom at 10 m depth. Samples were collected at three sites on 10 simultaneous days in 2004 and 48 days in 2005. A fourth surface site was sampled for the last 29 days in the 2005 sampling period. Megalopae were caught almost entirely in surface traps at the two sites closest to the mouth of Glacier Bay. Few megalopae were caught in bottom traps or in surface traps at the two sites farther away from the Bay mouth. High megalopal abundances in surface traps were correlated with flood tides and high winds. Reduced megalopae supply with increased distance from the mouth of Glacier Bay may be due to high turbulence within a shallow and narrow restriction, which results in tidal mixing over the shelf and subsequent breakdown of transport processes. Low adult abundances in the upper portion Glacier Bay may be limited by low megalopal supply to that area.

Talk Number 2.2: The influence of environmental parameters on zoeae recruitment dynamics of the Chinese Mitten crab, *Eriocheir sinensis* in San Francisco Bay, California

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Keywords: Recruitment dynamics, Chinese mitten crab

The Chinese mitten crab, *Eriocheir sinensis*, is an invasive nuisance species that has become established in estuaries around the world. The adult populations of mitten crabs oscillate dramatically and population explosions have caused dramatic ecological impacts. This research focused on environmental parameters influencing recruitment dynamics of *E. sinensis*, and the predictability of larval development in the North San Francisco Bay population. Monthly zoeae abundance in North San Francisco Bay/Delta was evaluated using California Department of Fish and Game ‘Neomysis’ and ‘Clarke-Bumpus’ zooplankton samples. A model was employed to predict the presence of *E. sinensis* zoeae stages II–V in the field; this model combined long-term mean
temperatures from San Pablo Bay with larval development expressed by a temperature and salinity-dependent linear regression function. Using this development model, predicted zoeal stages were found during the expected months of all years examined. Zoeae densities in North San Francisco Bay were low and only stage one zoeae were present when temperatures were <12°C. Zoeae density and adult abundance were correlated. The timing of adult migration in relation to temperature and salinity thresholds directly affects the supply of zoeae into the system. Zoeae densities declined during low outflow and high planktivore abundance. However, there was no correlation between these two variables and zoeae density. Physical factors and planktivores can create boundaries for zoeae recruitment, between which zoeae development and survivorship may be less affected. These analyses suggest that physical and biotic factors strongly influence development and survivorship of mitten crab zoeae.

**Talk Number 2.3: Spatial and temporal variation of larval abundance and hatch timing of Dungeness crabs in southeastern Alaska: implications for larval advection and retention**

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Keywords: crab larval transport

Spatial and temporal variation of larval abundance and hatch timing of Dungeness crabs, *Cancer magister*, were investigated. Dungeness crab larvae and oceanographic data were collected at four transects: Upper Chatham (UC), Icy Strait (IS), Cross Sound (CS), and Icy Point (IP), in southeastern Alaska during May to September, 1997-2004. Spatial and temporal changes of sea surface salinity (SSS), sea surface temperature (SST), chlorophyll concentration, zooplankton biomass, and larval abundance were examined with exploratory data analysis using Geographic Information System (GIS). Larval abundance was highest in IS transect (particularly at ISA), moderate in UC and CS transects, and lowest in the IP transect. The timing of larval hatching correlated with water temperature of the prior year (the egg incubation period): colder water temperature resulted in late larval hatching (e.g., the cohort of summer 1997), while warmer water temperature resulted in early larval hatching (e.g., the cohort of summer 1998). Variation in larval abundance was not related to oceanographic variables. Larval abundance at all transects was highest in June except at the IP transect. We assume a portion of locally hatched Dungeness larvae underwent ontogeny within Alaskan inland waters, while larvae which originated from the coast of northern Washington and British Columbia also may have been present. In May and June, unusually late stage larvae appeared along with early stage larvae in the IP transect. These allochtonous larvae may have hatched and been advected from more southern areas, as hatching does not occur in southeastern Alaska until May and June.
Spatial distributions of red king and snow crabs in the eastern Bering Sea changed profoundly during the last three decades. The shifts of distributions to the northeast for mature female red king crabs in Bristol Bay occurred right after the 1976/77 regime shift, while the shifts of mature female snow crabs to the northwest occurred from the mid-1970s to early 1980s. Because distribution centers of small juvenile red king and snow crabs are generally located downstream of the mature females, advection may be an important process for red king and snow crabs. In this study, we used the OSCURS model to simulate annual larval drifts from 1967 to 2004 for red king crabs in Bristol Bay and from 1975 to 2004 for snow crabs in the eastern Bering Sea. The locations of larvae 30 days and 61 days after hatching were compared to the corresponding year class strength indices. The northward shifts of spatial distributions of mature females might have made it difficult to supply larvae to the southern portions of their ranges. However, simulated larval locations cannot consistently explain the strong and weak year classes. Larval advection may be one of many important factors influencing crab year class strengths.
Plenary Talk 1: Historical trends in crustacean systematics

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Keywords: systematics, historical trends, history, taxonomy, diversity

Using a database that includes nearly half (46%) of the estimated 68,000 described species of extant crustaceans as well as the names of the authors who described each species and the date of description, I plotted the number of species described vs. year of description to examine rates of, and trends in, crustacean species descriptions over time. Plots were generated for all crustaceans and for selected major taxonomic subgroups (currently recognized classes and selected subclasses). The species description curve (cumulative number of species plotted over time) for all (pooled) crustaceans shows no sign of flattening over time; no asymptote is apparent. The same pattern is seen in all subgroups examined (Branchiopoda, Maxillopoda, Copepoda, Malacostraca, Peracarida, Decapoda, and Brachyura), although slopes of the curves vary. Thus, there is no reliable way to estimate the possible number of still-undescribed species of crustaceans through extrapolation. The current estimate of approximately 68,000 described species (Martin and Davis, 2001; Brusca and Brusca, 2003) may represent only half, or far fewer, of the actual number of extant crustacean species. There has been no apparent decrease in the rate of discovery (approximated by the rate of subsequent taxonomic description) since the first crustacean species (in our database) were described in the mid-1700s. Over time, the rate of discovery of smaller taxa (e.g., copepods) did not differ appreciably from the rate of discovery of larger taxa (e.g., brachyuran crabs) based on best-fit regression lines. The taxonomic contributions of notable workers and their published monographs are highlighted and discussed.

Plenary Talk 2: Reflections on crustacean systematics

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Keywords: systematics

Crustacean systematists are faced with many competing tasks – describing new species, building phylogenies, reconciling phylogeny with classifications, providing species lists, writing guides to identification. Conflicts exist between what is interesting and what is needed. Some issues are raised but few solutions offered.
Plenary Talk 3:
Eastern Tropical Pacific crustaceans: What we know and what we don’t

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No abstract available

Session 3:
Evolution and Systematics; Session Chair: Frederick Schram

Talk Number 3.1: Four DNA Markers for Studying the Systematics of Caridea

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Keywords: Caridea, DNA, Systematics

The current classification of the infraorder Caridea, both in the status of some families and their interrelationships, are controversial among taxonomists. Thus, molecular systematics would be complementary to the traditional classification approach in this group. In this study, partial segments of mitochondrial COI, 12S rRNA, and 16S rRNA and nuclear 18S rRNA were determined in 55 species belonging to 21 caridean families (i.e., ~60% of the generally accepted families in the infraorder) for phylogenetic analysis. While COI sequences from members of the same family do not cluster together, analysis of 12S and 16S sequences show that family members cluster together in most cases. The less variable 18S gene is a better marker than the three mitochondrial genes as it is capable of discriminating between different families such that members of the same family always cluster together, except families Hippolytidae and Palaemonidae. Although the two subfamilies in Palaemonidae do not cluster together, they group with the families Hymenoceridae, Gnathophyllidae and Anchistioididae to form the superfamily Palaemonoidea. However, the 18S gene is still too variable for resolving the relationships among most families as grouping of the other superfamilies (such as Crangonoidea and Nematocarcinoidea) is not supported. Thus the divergence time of the infraorder Caridea may be older than hypothesized and a more conserved gene is necessary for systematic analysis to elucidate the evolutionary history of Caridean families.
Talk Number 3.2: A newly arrived isopod in the eastern United States: *Synidotea laevidorsalis* or *S. laticauda*?

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Keywords: isopods, molting, cuticle, ultrastructure, calcium spherules, microtubular structures

The recent appearance of large populations of an isopod species, *Synidotea*, on the eastern coast of the United States (Delaware Bay, NJ; Charleston, SC) has lead to its inclusion on several invasive species lists as a possible threat to native biodiversity. While the species has been widely identified as *S. laevidorsalis*, several questions still remain as to its real identity. More than ten years ago, Chapman and Carlton (1991; 1994) reported *S. laevidorsalis*, originally described from Japan, to be globally widespread via hull fouling of commercial ships. They also synonymized several species under that name. In response to these papers, Poore (1996) used morphological taxonomy to dispute the synonymies and proposed that most of the US and European reports of *S. laevidorsalis* were probably *S. laticauda*, an estuarine species only known from San Fransisco, CA. Today, *S. laevidorsalis* continues to be identified from the United States and confusion exists.

This study compared populations identified as *S. laevidorsalis* from several US sites, as well as from Japan and Europe, to *S. laticauda*. The populations were examined morphologically and genetically (12S sequence data) in an attempt to find clear distinctions between the two species. Morphologically, two species were clearly identified and these findings are supported by ecological data; with one species (*S. laticauda*) distributed in estuarine environments and the other (*S. laevidorsalis*) marine. In the genetic analysis, several haplotypes were discovered. Importantly, the Japanese specimens comprised a single unique haplotype that was clearly different than those of US and European specimens.
Talk Number 3.3: Hypotheses concerning the origin of predatory behavior in fairy shrimp (Branchiopoda: Anostraca)

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Keywords: Anostraca, Branchiopoda, Evolution, Predatory Behavior, Paedomorphy

The Anostraca are a subclass of the Branchiopoda, composed of about 300 species of predominately filter feeding primitive crustaceans known as “fairy shrimp.” The filter feeding taxa are primarily consuming unicellular algae, protozoa, and micrometazoa that are filtered from the water column or scraped from substrates by the metachronally beating thoracopods. Predatory behavior has been reported in a handful of species. These predators consume rotifers, copepods, cladocerans, spinicaudatans clam shrimp and other anostracans. Two different hypotheses for the origin of a predatory life style are presented; that predation may be an extension of filtering or scraping behaviors, and; that filter feeding fairy shrimp may be paedomorphic, with predatory behavior being the more primitive state.

Talk Number 3.4: Preliminary review of the Dardanus sinistripes Stimpson (Anomura, Diogenidae) species complex from the Mexican Pacific

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Keywords: Anomura, Diogenidae, Mexican Pacific

The description by Stimpson (1859) for Dardanus sinistripes is very superficial. All specimens of Dardanus collected in the Mexican Pacific and the rest of the eastern tropical Pacific have been referred to this species. Recently revised material of Dardanus in the collection of the Benthic Invertebrate Laboratory at UNAM, Mazatlán, Mexico, indicates that at least four species occur along the Mexican Pacific coast. The type of Dardanus sinistripes was not located and species have therefore been designated as Dardanus sp1, sp2, sp3 and sp4. Characters use to separate species are the relative eye-stalk length, the sculptures and setation on the outer surface of the left cheliped and third left pereopod. Dardanus sp1 and sp2 have short eye-stalks (0.35-0.45 length of shield), while sp3 and sp4 have long eye-stalks (0.45-0.60 length of shield). Dardanus sp1 external surface of palm of left cheliped and left dactyl and propodus of P3 feature spiny tubercles, almost naked. Sp4 features very long setae on the external surface of the palm of left cheliped and third left pereopod, totally covering scales. Sp2 and sp3 have short setae on external surface of the palm of left cheliped and dactyl-propodus of third left pereopod, and scales are distincts from sp1 and sp2. Geographic and depth distribution of each species is presented.
Previous studies report nonannual egg extrusion among Dungeness crabs, *Cancer magister*, in southeastern Alaska which differs from the annual egg extrusion typically reported elsewhere. Dungeness crabs from Kodiak, Alaska waters were reared in flow-through tanks to determine if egg extrusion is annual and to observe which crabs mate or utilize stored sperm to fertilize egg clutches. Females were collected from 2 bays on the eastside of Kodiak Island May through August 2005, a time in which females should either have eyed eggs or recently hatched larvae. Females were held in sand tanks and checked twice weekly for egg extrusion. Females that molted were mated in the laboratory and females that did not molt fertilized eggs using stored sperm. Molting/mating and extrusion dates were recorded. Thirty two percent of females collected did not have eggs the previous reproductive season. Significantly more females used stored sperm to fertilize eggs (71%) than molted/mated (26 %). Females that molted/mated were significantly smaller than females that did not molt/mate. The mean extrusion date of females that used stored sperm is significantly earlier (30 September 2005) than the mean extrusion date of females that molted/mated (10 December 2005). Fifty four percent of females extruded eggs in two consecutive years, whereas 46% skipped at least one reproductive season and extruded an egg clutch the following season. Similar to southeastern Alaska, egg extrusion is not annual for all mature Dungeness crabs collected from Kodiak waters. Smaller crabs molt/mate while larger crabs rely on stored sperm to fertilize egg clutches.
Talk Number 4.2: Changes in embryonic development, hatching, and zoeae of the snow crab with varying incubation temperature

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Keywords: Crab, Bering Sea, Chionoecetes opilio, larvae, temperature

The effect of incubation temperature on duration of embryonic development and morphology, weight and energetic content of post-hatch zoeae was described for snow crab, Chionoecetes opilio, from the eastern Bering Sea held at -1, 0, 1, 3, and 6° C in the laboratory from collection to hatch. The mean incubation time increased by 32% with decreasing temperature between 6 (240 d) and -1° C (353 d). The duration of hatching did not vary significantly with incubation temperature, but successful post-hatch oviposition was lower at 6° C versus 0 or 3° C. A one-year cycle of embryo incubation was observed, indicating that switching from one to two-year duration of embryo incubation likely occurs early in embryo development. The energy content and individual weights of post-hatch zoeae were not significantly affected by temperature, indicating that longer incubation periods may not have an energetic cost. The rostro-dorsal length of zoeae incubated at 6° C was smaller than those from cooler temperatures. Conversely, the length of the 3rd abdominal somite increased significantly with decreasing temperature, perhaps serving as an indicator of incubation temperature in field collected zoeae. The consequences of varying incubation temperature appear on post-hatch zoeae appear to be limited between -1° and 6° C.

Talk Number 4.3: Development of a length-based model to estimate a limit harvest rate for biennially spawning blue king crab in the Pribilof Islands

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Keywords: length-based model, harvest rate, biennial spawn, blue king crab, Pribilof Islands

A length-based model was developed for the biennially spawning blue king crab (Paralithodes platypus) stock in the Pribilof Islands to estimate a limit harvest rate. The model incorporates a stochastic growth and recruitment; size specific molt probability, pot selectivity, and sexual maturity; and constant natural mortality and mating ratio. The limit harvest rate was determined by maximizing the legal male yield at the time of the fishery and converting it to a mature male harvest rate at the survey time, which is the harvest rate used to estimate total allowable catch. In the absence of a known stock-recruitment relationship, steepness parameters of the two well-known stock-recruitment models (Beverton-Holt and Ricker) were varied within a plausible range for limit reference point estimation.
Talk Number 4.4: A tagging study to estimate handling mortality of discarded red king crabs during commercial fisheries

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Keywords: Red king crab, Paralithodes camtschaticus, Bristol Bay, bycatch, handling mortality

The Bristol Bay red king crab fishery is managed as a males-only fishery with a minimum size limit for retention. Mortality of females and undersized males that are captured due to handling and discarding to sea is unknown but remains a concern for fishery management. We used an at-sea tagging study to estimate handling mortality due to two common injuries suffered by captured red king crabs prior to their discarding during commercial fisheries: injuries to walking legs and injuries to the rostrum. Our approach was to tag and release uninjured “control” crabs, crabs treated with a leg injury, and crabs treated with a rostrum injury and compare their relative recovery rates during subsequent commercial fisheries. Two-thousand-nine-hundred-thirty-seven crabs were tagged and released in fall 2001 and 4,994 crabs were tagged and released in fall 2002. Numbers of control, leg-injured, and rostrum-injured crabs released were approximately equal during each tag release. Recoveries during the 2001–2004 commercial Bristol Bay red king crab fishery seasons totaled 1,125. Based on relative rates of recoveries, crab with leg injuries were estimated to have 77% survival relative to uninjured control crabs; the 95% confidence interval on relative survival was 66% to 88%. Crabs with rostrum injuries were estimated to have only a slight, statistically insignificant reduction in survival relative to uninjured control crabs. Application of results to management of the commercial fishery is discussed and difficulties in estimating handling mortality during crab fisheries are lamented.
Talk Number 4.5: Development of a pot survey for the spot prawn *Pandalus platyceros* in Southeast Alaska

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Keywords: spot prawn, *Pandalus platyceros*, stock assessment, survey methods

The assessment program for the spot prawn *Pandalus platyceros* fishery in Southeast Alaska consists of a limited fishery-independent stock assessment pot survey, fairly extensive fishery-related sampling programs, and a voluntary logbook program. The primary goals are to monitor the size composition and to develop useful indices of abundance for Southeast Alaska stocks. Four major areas are surveyed annually in September. In each area, longlined shrimp pot gear is set at established stations in spot prawn habitat using standard gear and methods. In addition to preseason surveys, post-season surveys have been conducted in some areas and years in order to estimate population size using a ‘ratio estimator’. The commercial fishery is sampled in three different ways. On the grounds sampling has the advantage of being able to obtain unsorted prawn size composition information. Dockside sampling is fairly inexpensive and can be maintained throughout the season, allowing for a sample proportional to the harvest. However, sorted prawns are sampled. Onboard sampling allows unsorted prawns from a single vessel to be sampled and is useful in areas where effort is limited or geographically or temporally widespread. Because the product consists of 1 kg boxes, sorted by size the voluntary logbook program provides information on the size composition of the commercial harvest. Trends in size composition are the most useful indicator of stock health obtained from both survey and sampling programs to date. Development of a good survey index of abundance will require a better understanding of catchability, selectivity and saturation curves of the shrimp pot gear. This would also improve the usefulness of this data for modeling which has, to date, provided highly variable estimates of population size. The interpretation of commercial logbook data is still under development.
Plenary Talk 1: Molting probabilities in Glacier Bay Tanner crab

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Keywords: Tanner crab, Glacier Bay, molting, ecdysteroids

Tanner crabs are economically important crabs harvested throughout Alaska. Tanner crabs are thought to undergo a terminal molt after which they cease molting and exhibit a morphological change in chelae morphology. The terminal molt may result in a sublegal crab (< 130 mm) that will not recruit into the fishery. The purpose of this study was to measure circulating molting hormones in male crabs to assess molting probabilities and to correlate hormone measurements with morphometrics to better describe terminal molt morphology. Tanner crabs were collected in Glacier Bay, Alaska and their carapace width (CW) and chela height (CH) measured. Two groups were clearly identified based upon a ratio of CH to CW and defined as either large clawed (LC) or small clawed (SC). Circulating ecdysteroids in crab hemolymph samples were measured using an enzyme-linked immunosorbant assay. Large clawed crabs had significantly lower concentrations of ecdysteroids than did SC individuals (15.5 ± 3.8; 314.4 ± 59.3 ng ml⁻¹). Shell condition and occurrence of regenerating limbs of crabs was noted and used as an indicator of molt stage in LC and SC crabs. Circulating ecdysteroid concentrations correlated with molt stage in the SC crabs with the exception of the very old shelled crabs (soft shell = 48.1 ±19.1 ng ml⁻¹; new shell = 214.6 ± 62.8 ng ml⁻¹; old shell = 521.2 ± 133.0 ng ml⁻¹; premolt = 292.6 ± 68.4 ng ml⁻¹). Very old shelled SC crabs and all LC crabs showed statistically low ecdysteroid levels indicating a very low molting probability. It is of significance that sublegal LC males will not recruit into the fishery.
Plenary Talk 2: Defense against the dark arts: Immune response and molting in crustaceans

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Keywords: phenoloxidase hemocyanin hemocytes immune response *Cancer magister*

The innate immune response, a conserved trait shared by invertebrates and vertebrates, contributes to defense against pathogens and parasites. Recent outbreaks of infectious diseases in crustaceans emphasize the need to better understand how arthropods cope with immunochallenge in natural habitats and aquaculture. In crustaceans, circulating hemocytes play significant roles in the immune response, including release of non-self recognition proteins, clotting proteins, antimicrobial peptides and prophenoloxidases. Activated phenoloxidase (tyrosinase) participates in encapsulation and melanization of foreign organisms as well as sclerotization of the new exoskeleton after wound repair or molting. We now know that the oxygen-carrying hemocyanin functions as a phenoloxidase under certain conditions and thus also participates in the immune response and molting. Hemocyanin belongs to the same group of copper proteins as phenoloxidase. Here, we review findings on the phenoloxidase activity of hemocytes and hemocyanin. The relative contributions of hemocyte phenoloxidase and hemocyanin in the physiological ratio at which they occur in hemolymph have been investigated in the brachyuran crab *Cancer magister*. Differences in activity, substrate affinity and catalytic ability between the two enzymes indicate hemocytes are the predominant source of phenoloxidase activity in crabs, similar to patterns found in penaeidin and astacean crustaceans. In contrast, hemocyanin seems to be the primary source of phenoloxidase activity in chelicerates and peracaridans whose hemocytes show no phenoloxidase activity. Evolutionary relationships determined by phylogenetic analysis of hemocyanin, phenoloxidase and other members of this arthropod gene family are consistent with the possibility that a common ancestral molecule had both phenoloxidase and oxygen-binding capabilities.
Plenary Talk 3: An overview of the regulatory role of crustacean hyperglycemic hormone (CHH) neuropeptides in molting and reproduction in decapod crustaceans

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Keywords: CHH neuropeptides, molting, reproduction, Carcinus and Callinectes

Bilateral eyestalk ablation often induces precocious molting and reproduction in many crustacean species, suggesting that regulatory substances are present in the eyestalk, particularly the sinus gland and medulla terminalis X-organ. Since the first characterization of the primary structure of Carcinus CHH, approximately more than 40 CHH neuropeptides have been identified via cDNA cloning strategies. It is clear in their structures that the neuropeptides in this family can be sub-grouped into two types: CHH and molt inhibiting hormone (MIH)/ mandibular organ inhibiting hormone (MOIH)/ gonad inhibiting hormone (GIH). Despite the large number of structurally identified neuropeptides, their physiological functions have not been well defined yet. However, recent evidence has shown that CHH is pleiotrophic and in many crustacean species, exposure to stressful conditions (hyperthermia, hypoxia, and low salinity) causes the release of CHH into hemolymph resulting in hyperglycemia. Furthermore, a multifunctional role of CHH is confirmed with the presence of its specific binding sites in various tissues. In contrast, MIH binds exclusively on the membranes of Y organs where it suppresses the synthesis of ecdysteroids. This presentation focuses on the involvement of CHH and MIH in the regulatory processes of molting and reproduction in two crab models: Carcinus maenas and Callinectes sapidus.
Session 5:  
Crustacean Growth and Physiology; Session Chair: Ray Bauer

Talk Number 5.1: Antennal flagellar setae of decapod shrimps: sexual dimorphism and possible role in detection of contact sex pheromones

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Keywords: shrimp, pheromone, mating, setae

The antenna 2 (antennal) flagella of decapod shrimps are chemotactile, and in males their setae may be sensilla involved in detection of a female contact sex pheromone. The hypothesis of sexual dimorphism in the number and kind of setae on the antennal flagella of four caridean and one penaeid shrimp species was tested with setal counts and observations on setal morphology. Unique male antennal setae (“male-specific sensilla”) were not observed in any of the species investigated. However, the abundance of antennal setae was significantly greater in males than in breeding females in the palaemonid carideans Palemonetes pugio and Macrobrachium ohione. In the hippolytid caridean Thor manningi and alpheid caridean Alpheus normanni, no sexual dimorphism in setal abundance was demonstrated. In the penaeoid Rimapenaeus similis, males had a higher abundance of antennal setae than the larger breeding females but so did juvenile females, similar in size to males. The sexual dimorphism in antennal sensilla in the palaemonid species and its absence in A. normanni might be related to their different mating systems, but no such association is suggested for T. manningi and R. similis.  
Setal morphology suggestive of chemoreceptive function (a terminal pore) was observed in all species; ultrastructural studies on setal innervation and electrophysiological studies are needed to demonstrate a role of antennal setae in the detection of a possible female contact sex pheromone. Progress in the isolation and identification of the possible compounds allowing males to recognize females via contact is summarized.
Talk Number 5.2: Formation and calcification of cuticular structures in molting terrestrial isopods (Crustacea: Isopoda)

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Keywords: isopods, molting, cuticle, ultrastructure, calcium spherules, microtubular structures

Molting is a life-long and frequent event related to development and renewal of cuticular structures in terrestrial isopods. The body surface and the entire digestive tract of isopods are covered by cuticle. Diverse cuticular structures are formed by secretion of chitinous microfibrils at the microvillar surface of epithelial cells of the integument and the gut. Ultrastructural analysis of epithelial cells which secrete cuticle was performed by conventional electron microscopy and cytochemistry. The formation and mineralization of cuticle were studied in embryos and adults at different molting stages. Great diversity of cuticular structures was observed in cuticle-secreting cells of the digestive tract in embryos. Resorption of calcium from the old cuticle and calcification of the new cuticle was studied in adult isopods. In the anterior tergites of intramolt animals, spherical structures containing calcium were observed in the ecdysal space, and microtubular structures interconnected the spherules and the new cuticle. Localization of Ca ATP-ase activity in spherules and hypodermis demonstrates intense calcium fluxes in premolt and intramolt animals. In intermolt animals the enzyme activity was localized in cuticular pore canals, along the basolateral membranes, and in mitochondria of epithelial cells. The results show that in molting isopods calcium resorbed from the old cuticle is transported through the ecdysal space in lysosome-like spherules associated with microtubular structures, which suggest their role in calcium solubilization and transport during calcification of the new cuticle. A detailed immunocytochemical study of spherules and microtubular structures is underway.

Talk Number 5.3: Scaling of the rigid and hydrostatic skeletons of the aquatic blue crab, Callinectes sapidus, and the terrestrial blackback land crab, Gecarcinus lateralis

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Keywords: skeleton, scaling, molting, hydrostatic skeleton

The construction of a skeletal support system greatly influences how large an organism can be, because increases in body size result in greater mass and locomotor forces that must be supported by the skeleton. For rigid exoskeletons, the larger the ratio of cuticle thickness to limb diameter, the greater the force that can be supported. But for hydrostatic skeletons, the thickness to diameter ratio may not change if internal pressures remain constant. Crabs alternate between rigid and hydrostatic skeletons during molting, therefore, each mechanism may influence growth differently. I examined the scaling of the rigid and hydrostatic skeletons of the aquatic blue crab, Callinectes sapidus, and the terrestrial blackback land crab, Gecarcinus lateralis.
measured body mass and the linear dimensions of the merus of the second walking leg (length, height, width, and cuticle thickness) in soft- and hard-shell crabs of a range of sizes. Each parameter was compared to body mass in a log-transformed regression analysis. In blue crabs, the thickness of the cuticle in rigid animals scales isometrically (slope: 0.36), while that of hydrostatic animals scales allometrically (0.21). In blackback land crabs, the thickness of the cuticle in rigid animals scales isometrically (0.34) while that of hydrostatic animals scales independently of body mass (0.02). These data support the hypothesis that the rigid and hydrostatic skeletons of crabs scale differently in both aquatic and terrestrial environments. Alternating between two skeletons may represent a significant, yet previously unrecognized, aspect of growth to maximum size in crabs.

Talk Number 5.4: The invasion of freshwater by the prawn *Macrobrachium tuxtlaense*

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Keywords: *Macrobrachium*, freshwater, abbreviated development

The hololimnetic prawn *Macrobrachium tuxtlaense* was used as a model organism to elucidate how the invasion and adaptation to the freshwater biotope has proceeded in strictly freshwater palaemonid shrimps. Through three different approaches, namely: a) larval development, b) osmoregulation and respiration, and c) phylogenetic analysis, we explored the main pathways through which this species has become a strictly freshwater inhabitant. *Macrobrachium tuxtlaense* exhibits a partially abbreviated development, with newly hatched individuals requiring 5 molts before becoming juveniles. The eggs of *M. tuxtlaense* are larger than those of the rest of the American species with abbreviated development. The osmoregulatory response and oxygen consumption rate of *M. tuxtlaense* was measured under different salinity conditions. The results, a high isosmotic point, an inability to survive at salinities above 28 ‰, and a strong hyperregulator behavior at low salinity, suggest an advanced degree of adaptation to the freshwater environment. Phylogenetically, *M. tuxtlaense* and the rest of the species with abbreviated development from Mexico represent a distinct clade different form the *Macrobrachium* species from South America with abbreviated development and different from all the American species with extended larval development.
Talk Number 5.5: Extreme female-biased and size-dependent sex allocation in the simultaneous hermaphroditic shrimp \textit{Lysmata wurdemanni} (Caridea: Hippolytidae)

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Keywords: sex allocation, Lysmata, sexual selection, behavior, Caridea

A fundamental question in sex allocation theory is what conditions determine shifts in the optimal sex allocation with age/size of simultaneous hermaphrodites. Here, I explored multiple conditions that theoretically affect the relationship between sex-specific investment and reproductive success of simultaneous hermaphrodites to predict and test for the overall and size-dependent sex allocation in the shrimp \textit{Lysmata wurdemanni}. In this simultaneous hermaphroditic shrimp, sperm competition is absent as hermaphrodites reproducing in the female role invariably mated once with a single other shrimp. Brooding constraints were not severe and varied linearly with shrimp body size. In contrast, the ability to acquire resources increased markedly with shrimp body size. Male mating ability was greater for larger compared to smaller hermaphrodites and individuals reproducing in the female role preferred smaller over larger shrimps as male mating partners. After considering the combined effects of all these conditions on the relationship between sex-specific investment and reproductive success, I predicted for \textit{L. wurdemanni}: i) an overall female-biased sex allocation, and ii) a size-dependent sex allocation in which smaller hermaphrodites should allocate more resources than proportionally into male reproduction than larger ones. In agreement with these two predictions, hermaphrodites allocated, on average, 118 times more to female than to male gametes and larger hermaphrodites allocated relatively little to the male function compared to smaller shrimps. In \textit{L. wurdemanni}, the relationship between sex-specific investment and reproductive success changes during ontogeny in a way that is consistent with an adaptive adjustment of sex allocation to improve age-specific reproductive success.
Poster Presentation Abstracts

Poster Number P1:
The fairy shrimp (Crustacea; Branchiopoda; Anostraca) of Chile

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Keywords: Branchiopoda, Anostraca, Branchinectidae, Branchinecta

We surveyed portions of Chile for Anostraca. Including the two Artemia species previously reported from Chile, we found 5 new localities and range extensions for 5 species of Branchinecta. Previous studies on Chilean Anostraca have focused on Artemia, and although Branchinecta was previously reported in Antarctica close to Chilean Air Force installations, and in a few temporary ponds in Southern Patagonia, the species were never determined. Brief habitat descriptions, as well as conservation trends, and identification keys are presented and discussed. Additionally, we present a new species from the Atacama Desert.

Poster Number P2:
A western Atlantic peppermint shrimp complex: redescription of Lysmata wurdemanni (Gibbes), description of four new species and remarks on L. rathbunae Chace (Crustacea: Decapoda: Hippolytidae)

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Keywords: Lysmata wurdemanni, Lysmata, Hippolytidae

The present study is the first revision of the western Atlantic peppermint shrimp complex Lysmata wurdemanni (Gibbes). Lysmata wurdemanni, originally described from Florida and South Carolina, is redescribed. Gibbes’ types of L. wurdemanni are considered as lost, therefore, a neotype is selected from specimens collected near Key West, Florida. Lysmata rathbunae Chace is rediagnosed; its type locality of this species is restricted to Florida and Yucatan; Chace’s variety of L. rathbunae is separated from L. rathbunae and assigned to a new species. In total four new species are recognized: L. ankeri n. sp., L. boggessi n. sp., L. pederseni, n. sp. (corresponding to Chace’s variety of L. rathbunae), and L. bahia n. sp., all four previously mistaken for L. wurdemanni and/or L. rathbunae. Classical morphological and morphometrical analyses, in conjunction with examination of life color patterns, interbreeding experiments, and Differential Function Analysis (DFA) were used to corroborate the separation of these cryptic species. Each species may be most easily recognized by the unique color pattern. Lysmata pederseni, n. sp. also differs ecologically in being associated with tube sponges, a unique trait within the genus. Lysmata rathbunae appears to be a deep-water species, while the other five species are found mostly in shallow waters.
Poster Number P3:
A new family of stenopodid shrimps from an anchialine cave in the Bahamas

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Keywords: Stenopodidae, new family, Bahamas

A new family of stenopodidean shrimps, Macromaxillocarididae, is described from an anchialine cave in Great Guana Cay, Exuma Cays, Bahamas. Macromaxillocaris bahamaensis new genus, new species, is the sole representative of the family. The new taxon clearly belongs to the infraorder Stenopodidea. However, the presence of a massive third maxilliped, pereiopods that increase in length posteriorly, an epistome with two fang-like projections, and a reduced branchial formula distinguish the new family from the rest of the taxa in the infraorder. Moreover, a bifid palp of the first maxilla and an unsegmented palp of the first maxilliped, which are characters not present in the other two known families in the infraorder, support the separate status of the new family. Diagnostic characters of both, the Stenopodidae and Spongicolidae, are found in M. bahamaensis also, being the new taxon morphologically more similar to the Stenopodidae.

Poster Number P4:
Viral inclusion bodies of White Spot Syndrome Virus (WSSV) in digestive tract of Litopenaeus vannamei

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Keywords: White Spot Syndrome Virus, Litopenaeus vannamei, histology

One of the most important factors causing economic losses in the shrimp culture industry is the presence of disease, within which are those of viral origin. One of the most recently reported virosis is the White Spot Syndrome Virus (WSSV) that has as basic characteristics, the formation of white spots on the cuticle, causing mortalities of 80–90% in some populations. The objective of this study is to characterize the inclusion bodies and the histological alterations produced in the associated tissues of the digestive tract in Litopenaeus vannamei. WSSV infected organisms were collected in shrimp farms in Sinaloa, Mexico. The infection was confirmed using the polymerase chain reaction. The samples were fixed in Davidson’s solution (48-60 h) and preserved in 70% EtOH. The tissue was processed in paraffin and fine 5-7 µm sections obtained, conventional and molecular staining techniques were applied. The macroscopic characteristics seen in the infected shrimps are: opacity of the body musculature, excited chromatophores, as well as the white spots on the cuticle. In the connective tissue and digestive tract epithelium intranuclear inclusion bodies were observed, having a greater
concentration in epithelial cells than in the connective tissue. With Haematoxylin-Eosin (H-E) staining, the nuclei tend to be basophilic and with a granular texture. The inclusion body appears hypertrophied, it is well developed and chromatin is located marginally. By means of in situ hybridization, the virus genetic material dyes blue.

Poster Number P5:
Female reproductive output, fecundity, egg volume, and brood constraints in L. wurdemanni

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Keywords: L. wurdemanni, hermaphrodite, reproductive output, fecundity

An enigmatic breeding system among caridean shrimps is protandric simultaneous hermaphroditism (PSH), in which individuals reproduce as males first and later as simultaneous hermaphrodites. We examined female reproductive output, size-specific fecundity, size-specific egg volume, and brood constraints in L. wurdemanni to improve our understanding about the evolution of PSH. The amount of energy hermaphrodites allocated to female reproduction (female reproductive output), estimated as the ratio between egg and shrimp mass (dry weight), vary between 0.087 and 0.175 in shrimps 7.41 and 8.32 mm CL, respectively. Female reproductive output increased proportionally with shrimp body size. Eggs volume varied between 0.0241 and 0.04 mm3 in shrimps 9.49 and 6.76 mm CL, respectively. Egg volume increased by 43.14% during development but neither decreased nor increased with shrimp body size. Fecundity in hermaphrodites carrying early embryos increased exponentially with body size; from 407 eggs in shrimps 6.76 mm CL to 1493 eggs in shrimps 9.49 mm CL. Fecundity in shrimps carrying late embryos varied from 382 eggs in individuals 6.63 mm CL to 1367 eggs in individuals 9.36 mm CL. Fecundity decreased during development by 8% suggesting brood constraints in L. wurdemanni. No effect of shrimp body size on brood constraints was found. There are no apparent differences in female reproductive output and egg volume between L. wurdemanni and other shrimp species either featuring protandric hermaphroditism or separate sexes. However, the occurrence of brood constraints in L. wurdemanni is relevant as theoretical considerations suggest that brood constraints favor the evolution of simultaneous hermaphroditism.
Poster Number P6:
Survival and growth of prawn, *Palaemon elegans*, (Palaemonidae) reared in different salinities

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Keywords: Palaemon elegans, survival, growth, salinity, prawn

The aim of this study was to survey LS5096h in prawn, *P. elegans*, at various salinities (0-45 ppt) with the salt proportion of the Caspian Sea in laboratory (24±1˚C) and also studying salinity effect on growth indexes, survival and molting at salinities 8, 13 and 18 ppt during 30 days. Surveyed LS5096h showed that above 50% of prawns survived at 1 to 30 ppt salinity range, while above and below this range, below 50% survived within 24 hours. No significant difference (P > 0.05) in growth parameters such as carapace length increment, specific growth rate (SGR) and also in survival and molting rates were observed in prawns reared in salinities 8, 13 and 18 ppt.

Poster Number P7:
The best time and concentration for yeast probiotic enrichment of *Artemia urmiana* nauplii

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Keywords: *Artemia urmiana*; Saccharomyces cerevisiae; Probiotic; Enrichment; Concentration

*Artemia* is a practical and suitable larvae food for both marine and fresh water crustaceans and fishes. Yeast probiotic enrichment of *Artemia urmiana* nauplii, found in Uromieh Lake of Iran, has not been documented in literature. The nauplii were enriched with Thepax, a commercial probiotic material containing yeast cells of *Saccharomyces cerevisiae*, and the best time and concentration of the enrichment have been evaluated. To identify the optimal concentration of yeast cells, each group of nauplii (6-,12- and 18-hour after hatching) have been enriched with three treatments containing 10^4, 10^7 and 10^10 colony forming units (CFU) per ml. In result, the maximum survival rate of nauplii was in concentration of 10^7 CFU ml-1 (P<0.05). As the most yeast cells have been seen in the 6-hour group (P<0.05); the best time of enrichment was at 6 hours after hatching. In contrast to probiotic enrichment of other *Artemia* species, this study showed that the earlier enrichment of *Artemia urmiana* nauplii has better results.
Poster Number P8:
Cell surface growth in *Artemia* limb bud epidermal cells

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Keywords: epidermis, premolt, plasma membrane, growth, limb bud

Increase in size in crustaceans is a function of changes in the epidermis during the premolt period. In larvae, growth of the integument can occur by cell rearrangement, cell shape change, cell replication, and production or growth of setae. Some of these processes require biosynthesis of new plasma membrane as the cell surface increases in area. New membrane synthesis is supported by essential fatty acids in the diet. In this study, incorporation of fluorescent fatty acids (FFAs) in epidermal cells of developing limbs in *Artemia* was examined during the premolt periods of instars IV – VI. FFAs became evident in the cells after 45 minutes in the medium and the rate of incorporation was greater in non-fed larvae. Incorporation occurred in the lateral and apical surfaces before the basal surface in most cells. There was no difference in uptake in cells that separated lobes in instar IV. Little incorporation was observed in cells that increased surface area by shape change without change in surface area. Incorporation was heavy in the lateral surface of mitotic cells as these cells expanded during early premolt. By contrast, cytokinesis in these cells did not require membrane synthesis until very late in the instar. New and growing setae showed incorporation in the base of the cell but not in the shaft. Each lobe of the limb bud demonstrated differences in uptake and membrane synthesis that reflected the type of growth mechanism and the stage of development.

Poster Number P9:
The large branchiopods (Anostraca, Notostraca, Laevicaudata, Spinicaudata) of Oregon, Washington, and adjacent areas of North America

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Keywords: large branchiopods, Washington, Oregon

The large branchiopod fauna of the USA states of Oregon, Washington and adjacent areas of Idaho, Nevada and California are presented and discussed. We present new distribution and species records, biogeographical data, conservation issues and opportunities for further research, including an unidentified clam shrimp from eastern Washington. The morphology of this clam shrimp places it close to the eastern US species *Eulimnadia antlei*, which may suggest a recent introduction or colonization event.
Poster Number P10:
Behavioral and genetic differences between two populations of blue crab
(*Callinectes sapidus*) in New Jersey

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Keywords: behavior, blue crab, genetics, microsatellites

Blue crabs (*Callinectes sapidus*) were collected from Hackensack Meadowlands (HM), a contaminated site in northern NJ and Tuckerton (TK), a relatively clean site in southern NJ. Behavioral differences were previously found in predator avoidance, prey-capture, and response (attack or flee) to a threatening stimulus in HM blue crabs (Reichmuth et al., unpublished data). Specifically, HM adult blue crabs were less efficient at capturing prey compared to their TK conspecifics. The current investigation is being conducted to further explore behavioral differences between these populations, their causes and their ecological significance. Blue crabs from each population were placed in their respective habitat as well as “switched” habitats in the field; TK crabs were placed in HM environment (sediment, water and food) and vice versa for 12 weeks. Our data show that TK crabs placed in HM habitat become less efficient predators compared to TK crabs in TK habitat. HM crabs placed in TK habitat are more efficient predators than HM crabs in HM habitat. Genetic analysis of six microsatellite loci was also examined between the two populations. Data supports that the two populations are genetically similar, which suggests that the behavioral differences between the populations may be environmental (e.g., salinity, food, sediment/water quality).
Poster Number P11:
Preliminary study of biological characterizes of *Rhithropanopeus harrisii tridentatus*, the only species crab of the Caspian Sea, at Noor Coast

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Keywords: Biological Characterizes, Rhithropanopeus harrisii tridentatus, Noor Coast, Caspian Sea, Iran

In this study, Biological characterizes of crab *Rhithropanopeus harrisii tridentatus*, was studies during six months (July - December) in the Noor coast (The South of Caspian Sea) in 2005. Of the 176 specimen collected, 47.15% were males and 52.85% were females. In this study females with eggs on the pleopods were not observed. Comparing of the carapace width, carapace length, chela length, chela high and wet weight between males and females showed significant difference ($P < 0.05$) so that the all of characterizes in the males higher than females. Maximum and minimum carapace width in males and females were obtained 5.4–15 and 4–14 mm, respectively, Also the significant relationship ($P < 0.05$) was obtained between carapace length and another characterize. In addition, the results of this study showed that the size of this species in Caspian Sea smaller than another area.

Poster Number P12:
Larval development of the majid crab *Epialtus minimus* Lockington, from the eastern tropical Pacific

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Keywords: Larvae, majid crab, eastern tropical Pacific

The complete larval development is described for the majid crab *Epialtus minimus*, from the eastern tropical Pacific, reared under laboratory conditions. The development consists of two zoeal stages and one megalopa. At 25-28°C and 35 ‰, the megalopa appeared after 12 days from hatching. The morphological features of the zoeal and megalopal stages of *E. minimum* are compared with those of its congeneric species *E. dilatatus*, *E. bituberculatus* and *E. brasilensis*. Small differences of setation were observed in almost all appendages throughout the development stages and among species, but not on basis, endopod and exopod of zoeal maxilliped. When comparing the megalopa of the three species, more significant differences in maxilliped setation were observed.
Poster Number P13:

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Keywords: larval release, egg incubation, hatch duration, egg extrusion, *Hapalogaster mertensii*, Lithodid crab

The reproductive biology of female *Hapalogaster mertensii*, an intertidal lithodid crab, from Kodiak Island was observed in both the laboratory and field from 2000-2004. Their small size, adaptability to the laboratory environment, and accessibility at low tide, make them an ideal species to serve as proxies for studies of commercially exploited lithodid species. In the laboratory, no significant difference was found in the timing of larval release between years, occurring from February-June, or in the average number of larvae released, which was 214.75 ± 37.66 in 2001 and 157.38 ± 23.24 in 2003. Hatch duration in individual crabs varied significantly between years and pair wise comparisons showed the following differences: 2001 (32.38 ± 3.37 days)>2003 (22.62 ±2.08 days) >2004 (6.50 ±3.37 days). Molting, mating, and the extrusion of new egg clutches are not contiguous as in other lithodid crabs, but occur over a period of 2-5 months. Laboratory observations show that molting occurs twice in some females between hatching and extrusion. Possible mating behavior was observed twice, and occurred after the first molt, but was not associated with the molt or extrusion of new eggs. Egg extrusion in the lab was only observed in 2003 and occurred between 10 August and 10 November, and in the field in 2002 as early as July. Egg incubation between individual crabs was significantly different ranging from 187 to 244 days (224.67 ± 8.4288, P=0.00). Lab conditions appeared to mimic field observations for the timing of larval release and egg extrusion despite prolonged captivity of lab animals.

Poster Number P14:
Biogeography of the freshwater crabs of the Tribe Pseudothelphusini (Decapoda: Pseudothelphusidae)

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Keywords: Pseudothelphusidae, freshwater crab, Mexico, biogeography

Biogeographically, all the species included in the tribe Pseudothelphusini are endemic to Mexico, occurring between 16º and 27º N, following a strictly Neotropical pattern. Along the Pacific slope members of the genus *Pseudothelphusa* occur from the Tehuantepec River, Oaxaca (16º 19' N) to the north, reaching the locality of La Aduana, Sonora (27º 03') in the Mayo River basin. In central Mexico, they are distributed along a narrow transversal fringe across the states of Nayarit, Jalisco, Michoacan, Guanajuato, Mexico and Queretaro, as well as in Tlaxcala and Puebla. Along the Balsas River
another group of species of *Pseudothelphusa* are located in well defined areas in all portions of the basin. On the Gulf of Mexico slope species of the genus *Tehuana* are broadly distributed, through southern Veracruz, in tributaries of the Papaloapan River and in Los Tuxtlas region, and to the southeast along the junction of the states of Tabasco, Oaxaca and Chiapas following the basins of the Tonala and Coatzacolacos Rivers. A cladistic analysis of the tribe agrees with the geographic distribution of the different species groups, showing at least six patterns of ancestral distributions. Four major geologic events shaped the current distribution: the emergence of the southern portion of the Sierra Madre Occidental, the tectonic events related to the separation of the Baja California Peninsula, the formation of the Neovolcanic Axis and the movements of the tributaries and lakes within the Lerma-Santiago and Balsas basins.

**Poster Number  P15:**
**Histology of the hepatopancreas of *Callinectes* spp., parasitized by the rhizocephlan barnacle *Loxothylacus texanus***

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Keywords: blue crab, hepatopancreas, *Loxothylacus texanus*, histology

The hepatopancreas of blue crabs *Callinectes sapidus* and dark blue crabs *Callinectes rathbunae*, both parasitized and unparasitized by the rhizocephlan barnacle *Loxothylacus texanus*, were obtained from Sontecomapan lagoon, southern Veracruz, Mexico, for a histological study. Crabs showing several degrees of parasitization (internal phase, with virgin externae, with one mature externa, with multiple externae, and scarred) were analyzed and compared to control organisms. Hepatopancreas fixed in Davidson’s fluid were prepared using standard histological techniques and stained using hematoxilin-eosin. The sections show a progressive invasion of the intratubular spaces (hemal spaces) of the hepatopancreas by the roots of the interna of *L. texanus*. This progressive invasion, measured as the intratubular space occupied by the roots of *L. texanus*, is clearly correlated with the external morphological characteristics shown by the crabs. The tubular structure of the hepatopancreas also progressively deteriorates as the parasite matures, the several types of cells lining the interior of the tubule show necrotic and disorganized areas. The implications of a disfunctional hepatopancreas in crabs with mature parasites are discussed.
Reduced stock abundance and increased efficiency in the Southeast Alaska Tanner crab (*Chionoecetes bairdi*) fishery has led the Alaska Department of Fish and Game to reduce the season length to reduce effort. The department believes that this fishery intensification has decreased pot soak time which could increase handling and mortality of sublegal and female crabs. Also, soak time is used to standardize stock assessment CPUE data. Hence, the objectives of this experiment were to: 1) determine whether escape rings are effective in releasing females and sublegal males over soak periods less than 24 hours; 2) determine when females and sublegal males begin to exit a conical pot with escape rings; 3) to quantify potential correction factors of stock assessment survey abundance data. In 2004 and 2005, surveys were conducted in Icy Strait and in Stephens Passage in 2004 and Excursion Inlet in 2005. For each survey, 48 pots were set and pulled in each area. Half of the pots set had 4-inch escape rings and half did not. Pots were soaked for 3, 9, 18 and 24 hours. Overall, Icy Strait catch rates were 3 to 5 times higher than those of Stephens Passage and Excursion Inlet. In general, for non-legal males and females, pots with closed escape rings had a greater catch per unit effort (CPUE) than those with open escape rings, but soak time had no significant effect on CPUE. For legal size males, there was no significant effect of escape rings. Results indicate that escape rings function at soak times less than 24 hours. Catch rates from the experiment indicate that survey CPUE should not be standardized using a linear function of time.
Poster Number P17:
Pigment Dispersing Hormone immunohistochemistry in eyestalks and supraesophageal ganglion in crayfish

Authors: Héctor Solís-Chagoyán, Leonor Mendoza-Vargas, Miguel Verde, Eva Muñoz-Mancilla, José Luis Bortolini-Rosales, María del Pilar Torres-García, and Beatriz Fuentes-Pardo
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Keywords: Pigment Dispersing Hormone, crayfish

The protocerebrum of the supraesophageal ganglion and the X organ-sinus gland complex localized in the eyestalk, are elements strongly involved in the circadian systems in crayfish. In both of these structures it has been proposed the presence of circadian pacemakers responsible of generating and expressing locomotor and amplitude electroretinogram (ERG) circadian rhythms. The pigment dispersing hormone (PDH) has been proposed as a non-photic synchronizer in crayfish because it hormone phase shifts the ERG rhythm. On the other hand the retinular cells have been identified as effectors and light synchronizers of the ERG rhythm. For these reasons we made a histological description of these structures as well as localization of PDH immunoreactive cells. For the histological description the SG and eyestalks were dissected off and fixed in Davidson solution, embedded in paraffin and cut into 7 micrometers sections. The tissues were stained with hematoxilin-eosin technique. PDH immunoreactivity was detected with peroxidase immunohistochemistry technique. Bilateral symmetry and immunoreactive PDH cells in median protocerebrum were observed. The external, internal and terminal medulla present a layer of cells in the upper region around each of these structures. PDH immunoreactive cells were distributed in the medulla external, internal and terminal. The results will allow us correlate the histological organization of the supraesophageal ganglion and the eyestalks with electrophysiological evidences about the circadian rhythm organization in crayfish.
Poster Number P18:
Synchronization of electroretinogram circadian rhythm by melatonin in crayfish

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Keywords: Circadian Rhythms, electroretinogram, melatonin, synchronization, crayfish

Circadian rhythms are regular oscillations of physiological functions controlled by an endogenous system that is synchronized by environmental cues. Melatonin is a hormone related to photoperiod that reseats the circadian pacemaker and synchronizes circadian rhythms in vertebrates. Crayfish shows a circadian rhythm in the amplitude of the electrical response to light of retinal photoreceptors (electroretinogram, ERG). In Procambarus clarkia the level of circulating melatonin oscillates with a peak at night. In order to know if melatonin synchronizes the circadian system of this decapod, it was recorded during 35 days of the hormone was applied for 15 days at the same external time. Ten days before hormone was applied the period was 24 hours. After that, it was injected saline solution at the same time that melatonin application, and period was 23.5 h. When oscillation was synchronized, melatonin injection corresponds to circadian time 3 (CT 3) (CT 0 corresponds to the moment when initiates the activity time). These results suggest that melatonin reset the crayfish circadian system and it acts as a non-photic synchronizer signal in this decapod.
Poster Number P19:
Crustaceans in the Mazatlán (ICML, UNAM) Regional Collection of Marine Invertebrates

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Keywords: invertebrates, Crustacea, decapoda

The Regional Collection of Marine Invertebrates at UNAM, in Mazatlán, Mexico, contains 5238 lots of Crustacea from both the benthic and pelagic realms. Specimens were first incorporated in 1977 and were mostly collected during sampling activities along shore (1836 lots), diving (89 lots) and from oceanographic vessels (3298 lots). The collection contains specimens collected in the 11 states of the Pacific coast of Mexico, from Baja California to Chiapas. The bulk of the collection (82%) is made of Decapoda (Dendrobranchiata, 645 lots; Caridea, 499 lots; Astacidea, 9 lots; Thalassinidea, 31 lots; Palinura, 38 lots; Anomura, 922 lots; Brachyura, 2173 lots), followed by Peracarida (9%). The rest corresponds to Euphausiacea and Cirripedia. The collection contains 71 lots of types. At least 900 additional lots, many from deep water, are being currently reviewed and identified. Small collections of crustaceans at risks in other regional institutions have been donated to the Regional Collection with a view to guarantee their conservation on a long term.
Maps

Juneau roads
Downtown Juneau

1. City Hall
2. Juneau Public Library
3. State Capitol
4. State Office Building
5. The Governors Mansion
6. The City Museum
7. The State Museum
8. Centennial Hall
9. St. Nicholas Orthodox Church
10. House of Wickersham
11. Juneau-Douglas High School
12. Augustus Brown Swimming Pool
13. Douglas Bridge
14. Cope Park
15. Evergreen Cemetery
16. Gold Creek
17. Aurora Basin
18. Harris Harbor
19. The Federal Building and Main Post Office
20. Cruise Ship Docks
Centennial Hall
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