From: Michelle Bogardus
To: Britta Muiznieks
Subject: Turtle comments
Date: 06/09/2010 02:21 PM
Attachments: Turtle Issue Comments Relocation.docx

Well....its long. Call me when you are done reading it.

Michelle

Turtle Issue Comments Relocation.docx

ISSUE: Perception of high loss of sea turtle nests: ORV groups and NCWRC have concerns about high loss of sea turtle nests in locations that are predictably subject to frequent overwash.
OBJECTIVE: Refine nest relocation criteria to allow nest relocation in situations that are likely to result in nest loss due to overwash (not talking about major storm events, but regular storm or lunar high tides).
IDEAS FOR DISCUSSION:

- Use GIS to identify areas with history of nest loss due to overwash. Conduct 5-year adaptive management study to compare results of proactive relocation of 50% of nests in those areas vs. non-relocation of 50% of nests in those locations, then analyze/document results and re-evaluate the policy after five years; or
- If I understand Michelle correctly, she and Matthew Godfrey have already agreed to, and we are implementing, a more proactive nest relocation policy in certain locations that are known to be subjected to frequent overwash. If that is the case and we are comfortable with that approach, then maybe all we need to do in the FEIS is describe the current approach in more detail than currently is in the DEIS so it is more obvious what we are doing. As it stands now, the DEIS (Chapter 2, Table 10, p. 125) describes the above approach in brief terms but then it says that relocation will follow the policy identified in the NCWRC handbook, which is "relocation as a last resort".)

Comments by Michelle:

It is understandable that the public is concerned about the emergence and hatch success of the turtle nests at CAHA. Overall, our success rates are variable and generally reflect the storm season and how storms affect success. The current relocation policy we use is the guidelines set forth in the NCWRC handbook, which identifies criteria for when relocation should be used. These criteria dictate that nests should only be moved when nests are likely to have frequent inundation or will be washed out as a result of normal tidal activity. According to these criteria, nests should not be moved just because there is the potential for a major storm event, such as a hurricane. The criteria in the NCWRC handbook are consistent with the new Loggerhead Recovery Plan, which states:

6113. Use the least manipulative method to protect nests.

Until such time as a management plan for protecting nests is developed, the least manipulative method should be employed to protect nests. Because the incubation environment greatly influences the developing embryo, nest relocation can involve the transfer of eggs from an appropriate environment to an inappropriate one. As a general rule, nests should only be relocated if they are low enough on the beach to be washed daily by tides or if they are situated in well documented highrisk areas that routinely experience serious erosion and egg loss (e.g., nests laid near river mouths or beneath eroding sea walls).

Natural events, like storms, that accelerate beach erosion and accretion can sometimes reduce hatching success in existing nests. While damage from storm events can be severe, it is difficult to predict the precise areas where the storm is most likely to inflict damage. Because of the negative effects of

relocating eggs and the unpredictability of storm events, nests should not be moved out of areas threatened by storms.

Nests should not be relocated in areas where heavy foot traffic, lighting problems, or beach cleaning are a concern. Foot traffic generally is not a problem for nests, but depending on the nesting substrate, pedestrian traffic over nests near the time of emergence can cause the nests to collapse and result in hatchling mortality. Therefore, in areas where foot traffic is heavy, nests can be marked so pedestrians can avoid them. If a nest is made near a light that may misorient the hatchlings, efforts should focus on getting the light turned off or shielded (if protection is necessary, the nest should be caged).

Other state agencies have similar criteria for the use of relocation as a management tool. The following is from South Carolina's sea turtle management guidelines, which in some ways are even more stringent than that of NC:

NEST RELOCATION
Moving marine turtle eggs may create adverse impacts. Movement alone is known to kill developing embryos by rupturing delicate membranes that attach to the top of the egg. We also know that the incubation environment greatly influences the developing embryo and that nest relocation can involve the transfer of eggs from an appropriate environment to an inappropriate one.

Nest relocation must be considered a management technique of last resort and only if the likelihood of the nest surviving to hatch is nil.
Disposable gloves should be worn at all times. The most desirable alternative is to eliminate the problems that prompt relocation of the nest. Normally, the only situation that justifies nest relocation is when a nest is laid seaward of the debris line marking the high tide. If foot traffic is heavy, a nest can be roped off so that pedestrians avoid it. If a nest is laid near a light that may disorient the hatchlings, the light should be kept off or shielded. **Lighting problems are not a valid reason to relocate nests.** If mammalian predators threaten a nest, it should be screened with a self-releasing screen.

Use the following decision-making protocol when evaluating relocation:

Question 1: Will the nest be destroyed in situ?

If NO: No action required. Leave nest where it was deposited.
If YES: Go to question 2

Question 2: Can the nest be moved **directly** inland to a stable dune?
If YES: Move to new location directly inland.
If NO: Move to next best available site **closest** to original nest location.

Even the guidelines from Florida Fish and Wildlife Conservation Commission are consistent with the guidelines above. In Florida, beaches have to receive a second permit (in addition to the normal sea turtle management permit) to even have the option of using relocation as a management tool. If a beach receives a nest relocation permit, they only have the ability to relocate when a nest is in immediate threat. In Florida, this threat is most often beach construction, cleaning, nourishment, and other human activities. They do not relocate for the purpose of storms. (See attachment for full guidelines from FWC).

Why should relocation be used only on nests in imminent threat?

Sex Ratio –
We already know a lot about this, but essentially, the warmer a nest is the more females the nest will produce; a cooler nest means more males. When you relocate a nest to a safe-area you often increase the female to male ratio. There are long term concerns for how this may change population dynamics. In NC, the pivotal temp is 84.6 degrees F. This means that nests that incubate at this temp will produce 50% males and 50% females.

Fitness –
There is concern among turtle biologists that nests that are relocated result in hatchlings that are less fit. Theoretically, you could test this by determining the survivorship of hatchings from relocated nests vs. in-situ nests. However, the survivorship of hatchings is so low anyway that there is no logistical way to determine fitness in the wild.

Manipulation of eggs -
The manipulation of eggs when conducting a relocation can cause embryonic mortality. When a turtle drops eggs into the nest cavity, it begins a ticking clock to be able to safely handle and manipulate eggs. Generally if eggs are going to be moved, they have to be moves less than 9-12 hours from the time they were laid. Fragile membranes can detach while moving nests resulting in mortality.

Moving a nest from an appropriate location to an inappropriate location –

This is something that happens more than we can determine. For example, a nest is at the high tide line and the technician that found the nest decides that there is a good reason to move it. The technician moves it, according to protocol, to an area at the toe of the dune away from vegetation. Despite the fact that the nest never gets over-washed, it never hatches. During the excavation it is found that roots from vegetation 12 feet away has penetrated the nest cavity and punctured eggs. Ants have also gotten into the nest chamber, resulting in mortality. Whether that nest would have had better luck in the original location is never clear. The technician followed protocol and had no ability to know that this would happen – it simply isn't an exact science.

The perception that overwash always causes nest mortality:
Although overwash, particularly storm overwash, has the ability to result in nest mortality, some overwash is good. Overwash events can increase oxygen flow to nests as well as influence the sex ratio in favor of males. Honestly I don't currently have any studies on this handy, but I know that several have been done indicating the normal overwash can be beneficial to nest success and hatchling fitness.

Does CAHA relocate nests? So, here is the thing about relocation: it is an effective tool but has the potential for risks that could outweigh the benefits. Sex ratio, embryonic mortality, and hatchling fitness are all un-intended consequences of relocation methods. So, should relocation be used at all? Well, yes, but only when nests are going to meet the criteria set forth by NCWRC and the recovery plan. At CAHA we **DO** use relocation as a management tool – roughly 30% of our nests are relocated to the toe of the dune. According to NCWRC state sea turtle biologist Matthew Godfrey, 30% is approximately what we

should be aiming for, although he is careful to comment that any fixed percentage may be inappropriate for a given year. He feels as though aiming for an average of 30% relocation rate over a longer period of time (5-10 years) may be a better guideline.

Here's the big question: If CAHA uses relocation, then why do we have a low hatch success? The answer to this question goes back to the objective that Mike stated above:

OBJECTIVE: Refine nest relocation criteria to allow nest relocation in situations that are likely to result in nest loss due to overwash (not talking about major storm events, but regular storm or lunar high tides).

The relocation procedures that we currently follow already address this objective. Nests that are going to be lost due to normal tide cycles are relocated to a higher location. Typically we only loose 1-5 nests per year to normal tides, typically when a "trench" is formed. A "trench" is an area between the high tide line and the toe of the dune that occasionally fills with standing water. Turtle nests can survive overwash, even storm overwash, but not standing water. Trenches often develop during the season, and there may be no way to know if a nest may be lost to this type of hazard.

Let's look at 2009. Of the 104 nests that were laid over the season, 29 hatched and were excavated prior to Hurricane Bill. Anything during or after Hurricane Bill we will think of as post-storm and will look at those nests separately. During this pre-storm season (before Aug 21st when Bill hit), we lost two nests to high tides and two nests a nor' eastern on 6/23. In a perfect world we would have relocated the two nests that were lost due to high tide, but relocation is not an exact science. During Hurricane Bill, and Tropical Storm Danny a week later, we lost a substantial amount of nests. This is partly due to two reasons:

1) The two storms affected the beaches differently, meaning that nests that made it through Bill were lost when Danny hit from the other direction.
2) These two storms occurred at the worst time possible for turtle nests. Turtle nests become more susceptible to mortality caused by overwash the closer they are to hatching. The reason that Bill and Danny had such an effect was because 28 nests were about to hatch when the storms arrived. Prior to the Bill, staff was able to rescue a large amount of hatchlings, but nests where the hatchlings had not emerged from their eggshells had to stay in place. As an example of this point, there was a nest in Hatteras Village very close to hatching and a nest south of Ramp 55 that had been found on 8/4, only 2 weeks prior to Bill. Both nests were hit hard by the storm. The nest that was about to hatch was completely lost, despite the fact that it was on the side of a dune. The nest south of Ramp 55 had severe washover, enough to take the top 1/3 of the eggs and wash them away. However, because the nest was so young into incubation, it withstood the overwash well and went on to have a decent hatch success.

Bill and Danny ended up causing even more consequences. The erosion from these storms left nests that had survived more susceptible to later nor'easters and storm events. When a smaller storm hit the weekend of 9/11, we lost nests that had made it through both Bill and Danny.

The point of this storm analysis is that we could not have ever predicted any of those events. If the storms had not been back to back, or if they had been 2 weeks later in the season, or even if they had come from the same direction, our success would have been much different than what it was.

It is interesting to note that of the 24 nests completely lost to Bill/Danny, 7 of these nests had been relocated. This is not to say that relocation didn't work. These 7 nests were relocated to protect them from normal activity. The fact that the nests didn't make it through the storm shows that the storm impacted both in-situ and relocated nests similarly. In essence – it wouldn't matter if you relocated *every* nest, it still would have resulted in similar nest loss. In fact, during both the 2008 and 2009 season, the relocated nest success was lower than that of the in-situ nests. CALO had similar findings. Recently, NCWRC biologist Matthew Godfrey analyzed the data from a unique situation at Bogue Banks, NC. Due to a re-nourishment study, a 6 year moratorium was placed on Bogue Bank's permit to relocate. Godfrey has compared the success from these 6 years with the 6 years prior to the relocation ban, a time when about 30-40% of the nests on the island were being relocated. Overall, there was no statistical difference in the success between the two periods of time.

If relocation still results in high nest loss due to storm activity, then is there anything we can do to improve hatch success?

Since it is evident that general relocation policies **do** protect nests from normal inundation, but **do not** protect nests from storm overwash, can anything be done to increase success? Well, yes and no. The only way to ensure a high hatch success even in the face of a hurricane is to talk about the idea of a hatchery or corral system. Theoretically, by moving nests off of the beach entirely you reduce the potential for environmental impacts on that nest. It sounds great – an easy way to maintain access and put the most amount of hatchlings in the water. However, there are several concerns with both hatcheries and corrals (otherwise known as a "safe-area" a coral is typically on the beach or behind the primary dune line).

Let's start with the language in the Loggerhead Recovery plan:

6114. Discontinue the use of hatcheries as a nest management technique.
Relocation of sea turtle nests to hatcheries located higher on the beach was once a common practice throughout the southeast U.S. to mitigate the effects of naturally occurring events, such as erosion and vegetation encroachment, predation, and a variety of human-induced factors. In some areas, the extent and type of coastal development have resulted in significant light pollution problems. As a result, a few hatcheries are still used to protect hatchlings from disorientation. However, relocating nests into hatcheries concentrates eggs in an area and makes them more susceptible to catastrophic events and predation from both land and marine predators. Therefore, in areas where hatcheries are still being used to protect nests and hatchlings from light pollution, management efforts should be shifted to eliminate the lighting problems and phase out the use of hatcheries.

Most of this comes from several concerns about the effects of hatcheries on the sex ratio and fitness of emerging hatchlings, things we have already talked about. Other concerns come from the hatchery itself.

Disease –
When you put nests all together you increase the potential for disease, fungal problems, etc. which can result in egg mortality.

Storms –
Although the point of putting nests in a "safe-area" is to keep them safe from storms, sometimes storms can surprise you. If a storm hits a certain way or floods behind the primary dune line where the nests are being kept, the storm has the potential to take out every single nest. If nests were left on the beach where they were laid, or relocated to the dune directly behind the original location, the storm would probably not impact every single nest.

Predation -
The density of turtle nests found in "safe-areas" can increase the risk of predation from both ghost crabs and mammals. The only way to combat this is to put each nest into its own individual cage. This is time consuming, especially with 100 nests/yr. Additionally, the hatchlings then have to be removed from the cages and released on the beach.

Predation in the water -
A new impact that has been found with hatcheries is that all hatchlings are typically released in the same location. This has the potential to increase predation in the area surrounding the release site. The hatchlings released may have reduced survivorship within 500 yards of the beach.
Real hatcheries (building with incubators) are used in a couple of places around the country, mostly for research purposes. Padre Island National Seashore has a massive hatchery system that is used for all nests on the Seashore and surrounding areas. However, this was a management decision made for a different species of sea turtle – the Kemp's Ridley. At the time the decision was made, there were few options and little time. Now that the number of nests is increasing, another decision will have to be made about how to begin to leave some nests in-situ.

Obviously hatcheries, both safe-areas and incubators, have the potential to increase hatch success. However, they pose numerous risks that could have serious negative effects on the overall population.

What is the goal of the sea turtle program?

When you talk about hatcheries, it is impossible to not bring up the goals of the sea turtle program, at CAHA, in NC, and for loggerheads US-wide. Despite what the public may think, the overall goal of the recovery plan and NCWRC is **NOT** to put as many hatchlings in the water as possible. In fact, the major goal of FWS and NCWRC is to *provide protection for nesting females, nests, and hatchlings while maintaining the natural process and behaviors to the maximum extent possible*.

If you look at the old recovery plan (1991), you will find a section in there where it talks about increasing nest success to 60%. In the new recovery plan, this section is omitted. In talking with Sandy MacPherson, FWS sea turtle biologist, I learned more about why this change occurred. Apparently, beaches had begun to relocate more and more nests (even nests that did not need to be relocated) in order to meet this 60% success. The intention of stating 60% had originally been to get beaches to deal with the human impacts to nesting success, such as lighting and vehicles – not storms. In the 2010 Recovery Plan, the % was removed because it was felt that beaches had gone beyond appropriate relocation measures to boost success, which does not meet the goal of sea turtle program.

This brings us to Mike's comment:

Consider alternatives, if any, for reducing nest loss and improving hatch and emergence rates. Would it be reasonable to identify a target hatch or emergence rate (e.g., 60%)?

I think that defining a target hatch or emergence rate would result in the same type of activities that FWS found with the old recovery plan. Nest success is ultimately determined by storms, cold weather, and other environmental factors that cannot be controlled. To identify a success rate would put undue stress to biologists to over-protect nests from environmental factors. This is also the reason why there is no performance measure associated with hatch success in the BO. FWS knows that we cannot determine hatch success and that hatch success is not necessarily an indication of a successful program. Again, this goes back to the goal of sea turtle management overall.

So what is CAHA's Relocation Criteria?

This brings us to a good point – what *is* CAHA's relocation criteria? Obviously, we follow the guidelines in the NCWRC handbook, but what about identifying the areas of high erosion and nest loss? If you talk to Larry Hardham, he will pull out a map that shows the nest success for every nest on the Seashore for the last 10 years. The problem with using past data is that:

1) The data is influenced by storm activity which should not be considered when determining which areas cannot support nests. For example, nests that are within the north and south entrance to the bypass can be susceptible to a storm – which makes it appear as though there is low success for the area. However, nests that hatch prior to or in the absence of storms have an excellent success at the bypass.
2) We only have a couple of years of usable data – this is because pre-2006 or so there are no GPS points for turtle nests. We do have physical descriptions of the locations of all nests, and we can place them into park mile, but again, we have no documentation of exactly what these beaches looked like during these years. The success of nests 10 years ago is dependent on the beach of 10 years ago – a beach that no longer exists.

That being said, there has to be a way to determine where nests are going to have problems, right? Well, sometimes. Spits and points are always going to have water table issues. In 2008 a green turtle laid a nest at Cape Point. The nest was relocated further back on the beach to an area that was within guidelines and appeared suitable. In fact, although Hurricane Hannah hit Cape Point rather hard, the nest was not over-washed. Despite this, the nest never hatched. It was only later that we realized that beneath the surface the water take had risen far enough to cause nest mortality from the bottom of the nest up. There are two points to this example – first, with the amount of turnover in the RM division, there is no institutional knowledge about where these types of issues occur; second – we are always learning new things.

There are certainly other areas of the beach that we worry about. Isabel inlet (or what was once Islabel inlet) is easily eroded and an exceptionally narrow beach. Currently we automatically relocate out of this area. However, in 2009, a nest was found in this area a day *after* it had been laid, which meant that it could not be relocated. Ironically, this nest had a 100% success rate (I am serious when I tell you that I have NEVER had a nest with 100% hatch and emergence success before). Part of this luck occurred because the nest was laid at the top of the dune. Also, the nest was laid early in the season (6/12) which meant there was minimal chance storm season could affect it.

Anyway, below is the decision making criteria that we follow when relocating a nest. Items in Blue are from the NCWRC handbook. Items in Red are specific to CAHA. At the beginning of every nesting season, we sit down with NCWRC and discuss these additional criteria and whether they are appropriate and consistent with the guidelines, recovery plan, and the goals of sea turtle management. This assessment of the beach is done EACH YEAR, since the beach is liable to change between nesting seasons.

Nests should be moved ***only*** when one or more of the following situations exist:

- The nest is located at or below the average low tide line where ***regular*** inundation will result in embryonic mortality. Relocate any nests that are found in existing "troughs" or flooding pools. At the beginning of 2010 there is one north of Ramp 34, one south of Ramp 38, and one in between Ramp 70 and 72.
- The nest is laid in an area that is known to be susceptible to erosion:
  (Relocate the nest if it is located in any of the following locations)
  - Bodie Island Spit – any nest at Bodie Island should be relocated to S. of R23
  - Lighthouse Beach groins – Call your supervisor…it will be a tough call.
  - Cape Point – any nests found between the southern exit of the bypass and Salt Pond Rd. should be relocated to in between the bypass or west of Salt Pond Rd.
  - Isabel Inlet – any nests that are found in Isabel Inlet should be relocated to Hatteras Village unless the nest is on top of the existing dune.
  - North Ocracoke – any nest in the flats of N. Ocracoke should be moved south of R59.
  - South Ocracoke – any nest south of the dune line on South Point should be relocated to between R70 and R72 (so long as it is not in the area of the "trough."
- The nest is laid in an area in which unusual, but lawfully conducted, human activities pose a serious threat to nests, such as emergency dune pushing following a major storm event. When these situations arise, you will be notified by NCWRC and given instruction on nest relocation protocol that may be unique to the situation at hand. This generally does not occur at CAHA. Your supervisor will alert you if specific activities will alter normal protocol.
- When eggs are verified it is found that there are broken eggs that have resulted in yolk dripping down into the egg chamber. This situation can increase predation. Relocate the nest according to normal guidelines and gently rinse the eggs that have a high amount of yolk on them. This can result from either predation or vehicle impact. If this situation

occurs due to a vehicle or other human activity, call your supervisor and document prior to relocation.

- For any questions on relocation, or to make a difficult call, call your supervisor.

All together this makes up the decision criteria for moving nests at CAHA. It is important to re-iterate that this is for 2010 **only**, and that these protocols will most likely be revised prior to the 2011 nesting season. These additional criteria are determined based on how the beach looks, where we know water table issues are going to be, what type of erosion occurred over the past year, and where troughs are forming. It is NOT based on old and obscure data that does not correlate nest success with beach type. It is NOT based on any human-related activities, such as driving, lighting, or pedestrian access. It is NOT based on which areas nests could be impacted by storms (because that is everywhere).

In CAHA's nest management training manual, the following is the guidelines techs are given as to where to relocate nests to:

- Always make a plan before removing eggs from the nest.
- Relocate to the highest place on the beach possible without getting into vegetation.
- Do not put relocated nests on a steep slope or scarp.
- You should NEVER relocate for an access issue, but do keep this in mind while relocating (i.e. If you have a choice on whether to move a nest north of R44 or south of R44, choose north of R44.)
- Never move a nest more than 1 mile from its original location, unless it is a nest that meets the criteria for an area that is susceptible for erosion. In those cases, follow the guidelines above.

What about Pea Island's nest relocation protocol?

Public comments have indicated that a change to the protocols that were developed by Pea Island would increase our nest success and would generally be more suitable for CAHA. As a result of these comments I requested a copy of their official nest relocation procedures so that we could assess how the implementation of these protocols would impact our nests management activities at CAHA. For a complete set of protocols, please see attached document.

I should first preface that I have the utmost respect for Pea Island and the biologists that work there. I am personal friends with Kris Fair, so I do not take my analysis of their protocols lightly. I should also say that these protocols are being reviewed by Matthew Godfrey at NCWRC for his opinion as well.

Another point to make is that in the official NCWRC comment letter, it was stated that CAHA should consider the protocols developed by Pea Island. Since this is the complete opposite of the NCWRC handbook, the recovery plan, and the biologist's opinion at NCWRC, I can only ascertain that this comment came solely from political pressure put on NCWRC.

So, Pea Island protocols….lets go through the list of criteria one by one.

- Is the beach width from toe-of-dune to the mean high tide less than 50 feet? If yes, relocate to safe-area.

Narrow beaches are generally a result of our un-natural dune line. Unfortunately, beaches are becoming narrower every year. There are some situations where a narrow beach does warrant relocation – such as at Isabel Inlet where the high tide line is at the base of the dunes. However, if we were to have relocated every nest on a beach that was narrower than 50 feet in 2009, (as best as I can re-create it – these are not official numbers) we would have relocated 30 of our 104 nests for this criterion.

- Is the slope of the beach face greater than 4^{o}? If yes, relocate to safe-area.

I am not really sure where they got the 4^{o} measurement, or even how they determine this on the beach. I don't know enough about the theory behind this criterion, but I do know that the only beaches that we have that are less than 4^{o} are at the spits and points (which have water table issues) and south beach. Based on what I can re-create from last year, this would result in us relocating an additional 40-50 nest (We are now at 70-80 of our 2009 nests being relocated).

- Is the nest located at least 30 feet above the high tide line? If no, relocate to safe area.

Well, to be honest, this just is essentially against the NCWRC handbook guidelines and the Recovery Plan. Yes – moving nests that are less than 30 ft may result in a higher hatch success, but it goes against the principles that were discussed above and essentially is done to protect nests from potential storm events. I can't recreate how many nests this criterion would have resulted in us moving last year, but I think that it is safe to say that we are approaching 100 of our 2009 nests.

- Is the nest located in one of the identified "hot spots" as shown on the attached map? If so, relocate to safe area.

For us this would mean the areas that we have already determined (spits, points, Isabel, etc.). No real changes here – these are areas that they know must have erosion or water table issues.

- Is the nest located in an area with one or more of the following conditions:
  - In an area where the dune was reconstructed as a result of overwash within the last 12 months?
  - In an area where dunes have been undercut by water or at the base of a nearly-vertical dune face?
  - In a low, "slough" or intertidal pool area landward of the ocean berm that could result in a flooded pool?
  - Located in an area adjacent to or near a scarp formation?
  - Located westward of the primary dune system?

Luckily dune construction typically does not apply to us unless you are discussing Buxton village. Vertical dune faces exist and we typically move nests out of that area since it falls under the "slouching escarpment" clause of the NCWRC guidelines. We do relocate out of flooding pools or "troughs." We do not move nests away from scarp formations unless the nest is below the scarp (which typically means the nest is below the high tide line). We haven't had many nests that I would consider to be westward of the primary dune system, so we don't have an absolute guideline for that. In that situation we would call NCWRC and ask for advice.

With this type of criteria it is understandable why Pea Island relocates the vast majority of their nests. However, this set of criteria at CAHA would be near impossible. Even if these actions were biologically defensible (which we have discussed above as to why they are not) it would be logistically near impossible to implement these procedures due to the amount of nests we get per year.

Even if we needed to relocate EVERY nest laid on the Seashore based on *our* criteria, we are still supposed to move nests straight back to the closest area that does not incur immediate threat – not to a safe-area (for all the areas outlined above).

ISSUE: Other sea turtle issues. It is perceived that NPS focuses on the number of sea turtle nests, rather than hatch and emergence rates as its measure of "success". Expanded buffer for sea turtle nests during their hatch window seem larger than needed and unreasonably restrictive on recreational access. The filter fencing policy is perceived as ineffective and may put nests in jeopardy during overwash periods. "No pedestrians" in the intertidal zone below the nests seems unreasonable. (We say we are following the NCWRC handbook, but is says nothing about the various sizes of the expanded buffers or the filter fencing. These measures were in the Interim Strategy, perhaps because of similar measures mentioned in the USGS protocols, but the context is one of most of the park being open to ORV use in the fall and there being no night driving restriction. Do we think such measures reasonable and effective, really necessary if ORV use is limited to designated routes and there is some sort of night driving restriction in the fall, and do we really need to continue implementing these measures for the next 15 years?

OBJECTIVES: Take reasonable steps to improve hatch and emergence success. Reconsider and retain-or-revise the turtle management measures that do not originate in the NCWRC handbook. Ensure measures selected for FEIS are reasonable to implement, understand, and enforce.

IDEAS FOR DISCUSSION:

- Would a reduced expansion size, or standardized buffer regardless of use zone, be appropriate given that ORV would be restricted to fewer locations and at night?
- Aggressively pursue a nest watch program, or better define situations in which a nest watch would be applied vs. situations in which it would be less likely to occur.
- Consider key-hole fencing (like PINWR) for nests that are actively being watched.
- Once a nest reaches its hatch window and the buffer expansion is implemented, allow pedestrian access during daylight hours in the intertidal zone seaward of the nest; and sign site accordingly (to prevent pedestrians from walking up into the "U-shaped" closure.
- Develop educational signs for turtle closures.
- Consider alternatives, if any, for reducing nest loss and improving hatch and emergence rates. Would it be reasonable to identify a target hatch or emergence rate (e.g., 60%)?

Comments by Michelle:

It is perceived that NPS focuses on the number of sea turtle nests, rather than hatch and emergence rates as its measure of "success".

This is true. Please read the section I wrote on the goals of sea turtle management under the relocation section. The other reason why this perception exists is due to the fact that neither of our performance measures in the BO have to do with success. This is intentional on the part of FWS. Nest success is determined by storm activity rather than our relocation measures.

Expanded buffer for sea turtle nests during their hatch window seem larger than needed and unreasonably restrictive on recreational access.

The closures are massive and restrictive. They are some of the largest closures seen in the nest management of sea turtles. The reason for their size is lighting and human recreation. I believe we can reduce the size of closures and the way they impact access if we do two things:

1. **Work on our Lighting Issues**: This means *eliminating* night-time driving during the hatching season. Under the consent decree anyone who picked up a permit was allowed on the beach at night. To reduce closure sizes in ORV areas we need to *fully* protect emerging hatchings. This means something like 8-8 night time driving restrictions. I don't think we can reduce the size of closures in the villages unless we can get the village to adopt a comprehensive lighting plan. Also, see #2.
2. **Volunteers:** Other beaches have less to fear from lighting issues due to the fact that there are generally volunteers on the nests until a certain time. Volunteers are able to ensure that hatchings make it to the water. There are some logistical complications about if the volunteers could allow pedestrians into the closure to see the hatchings….but nothing that cannot be worked out. However, to have a large-scale dependable volunteer program, we NEED a volunteer coordinator. Also – this volunteer coordinator needs to be working within Resource Management, or at least have VERY good communication with RM (not to say that Interp cannot do this, but in terms of coordination it would be really hard to do it from outside RM). With volunteers on nests in the villages and day use areas, we could maybe reduce the buffers of these nests, although I still think we need a lighting plan to deal with this.

The filter fencing policy is perceived as ineffective and may put nests in jeopardy during overwash periods.

Filter fencing definitely has issues. It is difficult to install, maintain, and remove. It also doesn't always work. However, since we do not have *full* nighttime driving coverage, a lighting plan in the villages, or staff/volunteers on at night at every nest to determine how many hatchlings we lose to disorientation, currently there are no alternatives. I have talked in depth about this issue with several biologists and they all say that the only way to get rid of it is to address the lighting problems. Filter fencing can create a funnel for water that has the potential to drown nests in storm situations, which is why we pull it down prior to storm events. AT least in the last two years we have not lost a nest to inundation caused by filter fencing (it may be longer I just wasn't here). **If we wanted to make our filter fencing policy better, we could close the beach to vehicles 24-48 hours pre-storm activity so that we could pull the fencing earlier and reduce our risk. As it is right now we have to wait until the last couple of hours before the storm hit to remove it since nests could hatch overnight and become disoriented without the filter fencing.**

"No pedestrians" in the intertidal zone below the nests seems unreasonable. (We say we are following the NCWRC handbook, but is says nothing about the various sizes of the expanded

buffers or the filter fencing. These measures were in the Interim Strategy, perhaps because of similar measures mentioned in the USGS protocols, but the context is one of most of the park being open to ORV use in the fall and there being no night driving restriction. Do we think such measures reasonable and effective, really necessary if ORV use is limited to designated routes and there is some sort of night driving restriction in the fall, and do we really need to continue implementing these measures for the next 15 years?

Well, we could allow pedestrians in the inter-tidal zones, but unless we have staff/volunteers in the field at night to rake out tracks, fill in holes, and do education with people we will lose hatchlings. We can put up all the signs we want but people will still leave beach furniture out and dig a hole to China. We could open the inter-tidal zone during the day and then close it at night – which would be a perfect compromise, but again, we need more staff and volunteers to make that happen.

On another note, there is no biological reason to close the intertidal zone to vehicles during daylight hours. However, it again requires staff and volunteers to open and close the intertidal zone every day. We could not rely on volunteers alone for this task since there is a high level of responsibility (raking out vehicle tracks, closing and opening the area, asking people to leave area, etc.) It's a great idea, but logistically hard and easy to mess up. A volunteer doesn't show up one day and we end up with run over hatchlings or vehicles suck in areas that are now closed.

Signing the high tide line is also difficult. We would need to sign the tide line if we were allowing pedestrians and/or vehicles into the intertidal zone. However, if the signs fell during high tides and then a nest hatched they could become stuck in string or flagging. Also, if the signs were above the high tide we would not be able to use filter fencing as close to the water as we need to. At low tide, we already run the risk of large-scale disorientation below the filter fencing.

Would a reduced expansion size, or standardized buffer regardless of use zone, be appropriate given that ORV would be restricted to fewer locations and at night?

Possibly….if we deal with lighting and increase volunteers. See above.

Aggressively pursue a nest watch program, or better define situations in which a nest watch would be applied vs. situations in which it would be less likely to occur.

Yes! But we need a volunteer coordinator. Volunteers are most effective in villages and near campgrounds and day use areas where pedestrians are likely to congregate.

Consider key-hole fencing (like PINWR) for nests that are actively being watched.

NO!!! Although an alternative to filter fencing would be beneficial, Pea Island's methods result in several negative consequences. Unfortunately the way that the Pea Island system works is that the volunteers install the key-hole fencing every night, and then remove it when they leave. When they leave they cage the nest. Any hatchlings that emerge after the volunteers leave are trapped in the cage and then picked up by turtle patrol the next morning. They are then kept in a bucket in the office over the day and released the following night. This practice results in hatchlings expending all of their energy before they

even reach the water, resulting in hatchling mortality. If we did this fencing but did not cage the nest before the volunteers left emerging hatchlings would have no protection from lighting issues. If we left the key-hole fencing up all night every night it could funnel water to the nest (more so than filter fencing), increase predation, and trap hatchlings.

Once a nest reaches its hatch window and the buffer expansion is implemented, allow pedestrian access during daylight hours in the intertidal zone seaward of the nest; and sign site accordingly (to prevent pedestrians from walking up into the "U-shaped" closure.

See above. This is biologically defensible, but I think there are some major logistical issues that need to be considered.

Develop educational signs for turtle closures.

I think educational signs are great! If we have the money and support to do this I think we should do it with all of our signs. That being said, we have a hard time getting people to read our regulatory signs (wording and pictures), so I am not sure if everyone will read them. Really I think we need more education – period…not just signs. We need more resource interp programs, more public excavations, more outreach, etc.

Consider alternatives, if any, for reducing nest loss and improving hatch and emergence rates. Would it be reasonable to identify a target hatch or emergence rate (e.g., 60%)?

See the section in the relocation section about why the new Loggerhead Recovery Plan steers clear of setting a goal hatch success. Basically, hatch success depends on environmental conditions and storm activity, not our management. In terms of relocation, we should relocate those nests that we know will have problems.

ISSUE: Use of volunteers for turtle management activities
OBJECTIVE: Compare alternative F with stakeholder suggestions and decide upon best approach
IDEAS FOR DISCUSSION:

- Use volunteers to conduct daily patrols
  - Have two phased approach: FINDER patrol to looks for signs of a nest, then mark it; PROTECTORS – evaluate found nest sites to determine if relocation is needed (then implement relocation, if needed)
- Do NOT use volunteers to conduct turtle patrols (may have conflict of interest)
- Use volunteers for nest watch program
- Need a volunteer coordinator position to develop program and manage volunteers

Comments by Michelle:

Use volunteers to conduct daily patrols/Do NOT use volunteers to conduct daily patrols.

Allowing volunteers to conduct turtle patrols by themselves could lead to serious conflicts of interest. Even if we do not have volunteers touching nests, they may have pressure on them from friends and family to NOT find nests that result in limited recreational access. The majority of our current volunteers are reliable, genuine people that believe in what they are doing with us, but many of their friends and family do not support their activities. If a volunteer purposefully "missed" a nest in front of a ramp or access point, we may never even realize it. Even if a volunteer has the best of intentions and is trying to see everything that they can they may still miss nests….it is too much of a liability. I even worry about some techs, let alone volunteers. All of this being said, I do think that volunteers should be allowed to ride along with technicians that are conducting turtle patrol. We need a volunteer coordinator to work on this, but it opens the door for people to be involved and active without putting ourselves at risk. This is a program we started in 2009 and I am planning on continuing on Ocracoke in 2010.

Have two phased approach: FINDER patrol to looks for signs of a nest, then mark it; PROTECTORS – evaluate found nest sites to determine if relocation is needed (then implement relocation, if needed)

I am not opposed to this, since it means that we could potentially open the beaches earlier every morning. However, volunteers should be riding with technicians, not doing this themselves (see above). Also, we would need more morning differential to make this work.

Use volunteers for nest watch program

Yes! We need a volunteer coordinator!

Need a volunteer coordinator position to develop program and manage volunteers

YES PLEASE!

ISSUE: **Hours of night driving restrictions**: FWS and others recommend that we go with fixed hours, rather than "hour after sunset, ½ hours after sunrise or after turtle patrols are completed" language which is harder to understand and enforce. Others are concerned that the hours are overly restrictive given the history of good false crawl-to-nest ratios during most years at CAHA.

OBJECTIVE: Simplify. Come up with fixed hours for night driving restrictions that are perceived as protective for turtle protection, allows time for NPS turtle patrols of designated ORV areas during the primary nesting period, and is not unreasonably restrictive for recreational access at other times. Provide complementary protection measures for hatchlings in the fall (such as light filter fencing, etc.), but have criteria for allowing night driving in areas without unhatched turtle nests after September 15.

IDEAS FOR DISCUSSION:

- Use the existing data on first nest/last nest laid at CAHA, plus the data on sunrise/sunset times during that same period, to come up with fixed hours that provide effective resource protection during the expected nesting period (mid-May to early September) and some protection but reasonable recreational use before and after that period. For example, it would not make sense to me to say that night driving is restricted all season long from 7 p.m. to 7 a.m. based only on the fact that those hours approximate sunset/sunrise on September 30 when some nests may hatch. The hours should effectively cover the primary nesting period and have complementary measures for dealing with potential lighting effects during the fall hatching season.
- Limit modification of night driving hours (+/- 2 hrs) for commercial fishermen to morning hours only (i.e., do not modify in evening, only in the morning)
- Hybrid approach?

Comments by Michelle:

FWS and others recommend that we go with fixed hours, rather than "hour after sunset, ½ hours after sunrise or after turtle patrols are completed" language which is harder to understand and enforce. Others are concerned that the hours are overly restrictive given the history of good false crawl-to-nest ratios during most years at CAHA.

Both are correct. No matter what we do we need more money for LE so that night-time driving regulations can be enforced. Right now there are never any rangers on prior to 6am, so we don't know if we have a compliance problem with nighttime driving restrictions or not. As for hours, they are restrictive….but I don't know what our options are. We need the time in the morning to make sure that we are seeing everything, and if we don't close the beach early enough in the evening we are risking a good percentage of nesting adults and emerging hatchlings. I think we should stay away from talk of false crawl to nest ratios since this depends on our ability to *see* false crawls, which we don't always do (a lot may disappear overnight) and since there are so many factors that go into a turtle making a false crawl (sand texture, other lighting sources or disturbances, etc.).

Use the existing data on first nest/last nest laid at CAHA, plus the data on sunrise/sunset times during that same period, to come up with fixed hours that provide effective resource protection during the expected nesting period (mid-May to early September) and some protection but reasonable recreational use before and after that period. For example, it would not make sense to me to say that night driving is restricted all season long from 7 p.m. to 7 a.m. based only on the fact that those hours approximate sunset/sunrise on September 30 when some nests may hatch. The hours should effectively cover the primary nesting period and have complementary measures for dealing with potential lighting effects during the fall hatching season.

For nesting season I think our best bets are:

1. 8pm – 8am: Works well all season long even into hatching season. Easy to remember and enforce.
2. 8pm – 9am: Works well all season long even into hatching season. Harder to remember or get confused but easy to enforce. Ensures that RM has plenty of time to check beach in the morning.
3. 8pm – 8am w/ fixed barriers at Ramps: This may be the best option. It works all season long into hatching season. Easy to remember and enforce. Ensures that RM has plenty of time to check beach in the morning. Reduces violations. Makes it easy to reduce closure sizes. LE could close gates at night after getting people off the beach. Turtle patrol opens gates as they go by. Provides additional flexibility since beaches are guaranteed to open by 8am but could open earlier as turtle patrol passes. The negatives are that this makes it harder to have a park-and-stay program or to have the commercial fisherman come in earlier.
4. 9 or 10 pm – 8am: This works for nesting season, but we would have to change the hours at the onset of hatching season.

As for dates: I think night-time driving restrictions should be in effect from May 15 or the 1st nest of the season until October 15th. This takes care of both nesting and hatching season and, if we start restrictions at 8pm, we can reduce the closure sizes to 150ft rather than 350ft. Any active nest after October 15th could be bumped up to 350ft until it hatches or is removed.

Limit modification of night driving hours (+/- 2 hrs) for commercial fishermen to morning hours only (i.e., do not modify in evening, only in the morning)

I am not completely opposed to this, but the commercial fishermen need to be more accountable for their actions. First, if we permit a commercial fisherman, we need something obvious that we can identify them by. Techs on turtle patrol should be able to look at the vehicle and know that it is permitted to be out there – either by tag #, permit in the window, sticker, etc. Also, the by-catch from the commercial fishermen often increases predators in bird areas. I don't know how this could be done, we need to have them bury or trash their by-catch rather than dumping it overboard and having it land next to plover chicks. If there was a way that they were required to report any incidental captures of sea

turtles that would be good. There also needs to be a way to revoke a commercial fisherman's permit if he does not abide by regulations (i.e they are out earlier than they should, they enter a closure, etc.)