

Seagrass Workshop  
Everglades National Park

**Erik Stabeanu**

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Video Transcript

00 minutes :19 seconds

Erik Stabenau: Today I want to focus on, primarily let you know what type of data is available, give you a quick snapshot of what I saw from last year, and then you know where to go and get more information live or I hope we can make it obvious that we're willing to work with you to give you any additional at least background basic information of the physical environment as opposed to ecological, biological environment and stuff like that. I've broke down our presentation into a few simple groups I'm going to start with our data and what's available.

Erik Stabenau and laptop user: [converse about working the powerpoint remote, mostly indecipherable]

Erik Stabenau: We've got eighteen stations up in Florida Bay, we've got additional stations up on the west coast as well that are all connected by Argos . They're collecting hourly temperature for salinity, bottom temperature and rain, and we're getting six-minute resolution on stage, or sea surface elevation or tide or however you want to look at that, in our case we do it as stage to make it compatible with the upstream drivers for water motion.

On two of the stations in Whipray Basin, and out in Blackwater Sound, we've got chlorophyll sensors going that are doing chlorophyll fluorescence and then they're also doing turbidity by backscatter so those devices for that section are actually working pretty well for us and I'm going to talk about, a little bit about chlorophyll expansions later on. The most important part on this page, I think, is the Ever\_data\_request, its' the standard approach to getting data from us right now because our database is not directly available for historic on the web so if you send an email to this, Ever\_data\_request, I can get back to you immediately, request whatever you need on it. It goes to a group of us, there's five or six of us that watch this monitor, this email account so we can take care of your needs that way. If you're interested in live data though, I mean data within the last half hour, and anybody who's connected with internet now can take a look at this, this is on NDBC site. We collect this data by Argos, sent it to [indecipherable] and we pick it up, put it in our database do a quick range check on it to see if it's you know an obvious flier of some sort and then push the data to the National Data Buoy Center, so. They've got a website at [www.ndbc.noaa.gov](http://www.ndbc.noaa.gov) and you can go on the site and on the right-hand side there's a nice little owner filter and you click on Everglades National Park, use the graphical map to drive down to the area you want to point and click, click on the links for details or history of it, and you can get data for

last six months to a year, basically, on that site. However, it's a buyer beware scenario, this is the provisional data as it's coming out of the instruments being pushed up to the site, just some quick range checking, make it available. But, if you're going out today and you want to know what conditions are somewhere today that's where you can go and get, pick it up. We're going to do a quick review of the parameters that we monitor, give you an idea of where things fall for different regions of the bay. I start with precipitation for 2009, total precipitation for the year bay-wide average 40.66 inches; if you look at the state of Florida we start up above Kissimmee up in the range of forty-eight, forty-nine inches for the year, a little bit less than the fifty-two inch average for the historic record for Florida, and as you move down state you get a little bit less rain further and further down state, more on the central parts of the park and less in the bay. The bay is divided just like you see by the dots, with more rain to the north and northeast than it was down in the central, southern ends of the bay, and we have you know time-

serious data going on for four stations, four sites, regions of the bay. Western region generally speaking we're talking Little Rabbit, Johnson Key, Murray Key, open connections. The southern region I use the three sites of Peterson Key, Bob Allen and Butternut, and then for the eastern region we're talking about those closed basins up towards Blackwater Sound and such, and then the central region of course the area we had this fish kill in and when you look at the set, you can see that we had, this is a cumulative rain plot so we're looking at months of the year and the total amount of rain that shows up in the basin so any time we rapidly go up we're looking at large single rain events. So we're looking at a dry season of course to mid-May, then a couple big rain events kick us into our wet season and then start to trickle along with regular sets of rain that start to taper in October-November, and then we run into these unusual large events in November-December, that happened. This may be important for us for looking

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into the future on. Those late season events are classic ENSO type of arrangements, we get correlations between dry season rain events and dry season cold weather and the El Nino southern oscillation, so we are in a positive phase of in ENSO so we are more likely to get rain in our dry season here or colder weather in our dry season here and you can walk outside and see it. It's been a very obvious ENSO type of year, and this is just a standard plot of the ENSO index and we are in the upper right hand side in dry season rain and its accumulative and in this case our real data bay wide average on the rain against the ENSO index. I think that is an interesting one for predictive tools for the park. We can look at the ENSO index months in advance and say what we are going to see in three [or] six months out and we can something about the likelihood that our next dry season is going to be wetter than normal or what our temperatures may be like and this data at least for this for the ENSO index I pulled from the NOAA site. I have references for that on the tail end of this. The NOAA site provides a few different items on there, but one of them that's nice is this little plot that in this case it says three month outlook. So we are looking at three month outlook and little "A" region down here for above average precipitation and you will see "B's" for below average temperature so it gives you an idea and it gives you a couple of indices for making that predictive tool so in addition to the data we are collecting live with the rain we have these other indices that give us a way to look forward and see where we might be in the future months. I am going to move to some of our flow data. What we have here is a box and whisker plot where they give you a period of record, which in our case is about I want to say 18 years at this point and on top of

that we are holding the current 2009 year flow and this is from the Taylor Slough and you can see that we go to near zero flow through Taylor Slough during our regular dry season and then we start getting activity. We are actually above the record. We are in the upper percentile way out of range between 75 and 90th percentile here out in September, then we drop back down and flow in November–December and late season rain events don't seem to really be influencing the late season flow events in Taylor Slough. We are not seeing that combination. However, if you go to the creek flows. These are the coastal creek discharges. And, when you go through the creek flows, again looking January through December with the box and whisker representing the historic period of record and the stars representing this year's data you do start to see out here November December these season rain events are starting to effect flow in the panhandle region of the park going into the eastern. We also see some flow, some exceedance, or higher level flow coming up in June and dropping back into the regular rainy season as the rainy season takes us past the first large rain event.

So generally, the coastal creeks are showing a more immediate response to large rain events than the overall transect in Taylor Slough where we are dealing with more managed flow over a broader area.

Participant: Erik, do have negative values on there or is it truncated?

Erik Stabenau: It's truncated at zero. There are no negative values on it. There are from the discharge record. I am not sure how they are managing the upstream, the filtered portion.

Participant: Yes, because there are months when the flow is in a backward pattern.

Erik Stabenau: Yeah, we get the mixed. There are two types of flow data being made available. There is discharge and filtered discharge. I've never quite understood how those two work. One is trying to take into account the amount of flow that comes up and then gets exchanged on the other side. I've been a little confused on how they actually pull that off.

Participant: Erik, is it a 40 hour [indecipherable]?

Erik Stabenau: I'm not sure how they do that.

Participant: There are months of it flowing backward.

[indecipherable conversation in audience]

Erik Stabenau: Yes, in this case I took the daily numbers they had for the period of record and fed it in. I did not put a block on it reducing or eliminating any zeros. I just processed the data that was available to me and plotted it as is. That filter was put on before it got to me. Alright, so we are up to our salinity...

Participant: Just a minute, so Erik, the 2009 winter, the dry season, if I am reading this correctly, the freshwater discharge was right around the median for the period of record?

Since the dry season?

Participant: Yes, January through May.

Erik Stabenau: Yeah, leading up to these events, yeah. Leading up to it. It did not look like we were exceptionally long like the very late start to the rainy season or anything like that. We are in the window of what we consider normal behavior. And, that makes an important point because a lot of the data that we

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process, we got a lot of numbers coming out of it. But, from a management point of view we have to convert all this, I guess from my background working with the [] group at [] I want to convert all this to plain language ideas. Was it early or late? Was it a lot or a little? You know, these types of things. So, in this case it appears to be fairly normal leading up to our right. Moving to salinity. I did the same approach, but in this case the data is all our own. It's our salinity network data. It's an eighteen year period of record roughly '92 to the end of 2009. And, some of the stations are more like '94 and some of them have a couple gaps in the record where we had stations knocked out by hurricanes, but we are doing it by regions so we end up picking up the set. If you go down to those three sub-region basins that are those southern stations closest to the Florida Keys along the inter-coastal, you end up with fairly narrow range of salinity. And, you can see this pattern is obviously with the summer time highs are coming in. A little bit, a little bit higher salinities coming in. And, for our year we are just on the high side of the medium. We are at the 75<sup>th</sup> percentile for the whole year or just above that in May, June, July. And, see here in August and September again we did not come down to range in July; we moved up in August and September.

Participant: Erik, what are the other stars that are above the error bars?

Erik Stabenau: We put in, I did not filter any of the data so those are outside the 90 or 10 percent.

Participant: From that month?

Erik Stabenau: No, well yeah from this month for the period of record. So, for this month, let's just take January as an example. You're looking at a median 50 percent or 25<sup>th</sup> or 75<sup>th</sup> percentile of the range, the top ten, I'm sorry, top ninetieth and lowest ten percentile of the range. And, I guess this is a bad example because you want to use one of the stars, but in February we have five or six events that were above that ninetieth percentile.

Participant: Through the period of record?

Erik Stabenau: For the period of record, for the entire period of record. And, for our data for the year I put in to represent where we were with salinity for each is on top of that. It gives you the comparison. We jumped forward from the southern region to the central region, which includes Whipray Basin. And, this event, we can see that going in are relatively normal for the year. You can see our salinity went way out of our normal range. We're way out of our 25<sup>th</sup>, 75<sup>th</sup> percentile range going in here in May. And, when the rain did hit in June it dropped right into it and even below it. So we are looking at a pretty severe mix of high salinity during hypersalinity events and then coming down below the median, even

closer to the 25<sup>th</sup> percentile and even below that as the months went on for those three months going into it. And, then salinity bounces back up by November when those late season rains are coming and starts to affect the salinity up in the central basins. Another thing to note is that right when you look at it. It stands out as being a much broader range of salinity values that we observed there. Over on the west side [intelligible] key, Johnson Key, Peterson Key, I'm sorry, Little Rabbit Key, we deal with this site which is broader, and to me it is surprising the way the salinity rode so high in these stations through April, May, and June. Being that they are connected, open basins basically to the ocean side to the gulf coast side strikes me as odd that the salinity would climb like that. I know this is influenced by the amount of water that goes up the Shark's River we get evection as we go down the Shark's River. Freshwater is what bring salinity down as it pushes in, into the basin. So I'm not completely certain on that.

Participant: [indecipherable] hard to see.

Erik Stabenau: Oh, zero to sixty on all of these. So, we are looking here from 30 to 40 psu.

Participant: [indecipherable]

Erik Stabenau: So we are looking here where we are getting squeezing just above 40, and in our case we are getting 44-ish, 44 point something.

Participant: What gauges were included in this western region?

Erik Stabenau: Western region is influenced alittle bit more by Johnson Key than Murray Key and Little Rabbit. It's those three stations that Johnsons Key's period of record is a little bit longer than the others.

Participant: [indecipherable]

Presentation interruption edited out from video.

Erik Stabenau: The absolute highest peak of salinity [indecipherable] of where we are concerned that we took, we have that data in at least 18 stations that are there. This is my quick summary of how to pull all this together by basin, but all the underlying data is here. It's all available. Make sure you call or write or

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send [indecipherable] whatever it takes and we'll get that data to you so you can do what you need to from that step. Going to the last set here, eastern basins. Obviously, as it's been said, this is very connected to the coastal creeks. We can drive the salinity down to very low levels and sometimes the area can go to zero in different months of the year for these stations. You can also see the trend when the flow is not coming out of these creeks how easy and uniform this [indecipherable] and then in May and June our salinity kicks in and there are spikes coming around and again a little effect out here in December starts to show up from that increased flow that's coming out in December bringing the salinity back down from these higher events. I'm going to try to cut through this.

Participant: Can you go back?

Erik Stabenau: Yes, sir.

Participant: I have two questions. Do you mind if I ask questions?

Erik Stabenau: No, that's good.

Participant: The first one – it appears consistently from January through May all the eastern region showed, elevated, you know, regarding the rains, salinities. So, I'm wondering if, the first question is, where there any operational changes made to the structures on the C-111 canal during that season that could have caused this in any way especially given that rainfall was normal?

Erik Stabenau: Well, if there were changes to the structures it would be reflected in the flow data that we put out. The flow data did not show any unusual behavior within the range of the central 25 to 75 range in this quick analysis on it. I don't know anything else over there that would do that. That's the only measure I have is the actual flow coming out of it. And, that is related to what goes through out of S-118 but not out of 197, that's the overbank southeastern panhandle region. Yes, Chris.

Participant: Was rainfall normal? I only remember seeing that the plot discharge was normal.

Erik Stabenau: Right.

Participant: And , rainfall is different from discharge on the outer bank especially in the area we are talking about where [indecipherable] minimal effect.

Erik Stabenau: That's because I did not show you a normal line on the plot. I showed you the cumulative rainfall on the plot of four groups.

Participant: [indecipherable]

Erik Stabenau: It was a touch lower than what we had for the period of record.

Participant: A touch lower than the median but still within the 25-75.

Erik Stabenau: Well, the rainfall.

Participant: It also would beg what was the annual of last year.

Participant: There is an auto-regressive component

Erik Stabenau: Right, exactly. They are connected.

Participant: The other question was are you going to show north-central Florida Bay, which is where this happened?

Erik Stabenau: The central region includes all the way up through Garfield Bight and Terrepin Bay lumped together. The southern end of that is our station on Whipray Basin on the north side of the islands there inside that basin. That's where I drew the southern line of that.

Participant: Because it is worth noting that up in that region where it was using some of the gauges or some of our hand held devices for months there was 50-60 parts per thousand up in those embankments.

Erik Stabenau: Right. So we can look up to looking at those individual stations on the top and soon be at that median number that I put up on top that would reflect the median of the station that is more isolated up against those shallow basins in the northern end of that same. Anyway you want to process this we can pull that out. I've seen that there, it is there. It's not reflected as cleanly when you're trying to get that overview of the region, but they are available. Anyone else before I move past flow? So we'll look at dissolved oxygen. A quick disclaimer on it. I put in a basic equation on it from Garcia and Gordon paper from 1992 and used our bottom temperature and salinity data to figure out what our limit would be for dissolved oxygen. Just to put a limit on it. Now we can go super saturated see if it preserved in the water.

Participant: When you said a limit are you talking one hundred percent saturation?

Erik Stabenau: One hundred percent saturation. Given those conditions everything comes to equilibrium. You know obviously when you are working out there and plants are growing we can go super saturated and at night time we can pull dissolved oxygen down. But, I want to give an idea of what the dissolved oxygen pattern kinda looks like to get a picture on this. So, what I've done is this dashed line is a calculated dissolved oxygen limit and we're talking about 5, 6, 7 of milligrams per liter so we're in summer in these May, June, July, August times looking at something at 5.7 to 6 as the limit. That would be 100 percent for anything above or below that. I'm thinking as we working on expanding the network and improving the way we do this we can be measuring dissolved oxygen in the water and the difference between that calculated limit of ambient temperature and what we are observing might be a

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nice indicator for us to use to see what the, in a sense, an oxygen demand feature though I'm not sure if that is a legitimate way to approach that or not. I'm not an ecologist, but I'm thinking that might be a way to approach this. I dropped some fish kill event bars on here and on the right hand side I put a discharge. It's a thirty day running mean and I put this in that lies area of statistics. Where depending on how you filter this data, you can have this fish kill events that occur upstream or downstream of the data appears flow lines. If I put this raw data in, it's got such noise in the signal it's hard to pull out what you need to. So you need some better filtering depending on how you want to look at it. Salinity data, dissolved oxygen. I don't have an actual direct measure of dissolved oxygen in the water column, but it is part of what we are trying to expand. Also, that's also the chlorophyll section of this, something we are trying to expand. From our two stations, Whipray Basin was reading a little bit lower than Blackwater Sound for chlorophyll in it, and when we look on here the black line is the Blackwater Sound. It started getting a lot of spikes in the data from probably a seagrass or some sort of interference that for one hour spikes and for six hours it reads a different value. So I filtered it by just checking the minimum values to see if we can pick out any trends over the course of the year. And, the minimum values may be a little more telling of what's going on. You can pick up slight variation over the course of

the year with that. But, I'm not sure we're measuring that. This is a new instrument for us. It's our first year of having this instrument in the water. We're trying to figure out exactly how to do this and if it even works for us for to have a chlorophyll sensor sitting in the water. For instance, these sensors are at a station that are on average three feet deep and they are sitting a foot and a half off the bottom. As a diver I have been in and seen a cloud of green above my head so I figure it's possible to get chlorophyll in the surface layers that we are not seeing on these sensors at this depth or some other arrangement. So we need to think about how we want to deploy. We gotten, the Bio Branch has picked up on with SFWMD to put together – correct? – to put together an addition 5 oxygen sensors and corbel sensors out on the bay. We want to get to the point to get it right on this so we get data we can really work with. Whipray Basin had a little more variability in the time series. Something was happening in the way our sensor was recording and the way our station was reporting at the end of the year.

We have a couple of breaks in Whipray Basin data, the datastream and I get a little bit suspicious, suspect, of what was happening in between those when we have drop offs in the data. I want to make sure we have our QA/QC in place to be as solid as possible. When things were running well, it's a nice clear number for each season. But, when it starts to act up we need to be able to be out there and take of whatever is going on with it and deploy it in a way that is useful. So I'm hoping as part of your discussion you'll look at what we could do better with chlorophyll sensors. We've got 18 platforms with data loggers and power transmission. We have support people going out there every month. We want to make sure we use the infrastructure as well, as best as we can to be able to support these other needs especially for protecting the resource. Reiterating on that I called it FLBAM!, The Florida Bay Algal Monitoring network. I'll throw that out there one more time to see if you want to keep that because it has a little punch to it. And, we are in two locations, Whipray and Blackwater Sound and we may be expanding that. I'm not even sure what our final list of stations will be. I can think of five off the top of my head, but there are seven in total. And, we want to make sure we are doing these right. And, I'm going to stop there. I got my contact information, the data request line, a couple references, and a couple of links through the presentation, which I am sure will be made available so you will be able to see the links for the climate data center for NOAA and use that information as you see fit. So are there any additional questions after the discussion? I will be glad to answer those.

Participant: I found the dissolved oxygen data interesting, of course I'm assuming, those are mean daily?

Erik Stabenau: It's actually a live hourly calculation. Every hour I get a salinity and temperature data and the computer runs it through that calculation.

Participant: Did you present the mean for the day? That was continuous?

Erik Stabenau: That was continuous.

Participant: He was just presenting 100 percent saturation.

Participant: He was doing calculations.

Erik Stabenau: Those are just calculations.

Participant: That wasn't the curve on the bottom?

Erik Stabenau: No.

Participant: That was the saturation phase.

Erik Stabenau: That was the saturation point.

Participant: I was wondering if Marguerite and Chris who sent us some really good data from this time

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period could comment a little bit on what you did see with the diurnal swings and DO.

Marguerite: Well, I'm going to show it.

Participant: Even better.

Erik Stabenau: Is it helpful to have a calculation like that running or not?

Marguerite: Well, actually I made some similar calculations more to just show how salinity versus temperature out there turns the ranges is driving the percent saturation.

Erik Stabenau: Ok.

Marguerite: And, I think that temperature seems to be a lot more important than salinity, actually.

Erik Stabenau: Yeah, I think that in the calculations the coefficients show that in the sensitivity analysis that temperature is more important to it. But, the salinity is the one we might have a chance to do something with.

Marguerite: Well, and they may not be unlinked. If we have freshwater flowing it can actually produce the residence times then the temperature is building up because of the long residence time then there's an interaction.

R Erik Stabenau: ight, right.

Participant: What kind of oxygen sensors are on there?

Participant: [indecipherable] They are optical sensors.

Participant: Because in the old membrane ones you actually read directly percent saturation and had to calculate the other parameters so I was wondering if you back calculating [indecipherable].

Participant: Use a reference.

Erik Stabenau: From this one, yeah, I don't have. On the eighteen stations we have no dissolved oxygen sensors in the network. So any oxygen data here is pure calculation, pure speculation almost.

Participant: What is the relationship between salinity and the specific heat of water? Does salinity increase specific heat or does it decrease the specific heat of water?

Erik Stabenau: I'm not sure what you are getting at with that. I'm sure the effect of that is very small.

Participant: Does it increase in dissolved salts in water make it so that more is required to change a degree of water from 1 degree Celsius or less?

Erik Stabenau: Anybody know the fundamentals of that?

Participant: [indecipherable]

Participant: So it decreases the specific heat?

Participant: I think it takes more to increase it then it stays there.

Participant: It retains it.

Participant: That's a guess.

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[credits]