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Annual Pink Shrimp Review

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TO: OREGON SHRIMP INDUSTRY
FROM: Bob Hannah and Steve Jones
Subject: Opening of 2015 Commercial Fishery
Date: 25 February 2015

The 2015 pink shrimp (*Pandalus jordani*) season will begin on 1 April and will extend through 31 October. This newsletter provides a summary of the 2014 season for your review including catch, effort and market sample information. Indicators for the 2015 season are discussed. We recap the results of our 2014 LED light research and discuss LED light use patterns and possible implications for the fishery, along with our research priorities for 2015.

In a nut shell; 2014 age-1 shrimp recruitment and age-2 hold-over were super, catch-per-hour (CPUE) was a record high, a strong shrimp market just kept getting stronger, AND shrimpers heartily embraced the use of LED lights which dramatically reduced the bycatch of threatened eulachon smelt during the last three months of the season.

Hot Topics

2014 Season Summary

Oregon shrimpers continued to challenge several state shrimp fishery records in 2014, including the landing of 51,960,045 pounds of shrimp into Oregon ports (Figure 1). It was the first season total since 1978 to top 50 million pounds, when 56.9 million pounds were landed. The 2014 total continued the recent trend of exceptionally high landing totals that began in 2011. The 2014 landings were apparently driven by an exceptionally large age-1 shrimp recruitment (especially to the south), and good to excellent hold-over of age-2&3 shrimp (especially to the north).

Shrimping began quickly in 2014, settling on a price structure before the opener and avoiding an initial delay as in 2013. April landings were the highest in several years and proved to have the lowest monthly total in 2014 (Figure 2). Monthly totals peaked in May and again in August with each coming in at just over nine million pounds. The totals in August and September each set records for poundage landed in those months.

Catch totals by month and area were highly variable coast-wide in 2014 (Figure 3). The totals generally showed a more northerly distribution that occurred later in the season than we've seen in the last few years. Thirty-two percent of the 2014 Oregon catch came from the two areas off Washington alone; a big change from 2013 when they contributed about 10.6%. Conversely, the Northern California and Rogue River beds produced about 14.5% of Oregon's catch in 2014, but had produced about 33.6% of the catch in 2013.

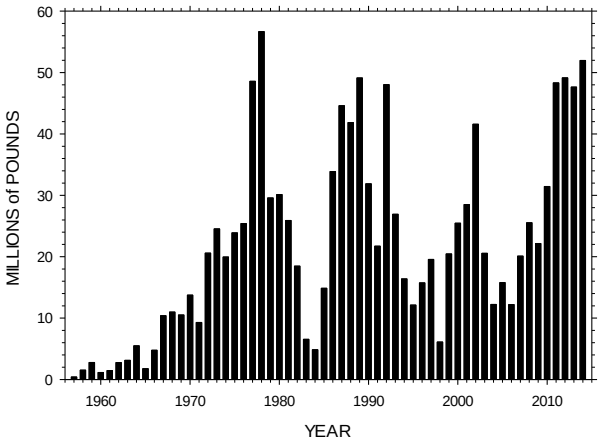

Figure 1. Oregon pink shrimp landings (millions of pounds) 1957-2014. Includes all pink shrimp landed into Oregon ports.

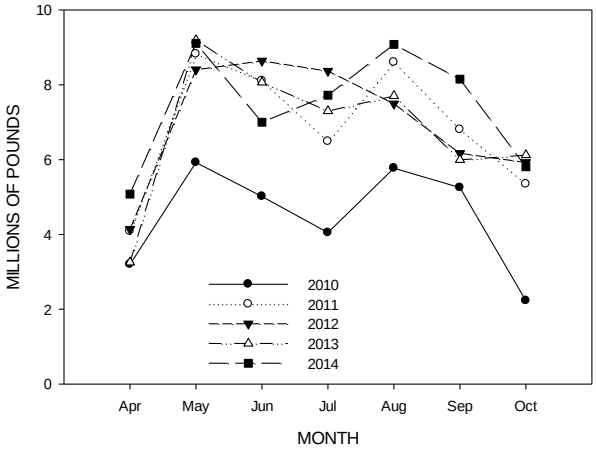

Figure 2. Oregon pink shrimp landings by month in 2010, 2011, 2012, 2013 and 2014.

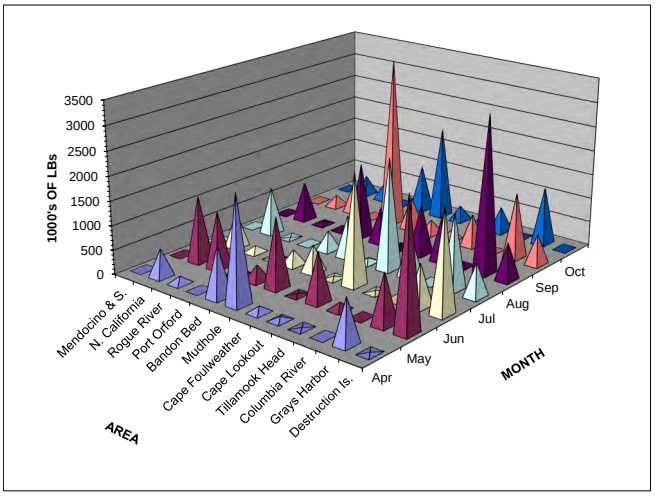

Figure 3. Total 2014 Oregon pink shrimp catch (1000's of pounds) by month and area.

Overall, fishing effort in 2014 was very similar to levels in 2013. Sixty vessels landed shrimp into Oregon ports in 2014; down one from 2013 (Figure 4). The vessels made 1,033 trips in 2014; up 16 trips from 2013 (Figure 5). Total hours fished was 32,641 single-rig equivalent hours (SRE); down 82 hours from 2013 (Figure 6).

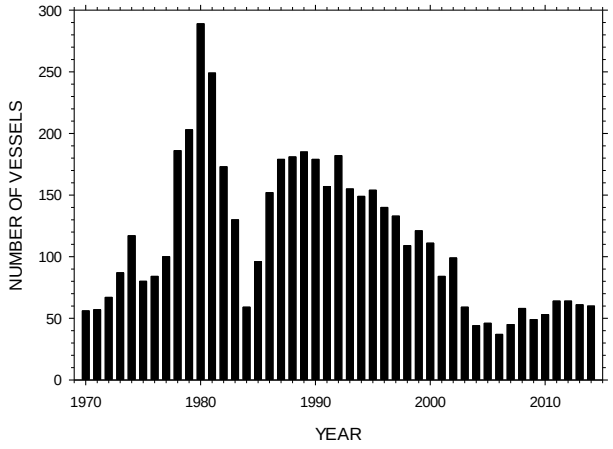

Figure 4. Annual number of vessels landing pink shrimp into Oregon ports: 1970-2014.

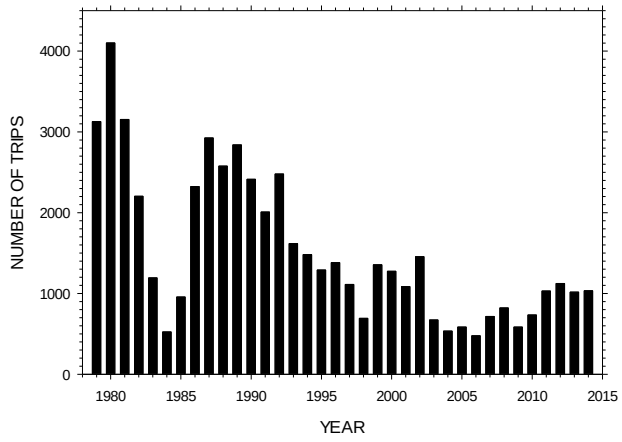

Figure 5. Annual number of trips landing pink shrimp into Oregon ports: 1979-2014.

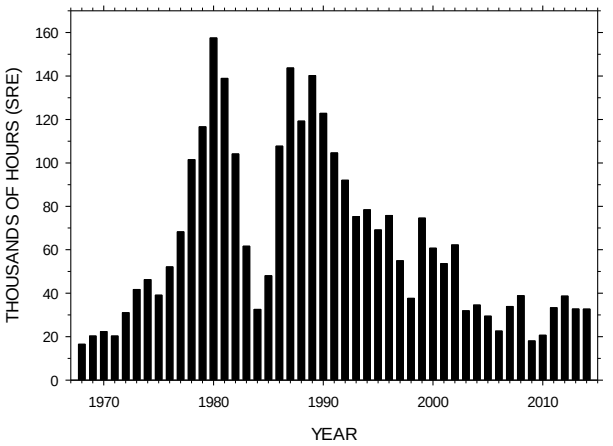

Figure 6. Fishing effort for pink shrimp landed in Oregon, 1968-2014. Note: single-rig hours (SRE) = 1.6 X double-rig hours.

Hours fished by area and month are shown in Figure 7. As a whole, shrimpers spent fewer hours fishing in areas south of Cape Blanco in 2014 and spent more time fishing off Washington. The hours fished from the Mudhole Bed through the Tillamook Head Bed represent about 55.7% of the hours fished in 2014, up from about 40% in 2013. The hours fished by area and month within these beds were highly variable and most consistent in the Cape Lookout Bed.

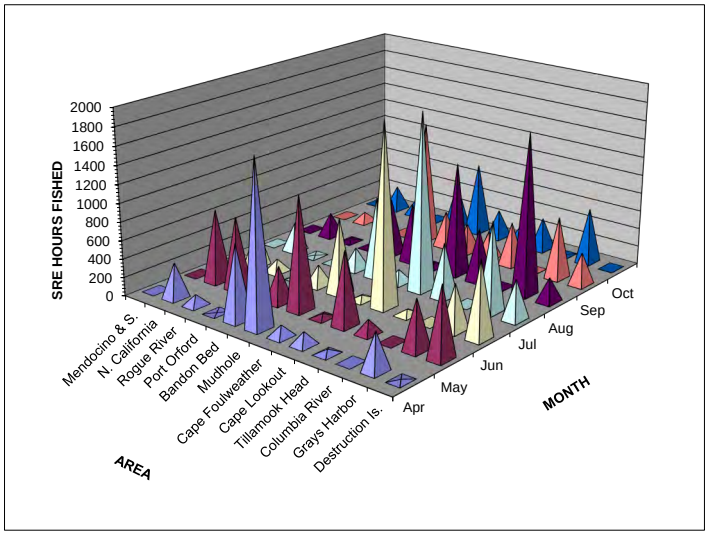

Figure 7. 2014 Fishing effort for pink shrimp landed in Oregon by month and area. (Thousands of single-rig equivalent hours (SRE), Note; single-rig hours = 1.6 X double-rig hours).

The overall average catch-per-hour (CPUE) was 1,592 pounds/sreh; a new record for the Oregon Shrimp Fishery (Figure 8). Moderate to high CPUE occurred in most areas and months in 2014 (Figure 9); a big change from 2013 when the highest catch rates were heavily skewed to southern areas. Average monthly CPUE was moderate to high throughout the season but peaked in September (Figure 10). It remained high through October, fueled by age-1 shrimp that made legal grade toward the end of the season.

Another indicator that shrimp were widespread and abundant in 2014 was a record high average catch-per-trip. Including trips out of all Oregon ports, the average landing over the whole season was about 50,300 pounds (Figure 11).

Overall, the shrimp catch landed during 2014 was heavily dominated by age-1 shrimp; a big change from what was landed in 2011-2013 when age-2 shrimp predominated (Figure 12). Our recruitment model indicated that conditions were right for a record recruitment of age-1 shrimp in 2014, and apparently it happened. The age-1 shrimp were abundant coast-wide, but were apparently most abundant and small in southern areas as evidenced by several count-per-pound (count) violations and high market sample counts from shrimp caught in these areas. Areas from the Cape Lookout bed and north generally had a well-balanced age composition, which meant lower counts.

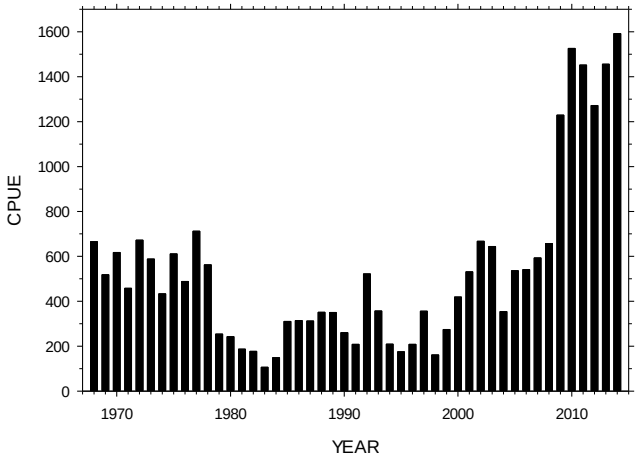

Figure 8. Catch-per-unit-of-effort (CPUE = lbs/SRE hour) for vessels landing pink shrimp into Oregon; 1968-2014.

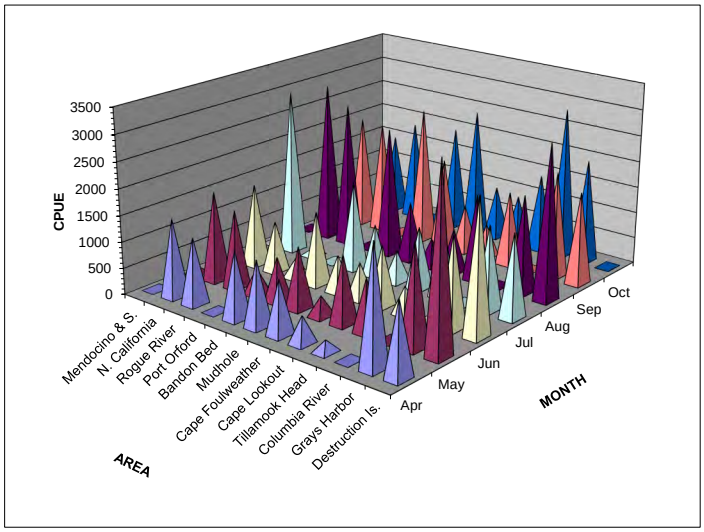

Figure 9. CPUE (=lbs/SRE hour) of vessels harvesting pink shrimp by month and area during 2014.

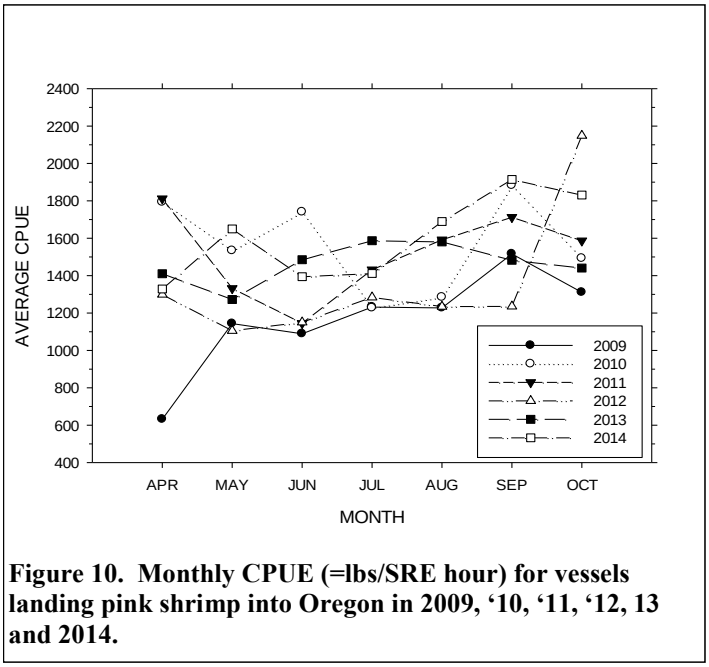

Figure 10. Monthly CPUE (=lbs/SRE hour) for vessels landing pink shrimp into Oregon in 2009, '10, '11, '12, 13 and 2014.

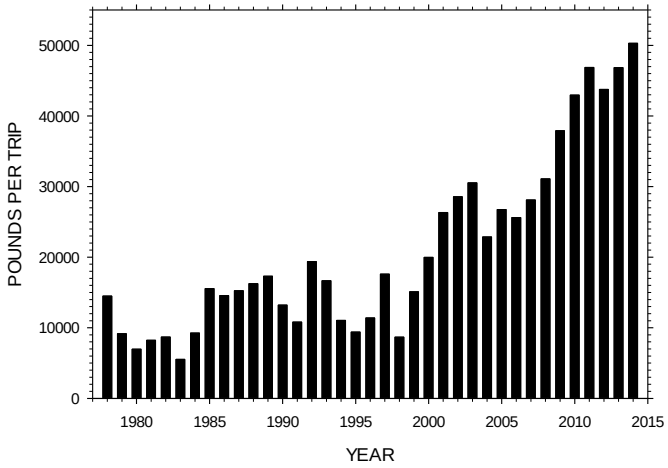

Figure 11. Average annual shrimp catch (pounds) per trip of shrimp vessels landing into Oregon ports; 1978-2014.

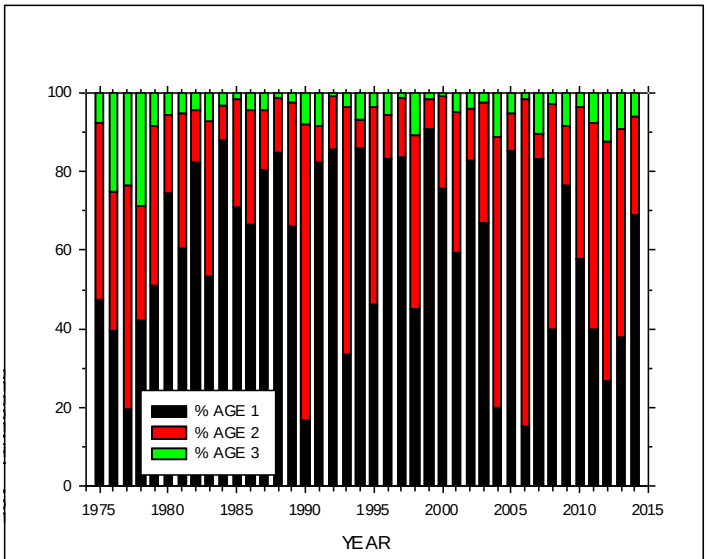

Figure 12. Annual percent age composition of pink shrimp (#'s of shrimp) landed in Oregon, 1975-2014.

The annual weighted average count of shrimp landed jumped up sharply in 2014, compared with levels seen in the last few years (Figure 13). The 2014 count was 136 shrimp/pound. The level reflects the abundance of relatively small age-1 shrimp that were available this year, particularly on the south coast. Although hold-over of age-2 shrimp (age-1 in 2013) was excellent coast-wide in 2014, the extremely high abundance of age-1 shrimp on the south coast made finding volume of low count shrimp harder through most of the season in 2014.

The average ex-vessel price-per-pound was $.57/lb, the highest price since the mid 1990's (Figure 14). A four-tiered price structure predominated. The poorest legal grade received $.35/ lb throughout the season, but the price increased for mid and top tiers as the season progressed and bigger shrimp became less abundant. The top grade received $.86/lb near the end of the season. The monthly average price increased steadily from June through October after starting at about $.51/lb in April (Figure 15). The monthly average peaked in October at almost $.67/lb. The overall ex-vessel value of the 2014 catch was $29,321,045.

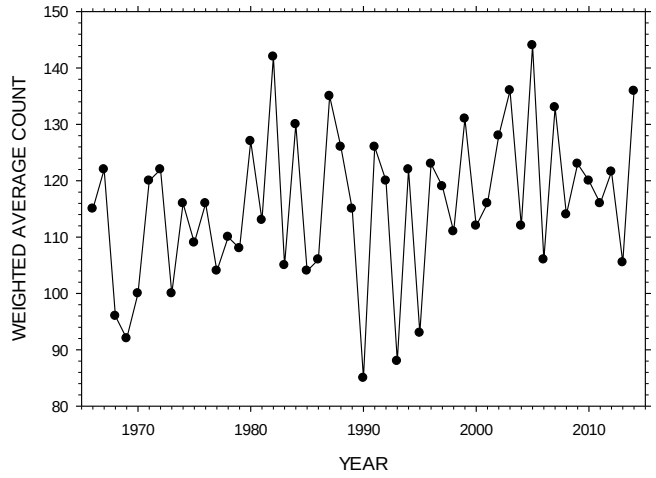

Figure 13. Average (catch weighted) count-per-pound of pink shrimp landed into Oregon; 1966-2014.

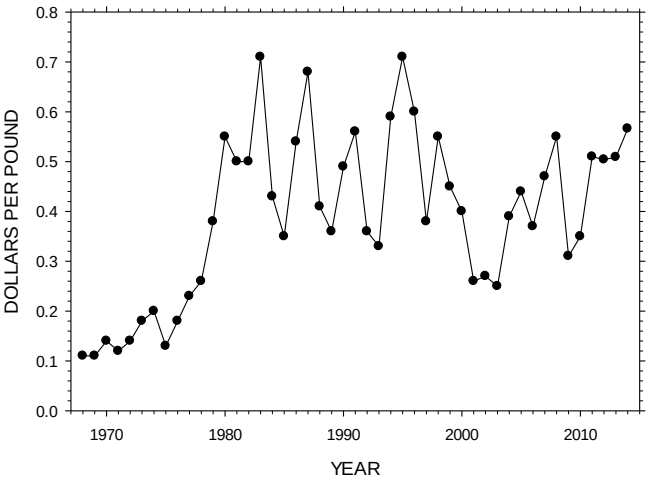

Figure 14. Annual average ex-vessel price per pound paid for pink shrimp landed in Oregon; 1968-2014.

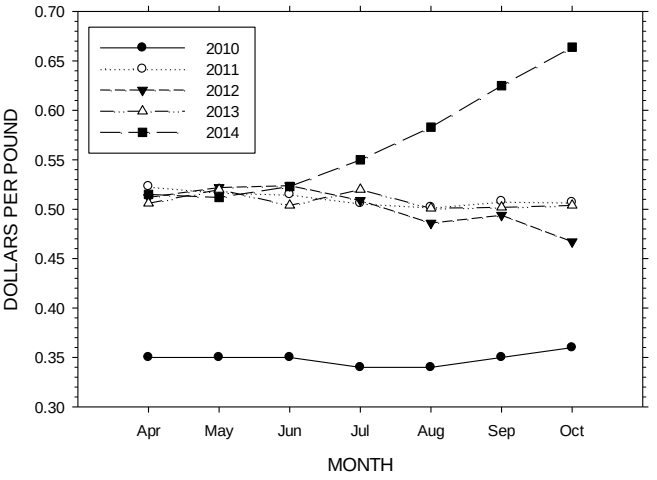

Figure 15. Monthly average ex-vessel price-per-pound paid for pink shrimp landed in Oregon; 2010 through 2014.

Indicators for 2015

Peak shrimp? We're all hoping that the recent trend of near-record landings will continue. Judging by the ups-and-downs of the Oregon shrimp landing history (Figure 1), shrimp production will start to decline at some point. We don't know if we're there yet, but circumstances suggest that change could be afoot. Two of our standard indicators suggest that a decline may be coming (see below), but some outside influences may play in as well. For example, a mild El Nino is predicted this winter (2014-2015). Mild events haven't impacted our fishery noticeably in the past. However, the abnormally warm surface water found all along the west coast (CA-AK) during 2014, combined with a mild El Nino, could have unknown influences on larval distribution during summer and survival over this winter. Also, we heard many reports from shrimpers during summer and fall that juvenile hake (*Merlucious productus*) were abundant on the grounds along the south coast and were spreading north. The hake population over the last few years has generally been distributed off the continental shelf and off the shrimp grounds. A large hake presence on the grounds could have negative impacts on larval survival and abundance.

The prospects for production in the 2015 season appears to be good, but possibly not as good as we've experienced during the last few years. Catch-per-hour (CPUE) was high coast-wide during September and October, suggesting that hold-over of age-1 shrimp into 2015 should be excellent. Barring unforeseen mortality or distribution shifts, age-2+ shrimp should be readily available for at least the first few months of the season. As the season progresses, the fishery will rely progressively more on age-1 shrimp as the age-2+ population is reduced and age-1 shrimp grow.

Shrimpers reported that zero-age (zero's) shrimp were scarce and spotty in their catches during September and October, backing up what we saw in our fall 2014 market samples. These shrimp will be our age-1 shrimp in 2015. The best showing in our samples came from the Mudhole and Bandon beds, but the level was sharply lower this year than last. Very few zero's were found in samples from areas north of the Mudhole. The reports from shrimpers and our sample results suggest that age-1 recruitment may be below average. If so, catch rates may decline late in the 2015 season once older shrimp are fished down.

Our current best recruitment model uses the average sea level from April through January to predict the recruitment level of age-1 shrimp the following April. The average this year was 7.46, suggesting that recruitment of age-1 shrimp in 2015 will be slightly below average to well below average (Figure 16).

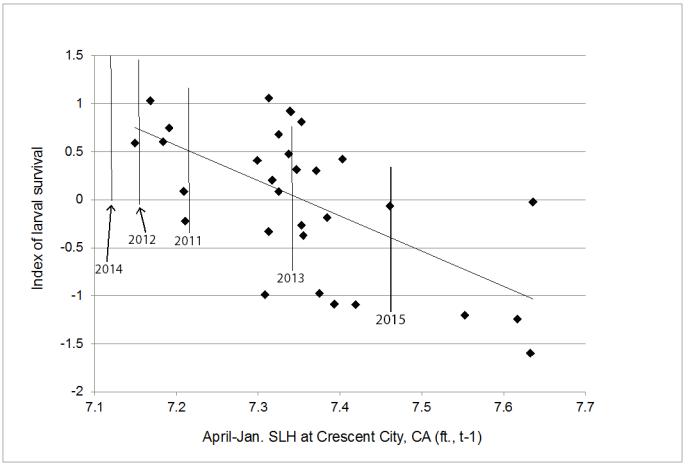

Figure 16. Index of larval survival vs. April-January average sea level at Crescent City, CA. Points shown indicate the year of age-1 catch. The vertical lines indicate the range of larval survival that might be expected given the sea level height for the years identified.

2014 Research

LED Light Test Recap

As we announced via an August in-season newsletter, our tests using a series of ten green LED lights on the fishing line of a shrimp trawl (Figure 17) to reduce Eulachon bycatch proved to be extremely successful. Working on the chartered vessel Miss Yvonne in late July, ODFW shrimp project and Pacific States Marine Fisheries Commission (PSMFC) staff identified a simple method for dramatically reducing eulachon smelt bycatch in the pink shrimp fishery; a method that has since been widely embraced by the fleet and really works!

Figure 17. Photo of the port-side net on deck with ten green lights attached to the fishing line (as tested). The rigid-grate BRD is shown leaning at the stern. The lights proved durable after the nets were dragged on-board at least twice a day, for 8 days.

The work was funded through a NOAA Bycatch Reduction Engineering Program (BREP) grant administered through PSMFC. The "2014 In-Season Pink Shrimp Update" is posted on the ODFW web site at http://www.dfw.state.or.us/MRP/publications/ . If you haven't seen it, please consider looking it up to see color photos of the lights and gear we used, how we set up the lights, and side-by-side catch comparisons. If you don't have web access, we'd be glad to mail you a copy.

Just to sum up; using heavy-duty zip-ties, we loosely attached ten green Lindgren-Pitman Electralume LED lights (Figures 18, 19) to the center third (approx. 25 ft) of the fishing line on one of the Miss Yvonne's two matched nets. The other side was fished dark. Each net was equipped with groundgear commonly referred to as "Newport Mud Gear". The lights were spaced roughly four feet apart, adjacent to the droppers. The effect was switched from side-to-side periodically and a total of 42 tows were evaluated under a variety of conditions. Catch from each side was kept separate using a divided hopper and each was processed separately.

Figure 18. Photo of a single green Lindgren-Pitman Electralume light zip-tied to the fishing line of a shrimp trawl. We found that looser zip-ties worked better to avoid torqueing the light.

Figure 19. The same light shown in Figure 2 showing its relative position to the chain droppers and doughnut-covered groundline. While fishing, the fishing line was about 15 inches above the groundline on each net.

Some of our final results are as follows and are presented graphically in Figure 20:

1. Eulachon were reduced by 90.5% (by weight), with levels ranging from about 60% to 99%.
2. Shrimp loss was 0.7% and was statistically non-significant, but variable.
3. Combined juvenile rockfish were reduced by 78.0% (by weight).
4. Combined flatfish (slender sole, rex, arrowtooth etc.) were reduced by 68.8% (by weight).

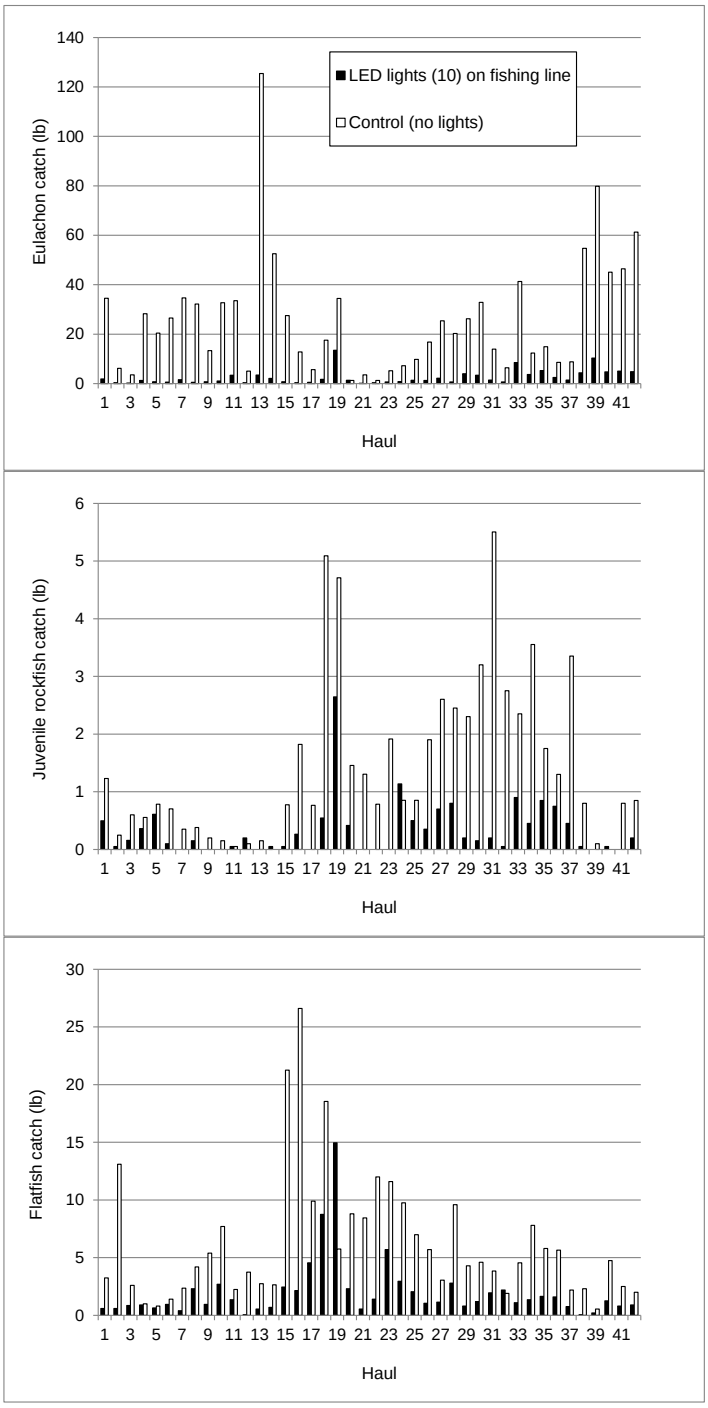

Figure 20. The reduction by weight of eulachon, juvenile rockfish and flatfish achieved in each tow of our illuminated fishing line LED study.

The beauty of this simple, relatively inexpensive method (approx. $40 per light) of reducing eulachon bycatch is that it allows eulachon to avoid the net entirely, eliminating any concerns about stress and resulting mortality to the fish. It's a rare win-win solution between management goals and shrimpers; shrimpers are saved time and effort by avoiding fishy catches, and untold numbers of eulachon are saved.

Our final report detailing all aspects of the eight-day study, titled "Tests of artificial light for bycatch reduction in an ocean shrimp (*Pandalus jordani*) trawl: strong but opposite effects at the footrope and near the bycatch reduction device", has been submitted for publication in the journal Fisheries Research and hopefully will be published sometime during 2015. Once in print, we'll make reprints available upon request.

The development, testing process and rapid adoption of LED's by the shrimp fleet to reduce eulachon bycatch makes quite the story. Fortuitously, a lot of factors came together at once. We have been seeking ways to reduce eulachon bycatch for a number of years with good success, but catches remained high when eulachon were very abundant. The idea of using LED lights to increase eulachon exclusion near a rigid-grate seemed like a long-shot, but considering possible NOAA actions being formulated in their upcoming recovery plan, the shrimp industry needed a better solution. Working with PSMFC biologist Mark Lomeli, two proposals (one unrelated to eulachon) were submitted to BREP asking for funding. Luckily for the fleet, the LED study was chosen. We solicited charter bids from the fleet during early 2014, ultimately receiving only one bid (from Jeff Boardman; F.V. Miss Yvonne: Figure 21). Our initial idea was to test the effect of LED's placed near the rigid-grate, but we decided to test LED's placed on the fishing line as well, because exclusion achieved there would keep eulachon out of the net entirely. The results, apparent even after the first few tows of each test, astonished us. Our hypothesis that LED's near the rigid-grate would increase eulachon exclusion was wrong; it increased eulachon catch by over 100% so we curtailed the test. LED's placed on the fishing line had a near-opposite effect, with an average eulachon reduction of over 90%. Word spread rapidly among shrimpers, even before the charter was completed. We announced the preliminary results in an in-season newsletter within a week after the charter. Within two months, most shrimpers were using or had ordered the lights. We anticipate that nearly 100% of the fleet will be using a lighted fishing line during the 2015 season.

LED Light Use Survey

Late in the 2014 season, we attempted to contact the skippers of all shrimp vessels that landed shrimp into Oregon after August 1. Each was asked to fill out a brief questionnaire about when they started using LED lights, how many lights were used, how the lights were arranged, and the color(s) used. The results strongly showed that the Oregon shrimp fleet heartily embraced the use of LED lights and generally began using them as soon as they could get them (there were initial back-order problems). We were able to survey 47 of the 52 skippers on our list (90.4%). Only three of the 47 skippers interviewed didn't use lights in 2014, but each said that they had purchased lights already or were planning to do so.

Figure 21. One happy crew; shown soon after realizing that eulachon bycatch was drastically reduced by using LED lights on the fishingline of the shrimp trawl. Pictured from left to right; Jeff Boardman (skipper), Bob Hannah (ODFW), Chad Lieferman (deck hand) and Mark Lomeli (PSMFC). Steve Jones (ODFW) was behind the camera. What a moment it was!

The potential impact of LED use by the shrimp fleet on eulachon bycatch reduction is impressive. Based on the dates skippers said they started using lights, they made a total of 282 trips with LED lights in use, accounting for 65.9% of all trips landed into Oregon during August, September and October. Scaling this use to the entire season, the 282 trips represent 27.3% of all trips landed into Oregon in 2014. Assuming that eulachon bycatch was reduced by an average of 90% on these trips, the weight and number of eulachon saved was undoubtedly huge.

Vessel skippers reported using green Lindgren-Pitman Electrolume lights almost exclusively and used an average of about 10 green lights per net. Most placed the lights along the center 1/3rd of the fishing line, but many put lights out in the wings as well. Comments were universally positive; the lights clearly save sorting crews work and many "dumped" tows were potentially avoided.

Through the grape-vine, we heard that blue and white lights worked as well, but we didn't test these colors. One skipper tried multi-color lights and thought he got poorer performance. Reports on durability of Lindgren-Pitman LED's were generally positive but mixed. Some shrimpers reported leakage that may have been caused by attaching the light too tightly at both ends, causing the light to torque. Others said they'd experienced damage to the light housing as the nets were dragged over the rail when retrieving the net. One innovative skipper has developed a LED "light string" setup that utilizes a pressure canister that houses rechargeable batteries. He only used it for two trips in 2014, and will be working out some glitches next season.

We've heard from several shrimpers that their lights become less effective as they dim. During our tests, we changed the batteries daily to make sure we had maximum brightness. Shrimpers probably don't need to change batteries that frequently, but do need to maintain an effective level of brightness. Decreased exclusion performance as lights dim fits with what we know now about the response of eulachon to the lights. Basically, added light allows them to see escape routes under the net better. If lights are dim (or turbidity increases), performance can be expected to decrease. A good way to test brightness is to do a side-by-side comparison between a light that's been used for say two or three days, with one that has new batteries. Lithium-ion batteries will probably provide the best performance.

Discard of used batteries at-sea has come up as a concern. Continued use of lights in the fishery will produce a lot of used batteries over a season. Shrimpers are encouraged not to throw them overboard. Please accumulate used batteries on-board and discard them appropriately once back in port.

As we emphasized in the Mid-Season Update, there may be other lights available on the market. The marine electronics company WESMAR has contacted us and is currently developing an LED light that may prove workable. We provided them with an Oregon shrimp permit list at their request and they intend to send product information to permit holders. If you try "new" lights, please give us feedback on their performance. We want to encourage innovation, with the goal of identifying the best dependable product(s) and arrangement that will be accepted and used universally by the fleet in the future.

Eulachon Population Impact Modeling

NOAA's biological review team for eulachon regards the shrimp fishery as at least a moderate threat to the Southern Distinct Population Segment (SPDS) of eulachon. We decided to do some in-house modeling that utilizes our knowledge of the extent of the areas trawled by Oregon shrimpers versus the total area potentially inhabited by SDPS eulachon, in an effort to estimate the level of impact our fishery really may have on the SDPS as a whole. Our conclusion, given numerous assumptions, is that the west coast shrimp trawl fishery (CA, OR, WA), especially at recent effort levels, would not have been enough to cause the sharp decline of the SDPS . Our paper, published as an ODFW Informational Report, is titled "Evaluating the population-level impact of the ocean shrimp (Pandalus jordani) trawl fishery on the southern distinct population segment of eulachon (Thaleichthys pacificus)". The report has also been forwarded to NOAA's Office of Protected Resources for their consideration.

Eulachon Issues & Developments

News from NOAA

The Southern Distinct Population Segment (SPDS) of eulachon smelt (*Thaleichthes pacificus*) remains listed as threatened under the Endangered Species Act (ESA), and will likely remain listed for some years to come. The SPDS inhabits west coast waters ranging from California to the Nass River in British Columbia, Canada. National Oceanic and Atmospheric Administration (NOAA) protected resources staff at the West Coast Regional Office in Seattle, Washington are in charge of

managing recovery of the SPDS. As mandated under the ESA, they are currently constructing a draft recovery plan that is due out for public review sometime in 2015. We encourage members of the shrimp industry to stay informed of proposals and actions taken by NOAA staff. Please keep informed by visiting NOAA's eulachon web site at "http://www.westcoast.fisheries.noaa.gov/protected_species/eulachon/pacific_eulachon.html". The site includes their most recent Eulachon newsletter, stakeholder meeting schedules, a recovery plan outline and background information put out since eulachon were listed in 2012. It's important to remember that decisions and actions taken by NOAA may influence the way state resource agencies like ODFW are allowed to manage the shrimp fishery in the future.

Apparent Abundance in 2014

Just at face value, eulachon abundance appeared relatively high again in 2014, both in the Ocean and the Columbia River system. Shrimpers reported seeing widespread and abundant eulachon in shrimp catches coast-wide (at least until they started using LED lights). The catches reportedly included at least two size-classes of eulachon. We experienced apparent high eulachon catch in our July sea research too. The eulachon run into the Columbia River during late February and early March 2014 was strong again this year. Abundance was high enough that ODFW and WDF were allowed to conduct a limited sport harvest for research purposes on the Cowlitz River in Washington and the Sandy River in Oregon, and a small commercial harvest on the main stem Columbia River was also allowed.

A Little "Light" Conversation

Since the 2012 listing of eulachon smelt as threatened under the ESA, the subject of eulachon has been "the elephant in the room" when talking about the future of the West Coast shrimp fishery. Although seemingly widespread and abundant, eulachon's listed status poses real challenges to current pink shrimp fishery management regimes in Oregon, California and Washington. Working with the Oregon shrimp fleet, ODFW shrimp project staff has tested several gear arrangements and devices over the last decade in an attempt to reduce eulachon bycatch and other species. Adoption of ¾" grates by shrimpers was hugely successful and has saved untold numbers of eulachon; to the fleets' credit. However, large numbers of eulachon were still being caught with shrimp, as documented by the West Coast Observer Program. We needed to further reduce eulachon bycatch, but were running out of relatively simple and inexpensive ideas to test. As a long-shot, based on what we knew then about eulachon behavior, we tried illuminating the fishing line of a shrimp trawl using an array of LED lights.

Most shrimpers along the West coast know the rest of the story by now. The LED lights worked astonishingly well. We conducted our tests in late July and by the end of August, most of the fleet was using them voluntarily. Reports generally backed up our findings. The prompt adoption of the technique undoubtedly saved an enormous number of eulachon during the last three months of the season (see 2014 Research, pg 5).

Broad adoption and continued use of LED lights by shrimpers, and the resulting sharp reduction of eulachon bycatch, could ultimately influence how NOAA protected resources staff view shrimp fishery impacts on the eulachon population and how they ultimately construct the Recovery Plan. We now have a proven tool to keep eulachon bycatch to a minimum. **The key is that shrimpers need to continually use them!** During our study, LED use reduced the bycatch of several species that we encountered. However, we heard reports that the lights work poorly for hake and whitebait smelt (we didn't encounter these species). In the future, if shrimpers get "swamped" with a species like juvenile hake and eulachon are relatively scarce, they may be tempted to poorly maintain or remove their lights. In such a situation, shrimpers needed to remember that eulachon bycatch is still being reduced, even when their numbers seem low. **The lights are still extremely important!** The number of eulachon caught really matters and reducing the numbers is the key to preserving the status quo in the shrimp fishery as best we can.

MSC annual review

ODFW shrimp project staff met in late March 2014 with Marine Stewardship Council (MSC) representatives for the fishery's annual performance review. Most aspects of the project were discussed, with special emphasis on current eulachon issues and our recently proposed Target and Limit (T&L) management system for the pink shrimp fishery. Reviewers comments were favorable concerning the proposed T&L Plan. You can review the proposed plan on the ODFW web site at http://www.dfw.state.or.us/MRP/publications/docs/Shrimp_Target_and_Limit_Management.pdf

Also regarding MSC; both Washington shrimp industry representatives and Washington Department of Fish and Wildlife (WDFW) shrimp project personnel contacted us inquiring about the types of data and other information that we collect and how it relates to Oregon's MSC certification. The inquiries apparently stem from some recent industry proposals that the Washington shrimp fishery should apply for MSC certification.

2015 Research Priorities

Starting in 2013, we changed the format of this section presenting our research plans for the upcoming year. The change addresses an MSC requirement that the shrimp project formalize its approach to planning for the fishery-related research that we do. In our new format, we address three research areas briefly every year: shrimp population dynamics, non-target catch and ecosystem effects. Note that although we address each priority every year, we don't necessarily have planned activities for all three every year. In interpreting the 2015 plan presented below, it should be noted that regardless of what priority is assigned to any particular research plan component, the completion of work in any given year will always depend on staff and equipment availability and the amount and type of funding available. The availability of research funding can be highly variable from year to year.

Shrimp Population Dynamics (Priority 1)

Our ongoing efforts to sample the fishery, analyze sample and logbook data and periodically evaluate our environmental models, trends in the fishery and any new evidence relating to fishery-driven stock declines is our top priority. This work is our top priority because it is the basis for managing the fishery

the way we do, using primarily just a 7-month season, limited entry system and a maximum count-per-pound regulation. In 2015, this component of our research plan will consist of two primary activities. First, we will continue with our basic monitoring program consisting of fishery sampling and collecting and analyzing logbook data to estimate total catch-at-age and effort by area. Second, we plan to complete a re-evaluation of the fishery's long-term effects on shrimp population structure, a project started in 2014. The study examines how recent increases in shrimp density have influenced growth, age composition and sex change of ocean shrimp.

Non-target catch (Priority 2)

Due to the very successful LED light research completed in 2014 (outlined in the special mid-season shrimp newlsletter last year), and the rapid adoption of this technology by virtually the entire U.S. west coast fleet, the shrimp fishery's bycatch of eulachon, slender sole and juvenile rockfishes has again been further reduced (significantly). Our research activities in bycatch reduction in 2015 will focus on completing the publication of the LED light research, as the results may have some application for bycatch reduction in a few other major fisheries. As it may ultimately also become necessary to create rules requiring the use of LED lights on the fishing lines of Oregon shrimp boats, we hope to continue to gather feedback from fishermen in 2015 on how the lights are best installed, effectiveness, maintenance and durability. Once again, if eulachon abundance drops off in 2015, please don't stop using the LED lights! Eulachon bycatch mortality that seems minimal to a shrimp operator won't necessarily be viewed that way by NOAA Protected Resources staff when they evaluate how this fishery will need to be operated going forward. If fishermen have ideas on how to best install or utilize LED lights on their fishing lines to improve durability and maintain trouble-free operation, we would very much appreciate hearing about it so we can help "spread the word".

Ecosystem Effects (Priority 3)

Research on ecosystem effects is our lowest research priority simply because our research program is small and the issue of ecosystem effects of west coast fisheries is large and complex (large spatial scales, effects from multiple fisheries, a generally poor understanding of many species that are not the focus of major fisheries, etc.). In 2014, we completed the write-up of the 2013 re-survey of Nehalem Bank. Those results are contained in an Informational Report entitled "A comparison of 2007 and 2013 macroinvertebrate surveys of mud habitats at Nehalem Bank, Oregon: changes in areas with continued trawling and those closed to trawling in 2006", which can be downloaded from the agency web site. In 2015, we have arranged with a shrimper to field test an experimental PVC-covered groundline we have developed that has no "pinch points" to grab and uproot sea whips. We hope simply to learn if the design is effective for catching shrimp and how durable it is during normal handling. We also hope to make progress in 2015 on developing camera systems and study designs to learn more about the ecosystem effects of shrimp trawling.

Observer News

No major changes are anticipated in 2015 regarding the West Coast Observer Program activities in the shrimp fishery. Selected Oregon, Washington and California shrimp vessels will continue to be required to accommodate observers. Observers will be documenting the use of LED lights this year, in addition to their other duties.

Enforcement Issues

Count-per-pound (count) became an issue in 2014 for the first time in several years. Oregon State Police (OSP) officers issued count citations to several Charleston-based vessels during May, for landing shrimp with an average count exceeding 160 shrimp/pound. According to OSP, three shrimpers were later convicted of a Class A Misdemeanor, forfeited the value of their catch to ODFW, and were ordered to pay restitution to ODFW for 5% of the value of their catch. One of the fishermen was additionally placed on court probation for one year. Comments from shrimpers, both in Charleston and other ports were positive about the citations. We commend OSP for their quick and effective response to the count problem!

Recent strong year-classes of shrimp and good hold-over of age-2 shrimp may have lulled some shrimpers into complacency regarding count. During the last few years, south coast shrimpers were used to travelling short distances and getting big loads and good grade quickly. Temptation may have led to some count problems this year because small age-1 shrimp were so abundant in nearby areas. We want to remind industry that both shrimpers and shrimp buyers may be cited for count violations. Shrimpers need to closely monitor shrimp count at-sea and buyers need to call OSP to report suspected illegal loads. For anyone who is unsure about which type of scales work best at-sea, or how much the average weight of retained shrimp is likely to change, we have two reports available which detail our research in these areas. Just call us for copies, or to ask any other questions about count-per-pound issues (541 867-4741).

Regulation Info.

Groundfish Limits

The NMFS proposed 2015 groundfish limits for shrimpers are listed below.

- The groundfish TRIP LIMIT for shrimpers is 1500 lb./trip, not to exceed 500 lb./day.
- The weight of groundfish landed may not exceed the weight of shrimp landed.
- Canary Rockfish, Thornyheads and Yelloweye Rockfish are prohibited.
- Lingcod, 300 lb./month with a 24" minimum size limit.
- Sablefish; 2000 lb./month.
- All other groundfish; Landings of these species count toward the per-day and per-trip groundfish limits and do not have species-specific limits.
- Limited entry groundfish vessels possessing pink shrimp permits and harvesting pink shrimp must stay within the daily/monthly limits established for the shrimp fishery. They must also include any fish catch taken while shrimping toward their species limits for the limited entry groundfish fishery.

Essential Fish Habitat Trawl Closures

The Pacific Fisheries Management Council (PFMC) has designated several Essential Fish Habitat (EFH) areas off the Oregon coast as no-trawl zones. The areas are set aside to protect hard-bottom habitats and associated species. Shrimpers are cautioned NOT to trawl within these areas. The NMFS will enforce the EFH no-trawl areas via the Vessel Monitoring System. The area-closure that may affect Oregon shrimpers most is the Nehalem Bank/Shalepile EFH. Other EFH no-trawl areas near commonly shrimped grounds are Daisy Bank, Stonewall Bank, Heceta Bank and Coquille Bank. The coordinates delineating the Nehalem Bank and other EFH areas are listed on the PFMC web page at "http://www.pcouncil.org/groundfish/fishery-management-plan/fmp-appendices/", under Appendix C #3: Coordinates for EFH Conservation Areas.

CA/OR Shrimp Trawl Mesh Regulations

Some Oregon shrimpers traveled below the California/Oregon border to harvest shrimp in 2014. We heard no reports of shrimping violations from these beds during 2014, but we want to remind Oregon shrimpers again of the need to be thoroughly aware of shrimp trawl regulations in both California and Oregon before they shrimp below the border.

California regulations require all California permitted pink shrimp trawlers fishing below the Oregon border to use trawls with a mesh size no smaller than 1-3/8" between the knots when shrimp trawling from 3-200 miles offshore. No trawling is allowed within California state waters (0-3 miles). Also, these vessels may not have any mesh smaller than 1-3/8" between the knots anywhere on-board (including extra codends). Oregon permitted pink shrimp trawlers fishing below the Oregon border that don't have a California permit must also use nets (including codends) with mesh no smaller than 1-3/8" between knots. If there is any other mesh in their nets or on-board (i.e. stored codends), such a vessel may not legally transit within California state waters (0-3 miles) at any time during the trip. Details on pertinent regulations can be found on the California Department of Fish and Wildlife website at: **http://www.dfg.ca.gov/**, pages 62-64.

Oregon regulations require that shrimp harvested below the California/Oregon border and landed into Oregon be caught with California-legal nets. The regulation reads; "It is unlawful to land shrimp taken south of the Oregon-California border with nets having a mesh size of less than 1-3/8 inches between the knots". Regulations pertaining to shrimp trawling can be found at: https://www.wildlife.ca.gov/
. Just search on "Commercial Fishing Digest".

VMS and Declarations required

The National Marine Fisheries Service (NMFS) permanently requires shrimp vessels to have an approved and operating Vessel Monitoring System (VMS) on-board. For VMS-related information, please consult the NMFS "Compliance Guide for the Pacific Coast Groundfish Fishery Vessel Monitoring Program" at the following website: http://www.westcoast.fisheries.noaa.gov/fisheries/management/vms.html.

Additionally, NMFS requires shrimpers to file a declaration report before the vessel is used to fish in any Rockfish Conservation Area (RCA). Shrimpers need to declare before leaving for their first shrimp trip of the season. Only one declaration is required for the season, providing that the vessel doesn't engage in another fishery during the season. For details about declaration procedures, please visit the NOAA Fisheries Office for Law Enforcement website at the address listed above.

Parasites Reported

We received several information requests from shrimpers and processors during 2014 regarding two species of parasites on pink shrimp that either they'd never seen before or which seemed abnormally abundant in some areas. Both species are well known parasites of selected crustacean species along the west coast. Each species is an unfamiliar example of types of critters familiar to many of us.

The first species, ***Bopyroides hippolytes***, is a parasitic isopod (think of a "pill bug"). We see it on shrimp from our market samples each year in fairly low abundance. It lives on the gills of the shrimp, underneath the shell covering the "head" (carapace). Viewed from the outside, it appears as a blister on the carapace of a shrimp. Cutting away the blister reveals the isopod (Figure 22). Reported detrimental effects on host shrimp include slower growth rates and retarded sex change from male to female.

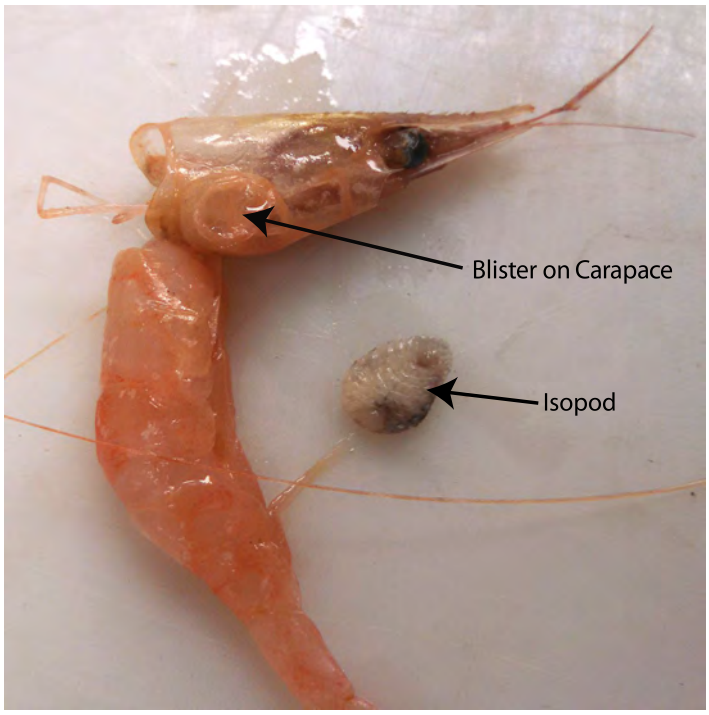

Figure 22. A pink shrimp shown with a parasitic isopod *Bopyroides hippolytes that's been* removed from a characteristic blister on the shrimp's carapace. Typically, an infested shrimp will have just one blister, about 1/4 inch in diameter. Photo credit: unknown.

The second species is the parasitic barnacle *Sylon hippolytes* (think goose-neck barnacle, common on floats at-sea). The group is well documented among west coast shrimps and elsewhere in the northern hemisphere, but has not been seen by our staff until now. Infested shrimp have a "pinkish" sac-like structure attached to the underside of their abdomen (Figures 23&24). We saw several examples this year from shrimpers and in market samples of shrimp caught in areas off Washington. Processors reported that the sac-like structures interfered with cooking and peeling, slowing processing lines down at times. Unfortunately, infected shrimp will die after the parasite has reproduced.

It's unknown how the seemingly unusual infestation level seen in 2014 off Washington compares to high levels reported in the past off British Columbia. However, the extremely high abundance of pink shrimp off Washington this year may have facilitated transmission of the parasite.

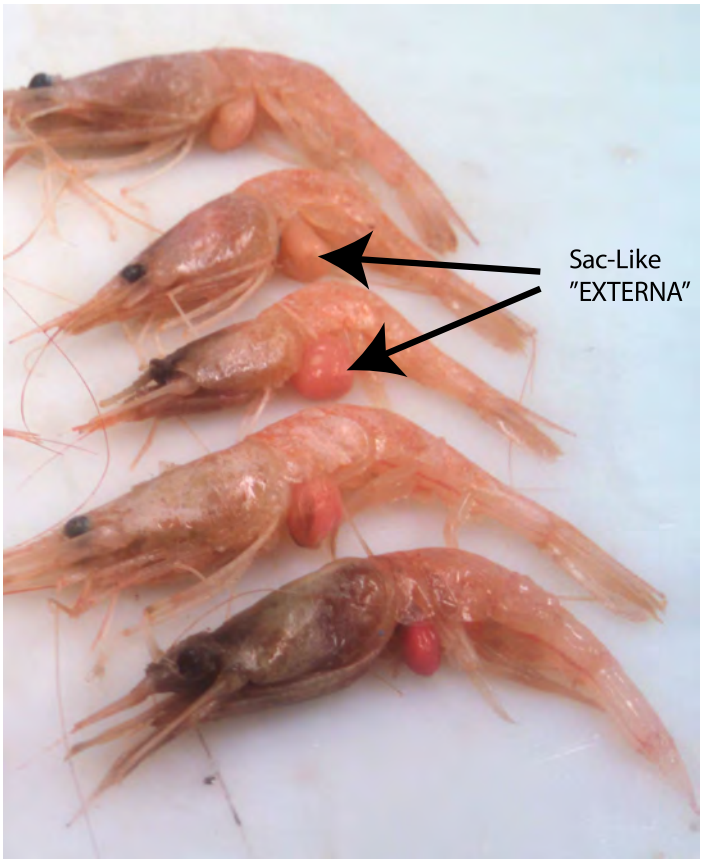

Figure 23. Five pink shrimp afflicted with the parasitic barnacle *Sylon hippolytes*. The characteristic sac-like "Externa" (a reproductive structure) is easily seen. Non-visible parts of the parasite permeate the cephalothorax ("head") of the shrimp internally, eventually killing the shrimp. Photo credit: unknown.

Figure 24. Close up photo of two pink shrimp; one afflicted with the parasitic barnacle *Sylon hippolytes* (left), alongside a shrimp that's apparently unafflicted by the parasite. Photo credit: unknown.

Reports Available

Hannah, R.W. et al. 2014. A comparison of 2007 and 2013 macroinvertebrate surveys of mud habitats at Nehalem Bank, Oregon: changes in areas with continued trawling and those closed to trawling in 2006. ODFW Information Report number 2013-03, 30pp.

Hannah, R.W. 2014. Evaluating the population-level impact of the ocean shrimp (*Pandalus jordani*) trawl fishery on the southern distinct population segment of eulachon (Thaleichthys pacificus). ODFW Information Report number 2014-06, 24 pp.

Hannah, R.W. and S.A Jones. 2014. The Population Dynamics of Oregon Ocean Shrimp (*Pandalus jordani*) and Recommendations for Management Using Target and Limit Reference Points or Suitable Proxies. ODFW Information Report number 2014-08, 24pp.

Hannah, R.W., Lomeli, J.M. and Jones, S.A. In Review. 2015. Tests of artificial light for bycatch reduction in an ocean shrimp (*Pandalus jordani*) trawl: strong but opposite effects at the footrope and near the bycatch reduction device. Fisheries Research.

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We'd like to extend special thanks to Mr. Jeff Boardman (owner and skipper of the F.V. Miss Yvonne, Newport) and crewman Chad Leiferman for making our LED light work possible in 2014. Jeff was the only bidder for the BREP funded project and without his bid, this important and extremely timely work would likely have been pushed back into 2015 (perhaps after the NOAA eulachon Recovery Plan was drafted).

We also thank Mr. Jack Emmons (Hallmark Fisheries, Charleston) for his willingness to adjust offloading schedules to accommodate the special needs of the LED research.

Good Luck Shrimping in 2015!