SUMMARY:

1) Octocoral density trends in the nearshore hardbottom habitat tend to follow one of two patterns; (1) a slow insignificant decline or (2) a rapid increase followed by a rapid decline.

2) Just four sites dominate the octocoral density figures comprising over 70% of the total counts; oceanside Marathon; Gulfside at Content Keys; oceanside west of Key West; and oceanside near Boca Chica Naval Air Station.

3) One density figure at one site showed a precipitous decline. Sea plume abundance on the oceanside near Marathon fell to roughly half its initial density (2003 vs 2007) (see page 4).

4) It is not possible to assign a definitive cause for these trends. Discussed below are possible environmental (natural and manmade) causes plus the possibility of sampling error (and why).

If you look at only a few examples below, I suggest *Pterogorgia citrina* (Yellow seawhip) (page 3); *Pseudopterogorgia* spp. (Sea plume) (page 4); and Sea rods (page 6). The last page shows the sampling sites and a very brief field methods overview.

INTRODUCTION:

First of all; some notations about the collection and distribution of these data

More than 40% of the octocoral counts come from a single site – S24 located on the oceanside middle Keys near Marathon High School. Just four sites make up 73% of the counts, S24; S56 (west of Key West oceanside); D13 (Content Keys Gulfside); and P17 (Boca Chica oceanside lower Keys). From the taxonomic side the Angular seawhip (Pterogorgia anceps) comprised 28%, Sea plumes (Pseudopterogorgia spp) 19%, Corky finger (Briareum asbestinium) 16%, and the sea rods (5 taxa) collectively made up 30% of the total.

The data were collected by students (i.e.; trained but not experienced) with a high degree of turnover from year to year. Generally, trained but inexperienced observers vary greatly in their attention to detail, skill, and consistency.

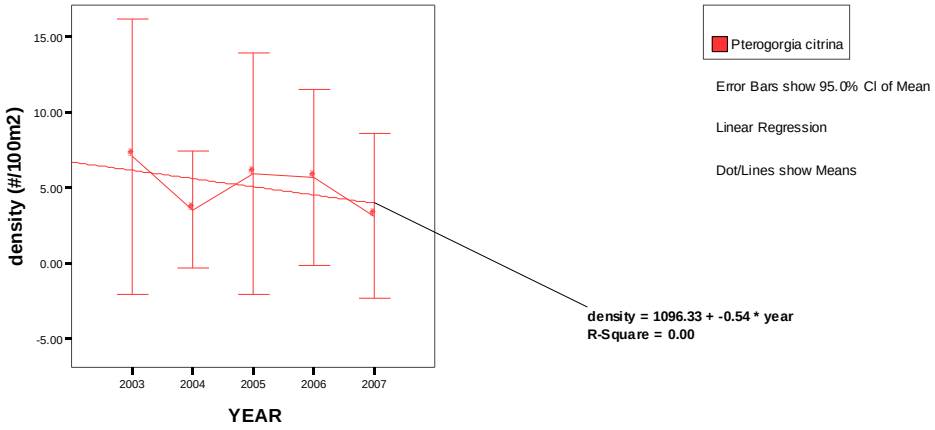
Like a lot of ecological data, these data distributions tend toward negative binomial (e.g.; lot's of zeros with a few very high numbers). These distributions tend to make means traditional statistical testing misleading and there are two additional consequences; (1) broad trends (i.e.; lumping all the Keys data together) are usually driven by a very few sites and because of this (2) one trained but inexperienced observer in one year can change everything.

I've decided to look at trends in octocorals mostly by looking at the taxon level. Relying on broad general descriptive stats tend to mask things.

## *Pterogorgia citrina* (Yellow seawhip)

The yellow seawhip is primarily an oceanside, gulfside, higher water flow seawhip species. Novice observers can and do mistake it for *P. anceps*; however, more commonly *P. anceps* is mistaken for *P. citrina*.

TREND: The overall trend suggests a decline of 0.5 individuals per $100m^2$ per year. The slope is not statistically




significant.

ANALYSIS:

This Key's wide picture is driven by just three sites, Content Keys (D13), Boca Chica (P17), and west of Key West (S56). P. citrina has been found in small numbers in 7 other sites in the middle and lower Keys. The trend in this graph results from the highest estimate in the first year (2003) and lowest estimate in the last year (2007).

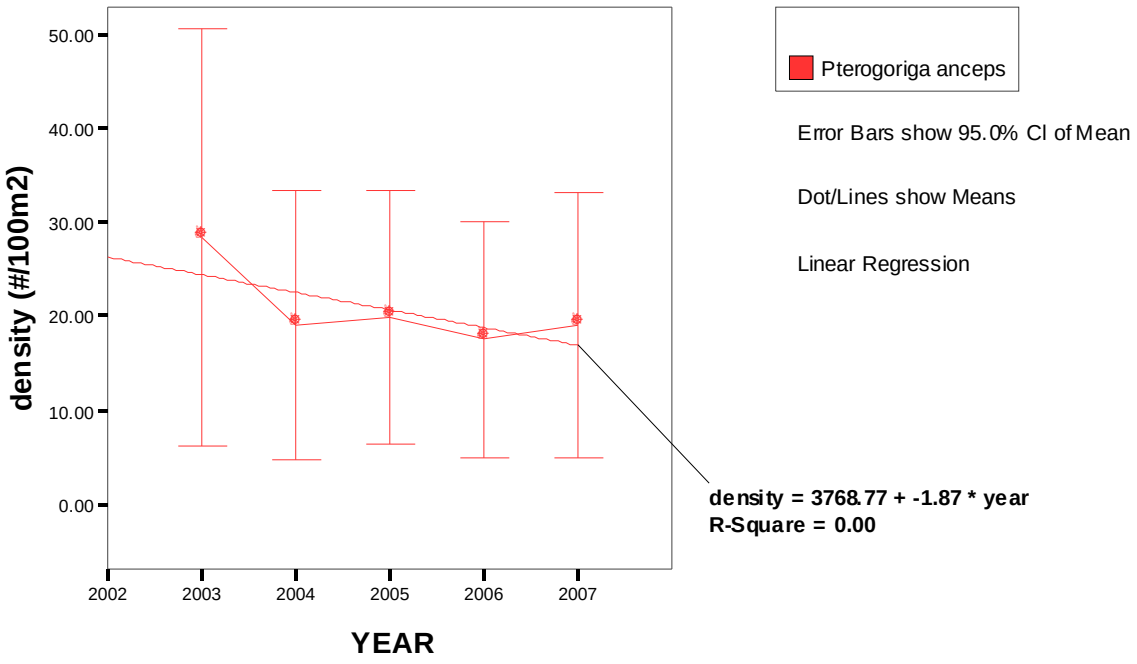
In 2007, the report showed 0 individuals at P17 (where the previous average count was ~25) and 11 individuals at S56 (previous average was ~100). D13 remained consistent at ~160 individuals.

The significant decline at these two oceanside sites could be due to these possibilities. (1) Environmental – I have witnessed portions of P13 undergo periodic burial in sand especially along the south transect (I have photos). While *P. anceps* did not decline at P13 in 2007, it is a much taller species than *P. citrina*. I have witnessed similar but smaller sand events at S56. Perhaps this explains why a few were found there. Hurricanes were not an issue in 2006 to affect the 2007 count but winter storms may have pushed sand around. (2)Human- mistaken id's are possible but less likely. The *P. anceps* count rose from 2006 to 2007 at P13 and remained consistent at S56. It is also possible the center pin marking the site was missed in 2007. S56 was notoriously difficult to find and maintenance of the sites had stopped by then. P17 and D13 were easy to find.

## *Pterogorgia anceps* (Angular seawhip)

The angular seawhip is the most widespread octocoral in the nearshore hardbottom habitat. It occurs in over 60% of our survey sites.

TREND: The overall trend is -2 individuals per 100m$^2$ per year (not significant).



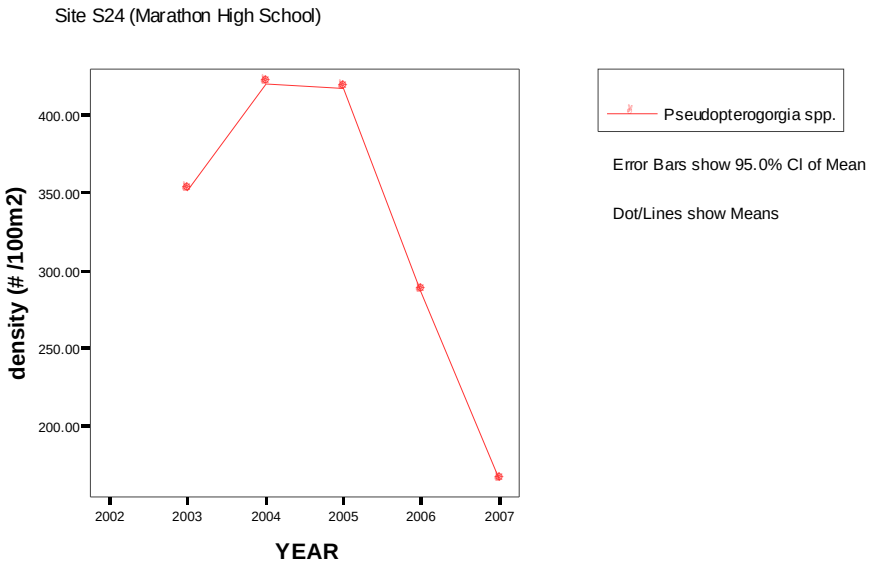

ANALYSIS:

There has been no decline in the numbers of this species. This trend line is influenced solely by the 2003 estimate primarily driven by one site (S56) west of Key West where the estimate was the highest ever reported anywhere in these surveys and 70% greater than any subsequent estimate at that site. All other sites show reasonably noisy fluctuation without trend.

## *Pseudopterogorgia* spp. (Sea plume)

The sea plume was primarily found in Florida Bay and around the middle Keys nearshore waters both bay and oceanside.

TREND: The Keys wide story suggests an overall decline, but that would mislead. One site which is located oceanside near the Marathon High School (S24) shows a tremendous decline from 2005-2007 and this one site drives the overall analysis.




ANALYSIS: S24 is the most diverse site of all our sites and requires a lot of time to survey and it is not easy. In any type of multivariate community analysis, this site stands apart as unique from all the others. The heavy hurricane season of 2005 is probably the best environmental hypothesis for the decline between 2005-6 but the continued drop through 2007 is difficult to explain using hurricanes.

I cannot rule out a steep decline in the density of *P*. spp. nor human factors such as misidentifying species (not likely) or missing the site pin.

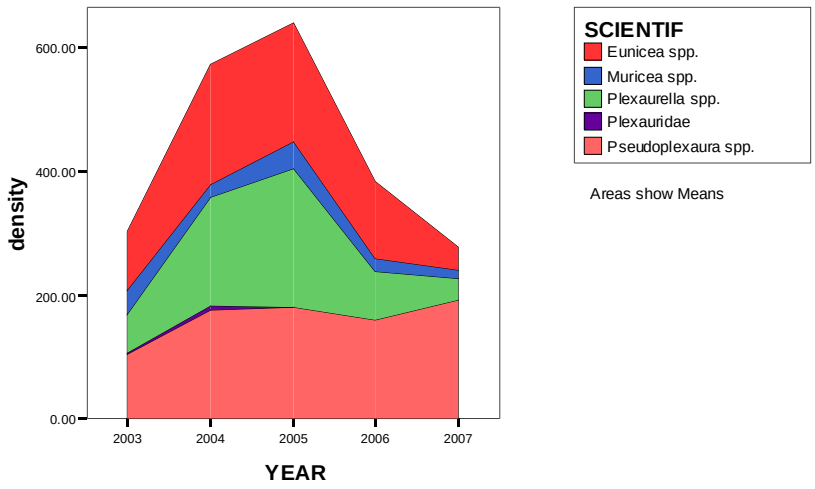
Another site with high numbers was in Everglades National Park (S70). While it showed non-significant declines it was not sampled prior to 2004 and was bypassed in 2007 due to poor visibility and so there are only three data points (2004-6) for that site.

## Sea Rods (*Plexauridae* [Sea Rod]; *Muricea* spp. [Spiny sea rod]; *Eunicea* spp. [Knobby sea rod]; *Plexaurella* spp. [Slit-pore sea rod]; and *Pseudoplexaura* spp. [Porous sea rod])

I've combined these taxa for most of this analysis because the sea rods are the most commonly misidentified of our octocorals. In theory, they should be very easy but in practice intermediate forms (e.g.; slits and pores can appear on the same stalk) can confuse even an experienced observer. Like Pseudopterogorgia spp. (Sea plume) above, this group is primarily an S24 (Marathon High School) story.

TREND: Overall, the abundance of sea rods has been following the same line as *Pseudopterogorgia* spp. (Sea plumes) which is a rise from 2003-3005, then a strong fall in 2006-2007. However in this case the overall numbers end up right where they were in 2003 instead of the steeper drop with *Pseudopterogorgia* spp.

In species composition, *Pseudoplexaura* spp. (Porous sea rod) increased at the expense of *Plexaurella* spp. (Slit-pore sea rod) (by the way, I wrote that caveat above about identifying sea rods before I saw this graph).

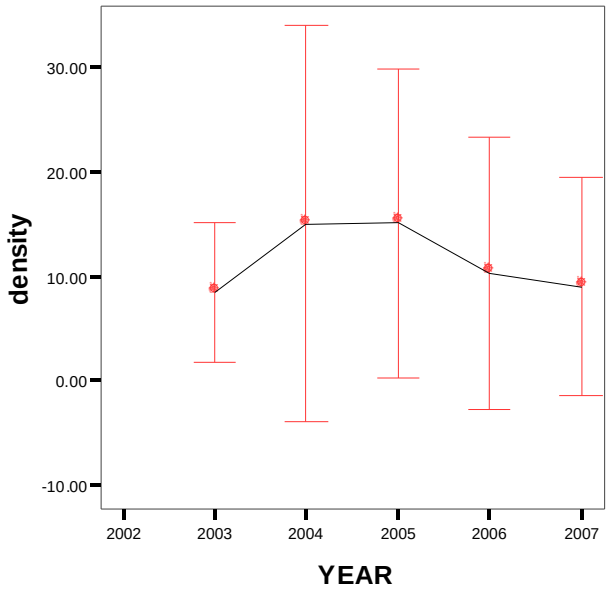



ANALYSIS: This pattern does not constitute a trend but could be part of a cycle. Possible environmental hypotheses are (1) a set of juvenile individuals settled in the area and the numbers fell back to the carrying capacity, (2) a water quality issue around Marathon periodically cuts the population back. Possible observer hypotheses are (1) the center pin marking the site was missed in later years (easy to do on this site) and the lower numbers reflect a change in the site position, (2) someone counted very small individuals (against the protocols) during 2004-5.

## *Briareum asbestinum* (Corky finger)

I generally find corky finger growing on top of other octocorals, typically seawhips dead or alive. It often reproduces through fragmentation therefore a disruptive violent event could conceivably produce a lot of new individuals.

TREND: No trend

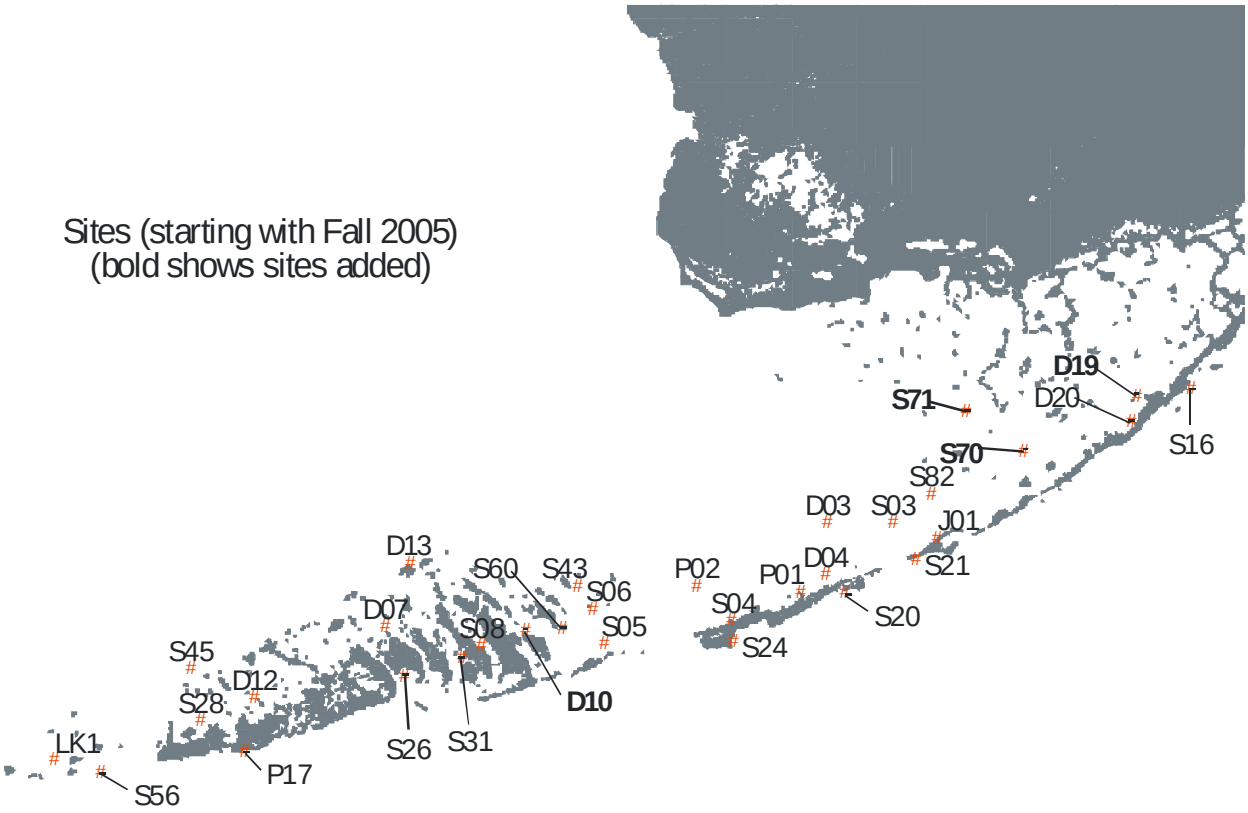



Error Bars show 95.0% CI of Mean

Dot/Lines show Means

ANALYSIS: Although there is clearly no trend, there is again a modest rise in 2004-5, then a fall back through 2007. In distribution and somewhat in abundance, this species follows *Pterogorgia anceps* (Angular seawhip) fairly well, probably because it uses *P. anceps* as settling habitat.

Nearshore hardbottom sites.




Methods overview: Sites were comprised of four 25 by 2 meter transects (200 $m^2$ total area) arranged north, south, east, and west from a central pin. Other pins marked the end of each transect. From 2002-2007, sites were visited during the summer for a sessile macro-invertebrate count that included stony coral, octocorals, sponges, and physical structures such as crevices (that could shelter fish and motile invertebrates). Other surveys conducted at different times included fish counts and size distribution, motile invertebrate counts, and algal cover. All counts were conducted to the lowest possible taxonomic level.