Things May Not Be What They Seem

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Wherefore Are The Critters?

In these glorious days of the 21st century with our instant communication, and myriads of data at our fingertips, I think most people in the Puget Sound region are quite assured figuring we probably know what's going on in our neighborhood's marine habitats. And, why not, the University of Washington is truly a powerhouse of marine research. Additionally, other colleges and universities in region, both in the US and Canada, also have vibrant marine programs. It would be reasonable to assume we have a pretty good handle on at least our local marine ecosystems.

Unfortunately,… that isn't the case. I would argue we don't have any real idea about specific interactions in the vast majority of marine habitats in the region, and for many of the others we have only a limited understanding of the interactions and forces at play. At best, there is a superficial understanding of a few organisms found in a few assemblages, but even this is questionable. Additionally, modern advances in genomics and molecular genetics indicate that we likely have vastly underestimated the number of species found in most marine ecosystems – worldwide, not just in our region - so our lack of understanding is really and truly sucky! As for the majority of the interactions occurring… well, speaking as a professional marine ecologist about all I can do is shake my head at the paucity of our knowledge.

To understand this situation a bit and borrowing a phrase from the introduction to the old 1950s oater, "The Lone Ranger," it is necessary to reflect a bit on "those thrilling days of yesteryear." Unlike when I started in this version of the game of life, back in 1970, there are now numerous guidebooks available now that list or illustrate the organisms found in our nearby oceans. I specifically should point out that *Beneath Pacific Tides* by Greg Jensen and co-authors is one of the more complete of these tomes, and a truly excellent book it is. But… to some extent such excellent treatments are misleading. They foster the idea that if we know WHAT an organism is, we automatically know its role in the natural systems where it is found.

That's a big Nope, folks.

As result, for a naïve individual perusing some actual shelves of a real bookstore (Do people still do that?) or the metaphorical bookshelves of our favorite online behemoth, Amazon.com, it might seem that we know what's going on out there under all that wet stuff that sloshes back and forth between the beaches of Puget Sound. After all, it can't be too hard to put it all together, it would seem that there is not too much area to learn about.

The Puget Sound/Salish Sea region is relatively small, easily defined and characterized; it is truly tiny compared to, for example, the Caribbean or the Great Barrier Reef. It is easy to look from one side to the other across Puget Sound, there really isn't a lot of physical space between those boundaries to fill up with habitats, critters, and other fun goodies. And, hey, how diverse can such a region be? After all, it all looks the same from above the water's surface.

Yeah, sure, you betcha!

Time

People forget, or don't know, just how recent our acquisition of knowledge about our local marine puddle really is – and similarly, most people have no conception of how sparse, and selective that information base is. Perhaps the following discussion and anecdote may help put things in perspective. And, sorry, but this tale is not about mollusks.

I first started my subtidal research in the greater Puget Sound area in 1970. At that time, the number of diving scientists working in the entire Oregonian Biome, a biological region stretching from Pt. Conception, California, to the Kenai Peninsula of Alaska could be counted on the fingers of one hand. Foam neoprene wet suits were still a "new thing", and the entire scuba diving community in the Pacific Northwest contained far fewer than 1000 people. There were essentially no true marine ecologists working here, in the two or three years before I started at UW, the UW Zoology Department had fledged about 5 newly minted Ph. D. level marine ecologists, and they were really the first scientists in the area who spent a significant amount of time actually underwater looking at the habitats or organisms they were studying.

Now, I probably should qualify that last statement a bit; there were some folks working in the intertidal habitats, and there were a few more diving to collect organisms to be examined in a laboratory. But, the intertidal zone does not a marine community make, it is an ecotone or boundary between the terrestrial and subtidal ecosystems, with its own distinctive biota – which is definitely not dominated by truly marine organisms.

Particularly, in 1970, there were very few individuals who were doing ecological work under the water's surface. And, pardon me, but calling oneself, a marine ecologist, implies, to me, that one does one's research work under water actually in the habitat that is being investigated. In those days, that was just not done, even in tropical waters; the ability of water to conduct heat away from oneself means is perfectly possible to get too cold without a wetsuit and to be able to function cogently for very long even in warm tropical water. Up here in the cold temperate waters, the initial attempts at wet and dry suits in the 1950s were at best useless. And to consider that it is possible to do marine ecology without getting very wet, is akin to say it is possible to study a forest by remotely taking samples from some aircraft flying over the forest above an overcast cloud layer.

As a result of these factors, in the early 1970s local subtidal habitats were essentially unknown. I investigated at 108 different soft-sediment areas as part of my doctoral dissertation research, and I can guarantee that my diving partners and I were the first humans ever to observe those habitats. Among other things, back then there were simply no other divers crazy enough to dive in those areas. There is a corollary to this: Not only could we not anticipate the specific types of organisms we were likely to encounter, but any interactions occurring in and structuring the communities could not even be guessed.

This unfamiliarity resulted in a learning curve that took time to process before it was possible to reliably observe what was being seen. Consider, if an ecosystem is wholly unknown, how is that habitat even evaluated? We made up the rules as we went along.

As an example of the problem, I was anticipating using the habitat in Friday Harbor Bay, directly adjacent to the UW Laboratories as my major study site. Instead of just "jumping right in,' I decided that it would be simple common sense to see if there were any data already available about that habitat. Now, this embayment is the largest habitat that directly impinges upon the UW facility. I presumed that after several decades of operation there should be some data about the facility's adjacent habitats. That presumption was absolutely incorrect. The several decades of research and teaching, involving many hundreds of students, and scores of researchers working at the labs produced zilch. I could find no indication that anybody ever had even a single thought whatsoever about the habitat. There was nothing in the library, no student reports, no preliminary research, not even a guess of what was found in the bay.

Okay, so I had to pull myself up by my own bootstraps. But, at the time, there were no consistent protocols about how to repeatedly sample such areas adequately and efficiently. In North American and European marine studies, most methodology used for shallow water marine benthos had been derived from limnological studies of small lakes or ponds. For many reasons, such methods were inadequate.

Unfortunately, in the intervening 50+ years, the situation hasn't changed a whole heck of a lot. There are many sampling programs now in effect in the Salish Sea marine habitats. Over the years, working as a private scientist, commercial consultant, and regulatory agency contractor, I have been instrumental in developing some of the protocols for such samples, as well as having taken hundreds of samples and directed many projects ranging from small personal projects to multiphasic programs covering large areas. The one take home message from and about all of these studies is that any data obtained have to very carefully interpreted. The flaws in the programs are legion; but even cursory discussions of the problems would be voluminous and, in some cases at least, fairly arcane. A short newsletter publication such as *The Dredgings* is just not the place for such explanation. Suffice it to say, the results of essentially every study I am familiar with from the Puget Sound/Salish Sea are flawed, to a greater or lesser degree. Without going into great detail, I will state the two major problems are a lack of funds and a lack of situational awareness of the environment and the creatures found in it.

A couple of the background problems are worth considering. The basic flaw is in the inadequacy of the techniques and procedures for determining the biota present. There are three major problems. The first problem is that many of the organisms are small or smaller or even smaller than that… and such creatures are both hard to identify and difficult to study, leading directly to a profound paucity of analytical results. The second problem is that many of the organism assemblages are very diverse. It is very difficult trying to meaningfully compare highly species-rich samples containing hundreds to thousands of individuals spread over dozens to hundreds of different organism groups.

Another major problem, unfortunately seldom noted, is that due to the design of the quantitative sampling apparatus used, samples are typically obtained only from the upper 30 cm (1 foot) of the sediment. In most subtidal areas in the region, the unconsolidated sediments, such as sands, muds and the like, may be aerobic and full of life to depths well exceeding 3 m. These deeper sediments are, in most cases, completely ignored; there are simply no useful guesses as to what lives down in those deeper layers. These depths may be sampled, but that involves throwing an awful lot of money at somebody who has the expertise to do it. Such costs are prohibitive. The final result of all of these factors is that even in familiar areas with an apparently well characterized biota, surprises await. In short, we probably know less than half of the species found in any given area, and likely far less than 5 percent of the interactions.

All of these factors result in some truly remarkable occurrences. Every now and then diligent observers get the chance to see something truly extraordinary, coming out of the sediments.

The Worms ….

The first image (**Fig. 1**) shows the head of one worm I encountered as I was surveying along a permanently marked, in one-meter increments, 100 meter long transect line I had emplaced in my 10,000 m2 study site in Friday Harbor Bay. The body was about one centimeter (0.4 in) in diameter. This bad boy was a ribbon-worm, or nemertean.

Most nemerteans are predators, and few species are parasitic. This worm, *Tubulanus albocinctus* is predatory. It is also attractive, being a bright-red ochre colored, with white striped detailing. Likely this

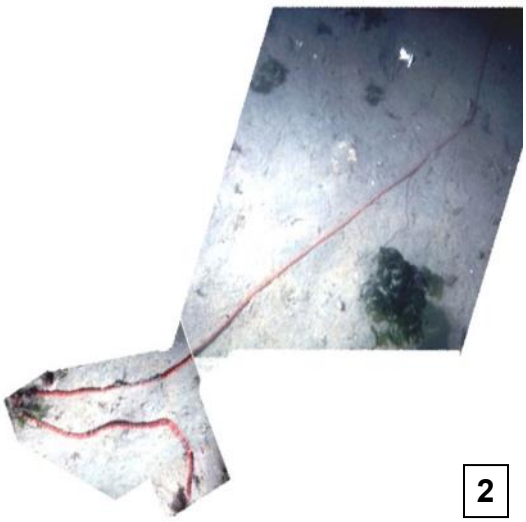
The head of the large *Tubulanus albocinctus* worm

coloration is aposematic, (used to warn off predators) but that is only a guess, essentially nothing is definitively known about this species' natural history.

Many authorities regard this species as being of moderate size; for example, Jensen et al. state the individuals reach up to a meter in length, which may actually seem fairly large for a marine benthic animal.

Uh, no…

The second image is a composite of three images of the same worm. (**Fig. 2**) The head is at the lower left, and the body extended toward the upper right where it may be seen fading away into the distance, about 4m to 5m distant from the head.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My permanent transect line is just out of sight to the right, stretched more-or-less parallel to the worm, so I was able to follow the worm's body from the tip of its snout to where the tip of the tail crossed transect… 16 meters away! This was neither a guess, nor an estimate. The line was marked and numbered at one-meter increments. The tip of the posterior end of the worm was not photographed. (This was taken back "in the day" when the number of photographs was determined by the amount of film in a canister, and the last of my film was used on the previous images).

In other words, the worm was over 16m long, more than 52 feet long! I have seen 3 examples of such long *T. albocinctus;* two in my Friday Harbor Bay study site, and one near Cia Rock in Trevor Channel in Barkley Sound, a few kilometers from the Bamfield Marine Station, now called the Bamfield Marine Science Centre, on the southwest edge of Vancouver Island. Other than the one individual that conveniently crossed my transect line, I can only estimate the lengths for the two other specimens, and they both were longer than 10 meters.

Doing some back-of-the-envelope calculations, and assuming an elliptical cross section, I was able to calculate a ball-park guestimate of volume for the largest worm and relate that to its mass, assuming it had a density more-or-less equivalent to sea water. From that, I could guestimate its weight to be between 2 and 3 kilograms (about 4.5 to 6.5 pounds). This mass makes this worm one of the larger predatory animals in the Friday Harbor Bay benthic habitat. Yet, other than the species presence and the literature description, essentially nothing is known about them. What they eat, how they hunt, where they are found when they are not out in front of all the gods and everybody else, how long they live, and so forth, all of these characteristics are unknown. And, they aren't alone.

There is a different nemertean, possibly a *Cerebratulus* species, also found in the same region. (**Fig. 3**) This animal was a brilliant "1940s-lipstick red". I collected one of this species subtidally near Seward, Alaska and it measured over 18m (60ft) in length. I took it back to my teaching lab at the University of Alaska, Anchorage, and kept it for student observations for about two weeks until I returned from whence it was collected. The following summer, I observed several of what I presumed were the same species at an intertidal site near Homer, AK. Additionally, the late Paul Illg, formerly of the UW Zoology department, told me he saw two similarly colored long, red nemerteans in the intertidal zone near Turn Island, at the southern corner of Friday Harbor Bay. A few other nemertean species have had reputations for being quite long, one specimen of *Lineus longissimus* collected in the mid-nineteenth century was estimated to be about 55 m (180 feet) long.


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Most of our local nemerteans are small, less than 10 cm long, but even some of these, *Cerebratulus* species, are quite bulky muscular worms that swim very well. Some years ago, during some night dives, the late Roland Anderson and I would encounter them commonly offshore of the Don Armeni boat ramp in West Seattle and noted their swimming ability.

The point of this long ramble is not really about the worms, per se, but I think they make a series of rather good exclamation points about the lack of information about the fauna of all such habitats and by our ignorance of the shallow water ecosystems of the region. Most of the animals found in unconsolidated habitats in the Salish Sea shallow subtidal habitats, as well as similar marine habitats throughout the world, are simply unknown except for some basic taxonomic information, and the occasional happy -and unexpected observation.

Until another time, Happy Trails…

Potentially Interesting References

Jensen, G. D, D. W. Gotshall, and R. E. Flores Miller, 2018. *Beneath Pacific Tides, Subtidal Invertebrates of the West Coast*. Mola Marine. Bremerton. WA 296 pp. ISBN 978-0-9898391-1-2.

Roe, P., 1976. Life history and predator-prey interactions of the nemertean *Paranemertes peregrina* Coe. *The Biological Bulletin*, 150(1), pp.80-106.