

From Dave Owens (CofC retired), Jeff Schwenter (South Carolina DNR) and Josh Ratay (CofC graduate student)

Preliminary assessment of the ANYKIT Endoscope (borescope) for use in sex identification prior to necropsy in sea turtles

In January 2024 George Balazs suggested trying an inexpensive industrial style endoscope (borescope) for determining turtle sex without full necropsy. The South Carolina Department of Natural Resources Sea turtle program was just beginning an exercise to catch up on some stranded animals that had been frozen. Very simply, the plan was to try the endoscope on a set of frozen turtles prior to regular necropsy. The following is the original question which George proposed.

“Determining the gender of a dead sea turtle is one of the many benefits of conducting a necropsy. However, thorough necropsies are labor and time intensive involving messy fluids and tissues to clean up and dispose. Also, in some areas here in Oceania necropsies are culturally frowned upon. For these and other reasons, in some situations it would be nice to have a rapid clean non-necropsy way to view the gonads. The attached photo shows an inexpensive (~\$40 USD) endoscope camera with semi-flexible line and LED light. The light tip would be inserted into a small slit made in the inguinal of the turtle. Has anyone used such a camera for this purpose?”

Looking forward to learning. Others on Cturtle may be too, so please send whatever information you have to everyone. George”

The **PROCEDURE** we used was similar to what is typically done in a live turtle laparoscopy (celioscopy). We thank Drs. Wyneken, Jacobson and Pilcher for several helpful suggestions and insights. After the turtles were thawed they were placed head down and attached with bungee cords to a stabilizing frame (we used a lab stool on a table) so that the inguinal areas could be accessed (see Figures 1-5). The rear legs were pulled firmly up and tied to expose the full inguinal region.

We then used a veres canula needle (a 3 inch spinal tap needle should also work) inserted into the coelomic (peritoneal) cavity to introduce air to inflate the cavity (Figure 6). We used my wife’s bicycle pump (please don’t tell her) to slowly inflate (insufflation) making sure the air was entering the cavity and not confined in the body wall (Figure 2 and 6). The needle was attached tightly to the pump with a 2 meter piece of aquarium tubing.

Then on the opposite inguinal side a round tip (not sharp tip) scalpel was used to make an approximately 0.5 to 1 cm long cut through the skin and then deeply into the inflated body cavity (Figure 7). You know you are deep enough when horrific smelling gas escapes from the turtle.

We then inserted the endoscope through the cut, making every effort to keep the lens dry and free from body fluids (this is a major challenge). Our Anykit came with a 90 degree angle and protected mirror attachment for the end of the scope. This attachment helped to protect the lens and to keep the actual lens clean and pointed posteriorly to locate the gonads. Then, we needed to introduce more air into the body cavity to improve the visual field. Because the scope entry cut now leaked air, a hemostat was clamped around the skin covering the endoscope cable to reduce air loss as additional air was inserted with the pump.

Our ANYKIT inspection camera (the cheapest one) model NTC30L/NTC30D came with a simple software package for your phone which you use to control camera angles, photos etc. In our system the phone provides power for the camera's LED lights and stores photos. More expensive systems come with light sources, viewing screens and memory chips for photos. Instead of a phone, a laptop computer can be used. These modifications should improve image quality.

The 90 degree mirror we used directed the image posteriorly in the animal where the bladder could often be seen as a landmark. Our previously frozen (and still very cold) animals did not have a significant amount of gas in the gut. As long as insufflation was maintained (a nearly full time job for an assistant) viewing was fairly easy if the lens could be kept clean and did not fog due to the temperature differential between the scope and the turtle. This should not be a problem on previously unfrozen animals.

Each of the turtles examined was fully necropsied after scoping for data collection and sex determination.

Our **RESULTS** have been mixed. To date, we've tried the camera procedure on 8 turtles; 5 Cm (28.1 – 52.2cm SCL), 2 Lk (29.8, 38.0cm) and 1 Cc (about 62 cm). All had been frozen prior to necropsy. We would make note that the camera lens regularly needed to be cleaned off to improve vision on the phone app (although this may be improved if the turtle was not frozen/thawed and contributing to condensation).

We were able to clearly determine the sex of 5 of the 8 turtles using the AnyKit endoscope. As Dr. Wyneken noted the decaying ovary in small animals loses most of its distinctive pink/yellow coloring, becomes flattened (Figures 9 & 10) and is often difficult to see. The only male we have examined was quite obvious (Figure 11).

Comments and problems:

1. The smaller turtles we examined were more difficult to visualize with this scope technique.
2. The process is very similar to laparoscopy except you do not have to worry about harming the turtle or breaking an expensive endoscope.
3. It is important to keep the lens clean to avoid a blurry or foggy image. We had to take the scope out regularly to clean the lens (Q-tip cotton swabs worked OK). When you

take the scope out you also lose the insufflation, thus constant attention to the air pump is needed.

4. Due to glare, necropsy using this technique would most likely need to be done inside or under shading.
5. We required three people to do an examination: 1. Scope person, 2. Phone person and 3. Air Pump person.
6. With practice we did improve our technique.
7. Get the shortest cable available for the scope as the long cable will be in the way.
8. To stiffen the AnyKit endoscope cable we slit a 20 cm piece of tigon aquarium tubing (7mm o.d., 5 mm i.d.), wrapped it around the cable adjacent to the scope and then wrapped the enlarged section with a waterproof tape. This made the scope cable stiffer and easier to rotate and control in the body cavity (see figure 1).
9. A real endoscope (for surgery) comes with a sleeve and valve system which helps to keep the scope lens clean and the air contained inside the body cavity.
10. When learning this endoscope technique it will be very important to do at least a partial necropsy for sexing the turtle to evaluate/validate your borescope assessment.
11. Some AnyKit type Endoscope systems come with included LCD screen which may improve image quality.

https://www.amazon.com/Anykit-Endoscope-Inspection-Semi-Rigid-Waterproof/dp/B0C1B47KSS/ref=asc_df_B0C1B47KSS/?tag=hyprod-20&linkCode=df0&hvadid=674076307663&hvpos=&hvnetw=g&hvrnd=8845205687859631830&hvpone=&hvptwo=&hvqmt=&hvdev=c&hvdvcmdl=&hvlocint=&hvlocphy=9010521&hvvtargid=pla-2204750239823&mcid=cd1fae3b0e1633e6b2cb9ef9e4e3eb84&th=1

Suggestions from experienced researchers:

Hiyya

For insufflation, one thing I have found that works for small turtles is the small hand pumps used for blowing dust off camera lenses. They are cheap and have a long thin tube that can fit a piece of aquarium hose. This works really well for only small turtles - for the larger ones a regular foot pump for inflating footballs and such works well. Today there are also small USBD car tyre inflators that would probably do a wonderful job also.

Nick

Dr. Nicolas J. Pilcher

It looks like this might be best for identifying sex. Other issues may be much more challenging.

For dead turtles and sex ID, there are a couple of things to keep in mind.

The first is the GI tract tends to get "gassy" so as an expandable tube trapped in a box, the viscera may not get out of the way in a dead turtle when it is tilted.

The second is for immature turtles. Once degradation gets to the point of all the organs being the same color (usually some form of dark pink) some of the key characteristics that aid in distinguishing ovaries from testes break down (literally). Before degradation, it is typical for the ovary to have a relatively

wide mesentery attaching it to the coelomic membrane covering the kidney. Thus, the ovary appears floppy. In contrast, the testis tends to be tightly attached to the kidney by a very short mesentery. As degradation progresses, the mesenteries and the coelomic membrane become loose so that the testis too can appear floppy.

I suspect that viewing the accessory ducts with this system may be a significant challenge, I echo the recommendation have a system to allow stiffen the flexible end.

Cheers!

Dr. Jeanette Wyneken

I have used one for other purposes and not impressed. Especially when compared to a high quality scope that we use for sexing birds and other reptiles. Given cost, worthy of a try. But first training to identify the gonads is needed.

Dr. Elliott Jacobsen



Figure 1. AnyKit Endoscope (borescope) system. From left, modified scope attached to phone. Our scope has been modified with a section of tigon tubing then covered with waterproof tape. Above is a separate section of tigon tube and the type of tape used to cover the cable to make it stiffer. Also shown are the instruments (hemostat, forceps, rounded blade #10 and scalpel #3) and lab stool for holding turtle in an inverted position.



Figure 2. Insulation system. From left, veres canula needle attached to aquarium tubing and bicycle pump.



Figure 3. Set up with stool on table all tied up with bungee cords.

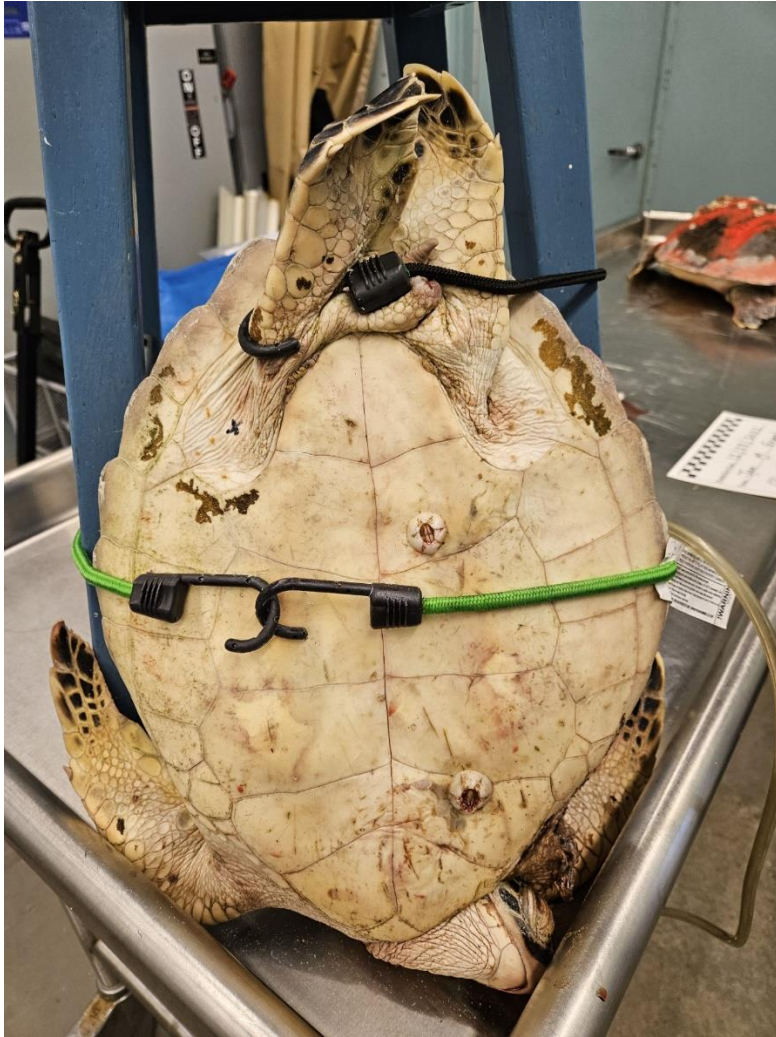


Figure 4. Set up on stool with both inguinal areas exposed.



Figure 5. The “X” marks the spot to be used for scope insertion. A similar area is used on the opposite inguinal area for the inflation needle insertion (we used a veres canula).



Figure 6. Area on the opposite inguinal area with veres canula inserted. Inflation is required prior to scalpel use on the opposite inguinal area.



Figure 7. Making initial scalpel cut using forceps.



Figure 8. With the scope inserted, the scope person is viewing the phone and the phone person is taking photos. Note veres needle is still inserted in the opposite inguinal area (below fibropapillomas), thus air can be regularly infused from the pump.



Figure 9. Female ovarian tissue visible despite some fog and glare on lens tip.



Figure 10. A not very well focused Ovarian image but the lens is not at the optimal focus distance for this inexpensive endoscope (borescope).



Figure 11. Yellowish Male testis with white bladder above.

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