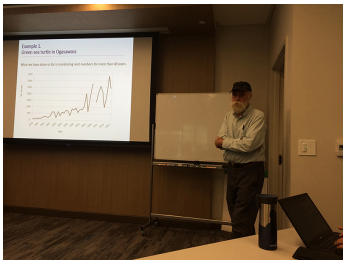
# Impressions on the 39th International Sea Turtle Symposium, Charleston, USA, 2-8 February 2019

George Glen & Kostas Papafitsoros [1]

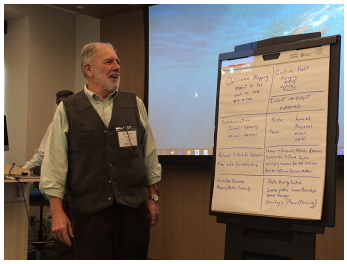
The 39th annual International Sea Turtle Symposium (ISTS) took place on the 2-8 February 2019 in Charleston, South Carolina, USA. Over 800 biologists, conservationists, vets, and social scientists participated from 50+ countries. This is a very unique conference in that it is a medium to discuss and share scientific knowledge as well as a celebration of sea turtles and everything that surrounds them − including humans.

This year's theme was "Navigating the Future", a phrase that has a double meaning: on one hand it refers to the work of the current president of the International Sea Turtle Society, Ken Lohmann, who has dedicated his life's work to understanding the mechanics and conservation implications of sea turtle navigation (more details below). On the other hand, it encapsulates recent thoughts on the future of sea turtle conservation given that it is widely considered a global success story.

The symposium opened up at the weekend of 2-3 February with 25 workshops − more than any previous symposium. An energetic and perhaps unusual workshop was organized by Jack Frazier, Jeff Miller, and Shelli Hendricks, titled "Does What We Do Matter? The Critical Need to Evaluate and How to Do it". Jack and Jeff are two iconic figures in sea turtle conservation and science with 50 and 40 years of experience respectively. They expressed the need to constantly evaluate the efficiency of sea turtle programmes; for, in a changing world, it is important to update your protocols and management decisions to identify new, and persistent old, threats.



Jack Frazier



Jeff Miller

Group photo, workshop *Does What We Do Matter? The Critical Need to Evaluate and How to Do it*

Sometimes, we, NGOs or scientists, have done things for so long that we lose our direction and forget our objectives; by having some form of oversight, we can reassess and reevaluate the mission of conservation in the light of new data and recovering populations. Jack was continuously encouraging the participants during their presentation as any good teacher should do. He urged everyone to assess their work and their motivations:

*Conservation: for who? Whose sea turtles are they?*

Jack was kind enough to share with us some stories from the early 80's when he visited Greece to offer his advise to Dimitris Margaritoulis along with several other individuals who were later to

[1] This review expresses the personal opinions of the authors. While the symposium had many very interesting and high quality presentations, here we mention those that got our attention (subjective).

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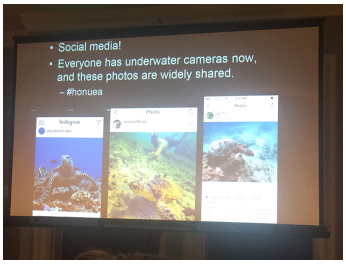
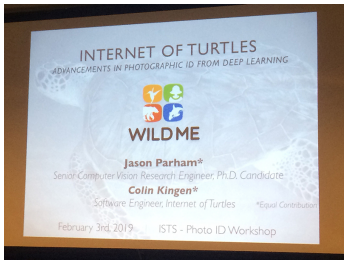
found ARCHELON, the Sea Turtle Protection Society of Greece. We were excited to hear that Jack still remembers the beach that he was tagging turtles back then, the same that we also grew up as conservationists: Sekania beach on Zakynthos island. It was also our first meeting with Jeff, also a great teacher, master in sea turtle embryology. Jeff Miller went on to win one of this year's lifetime achievement awards – the most prestigious of the society.

Another very active workshop was the one on "Sea Turtle Photo Identification", organized by Steve Dunbar, Jill Hudgins and Dustin Baumbach. Exciting projects were presented, from Maldives (Olive Ridley Project), Curacao in the Caribbean (Sabine Berendse–Sea Turtle Conservation Curacao), Hawaii (Cheryl King), and Zakynthos island (K.P). It is clear that with the rise of social media and citizen science, photo ID has evolved into a very useful tool for a variety of topics in sea turtle research and conservation. Moreover, recent progress in the fields of machine learning and computer vision have resulted in promising techniques that may lead to an automated matching process, i.e., find turtles that have the same scute pattern from a large set of data (talk by Jason Parham).



Cheryl King's presentation



Jason Parham–WILDME


Photo ID workshop

While sea turtle conservation and research started on nesting beaches, these areas are half of the equation. On beaches, we monitor females and hatchlings, but that begs the question, what about males? The Global Male Sea Turtle Initiative workshop is the brainchild of Marco Garcia and several members of the Archie Carr Center for Sea Turtle Research. The aim of the workshop was to identify key areas of research on several topics relating to male turtles. These topics included, but were not limited to, demographics, dichotomies in life-history traits with females, and threats. To achieve this, the participants split into groups with each group tasked with discussing and presenting gaps in knowledge on their chosen topic. Of the issues identified the early identification of sex is a problem researchers have struggled with for decades. Without the ability to identify sex in immature individuals, how can we start disentangling differences in male and female ecology? The ending presentations provided a peer review process to refine the goals each group decided on and provide a foundation for future research on male turtles.



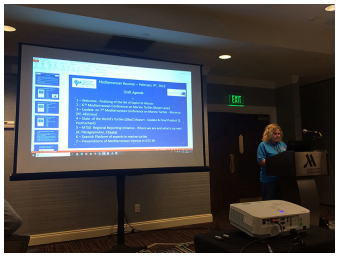

The *Global Male Sea turtle Initiative* workshop

Another productive workshop was titled "Reproductive Physiology: What Turtle Gonads Reveal and How to Read Their Secrets" and presented by Colin Limpus – another historic figure – and Jeff Miller. The question now stand, what can gonads tell us about a sea turtle? By examining a females ovaries, researchers can crudely estimate the start and end of a females nesting season, as well as number of times a female has reproduced in her lifetime. This is important because with an understanding of lifetime reproductive output and reproductive lifespan, we can increase the accuracy of current population models. Nevertheless, this is a simplified explanation and there are underlying difficulties scientists still face. One interesting fact that stood out is how the end of a nesting season is determined: when a critical threshold of mature follicles (or eggs in the ovary capable of being fertilized) is reached, the hormonal feedback loop is broken and a female turtle will reabsorb her remaining mature follicles in a process known as follicular aterisia. Even if she is "capable" of producing another clutch of eggs, she will not because of that hormonal change.

The third day continued with the regional meetings, where news were discussed on a more local

scale: Indian ocean, Mediterranean, Caribbean, Oceania/Pacific islands, Africa and east Asia. The Mediterranean meeting was quite engaging even though it had many absences also due to the fact that the Mediterranean conference in marine turtles took place recently. Nevertheless, the strong connection and collaboration between the Mediterranean people was one more time evident. This is further reflected in the recently published report of IUCN Marine Turtle Specialist Group for the Mediterranean sea turtles, as well the new SWOT report dedicated to the sea turtles of the region.


The new issue of the State of the World's Sea Turtles dedicated to the sea turtles of the Mediterreanean sea



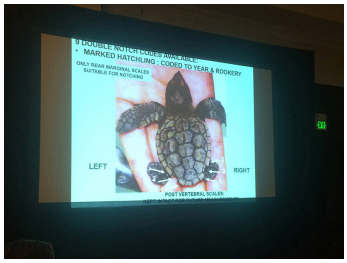
Aliki Panagopoulou (the Leatherback trust & ARCHELON) coordinating the Mediterranean meeting

Group photo, Mediterranean regional meeting

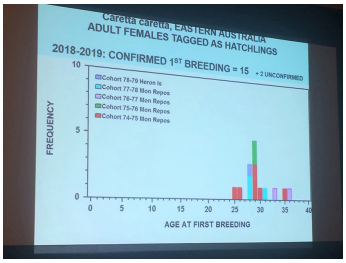
The day closed with a social gathering in South Carolina's aquarium which also hosts a sea turtle rehabilitation centre. A huge Atlantic male loggerhead undergoing rehabilitation there, reminded us one more time the incredible size difference between Mediterranean and Atlantic loggerheads.

Tuesday, 5th February was the first day of the main part of the symposium. The plenary talk of Colin Limpus stood out, looking back at his 50 years working with sea turtles in Australia. Colin later gave a talk on probably one of the longest experiments in the world: tagging loggerhead hatchlings by removing small parts of their carapace and see them coming back to nest in the same region where they were born only...around 30 years later.


Colin Limpus' presentation




Colin Limpus: marking loggerhead hatchlings mid-late 70's...



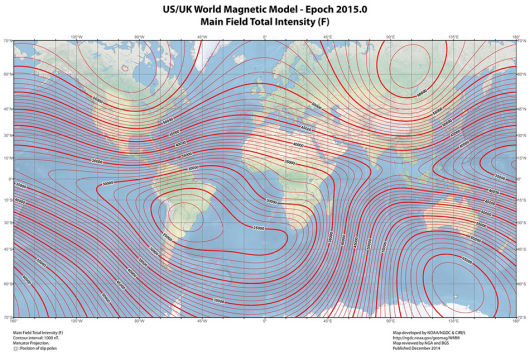

...only to see them again nesting 25-35 years later...

The day continued with sessions on Fisheries and Threats and Nesting Biology. One of the highlights of the latter, and probably of the whole symposium, was a talk by Boris Tezak on "Using Blood Samples to Identify the Sex of Loggerhead Hatchlings", which also won an Archie Carr student award. This has great implications for identifying sex ratios of breeding sites without the need to sacrifice a few hatchlings as it has been done so far or wait for them to grow up a few months in order to find their sex using laparoscopic techniques. Identifying sex ratios of sea turtle populations is a critical issue in view of global warming (higher temperatures produce more females), at least with respect to hatchling sex ratios since the issue of sex specific mortality remains an open and an interesting question. This effect of climate change is a big question mark with some studies suggesting resilience of some sea turtle populations and some others already reporting feminization of other populations at least in specific foraging sites. Marc Girondot stressed one more time the difficulty to infer sex ratios of naturally incubating nests given the temperature fluctuations within it. Marc, with his critical and challenging questions, highlighted many times the need to think outside the box.

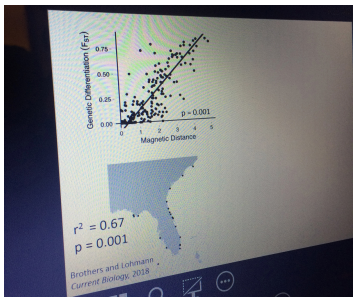
A relevant talk to the effect that weather can play on sea turtle breeding sites was given by Marylou Staman. She explained that even though some recent storms completely destroyed one of the main nesting beach for the Hawaiian sea turtles (East island on French Frigate Shoals), nesting can shift to nearby areas, an optimism originating by the historic resilience of the specific population. That view was also supported by George Balazs (expert on Hawaiian sea turtles) with a recent letter to the CTURTLE forum.

A special session on Genetics and Genomics highlighted on more time the wide applicability of this field. As an example we mention Brian Shamblin, who leads a loggerhead genetic tagging project in the southeast United States. One egg from every single nest is removed and the genetic signature of the mother loggerhead is identified, providing new insights in nesting site selection and mean clutch frequency that were difficult to obtain through traditional flipper tagging techniques. To say this research is impressive is an understatement. In a recent publication, Brian Shamblin and others sampled 20,682 clutches in 2 years. Of these, 20,222 clutches were assigned to 5684 females. The scale of this research is unprecedented. With the study ongoing, we will be excited to see their future results and innovations.

Wednesday, 6th February opened with a special session of "Navigation, Migration and Natal Homing", a field that Ken & Catherine Lohmann and their group (e.g. Roger Brothers, Kayla Goforth) have contributed a lot. During a series of exquisite experiments, they have shown how sea turtles (adults and hatchlings) detect the earth's magnetic field (intensity and inclination angle) and how they use it to navigate back to breeding and foraging grounds. Their results are very convincing and it was shown that at least in the southeast US loggerhead population, distant geographical areas with similar magnetic signature host breeding individuals of similar genetic structure. What is also very intriguing is that the most important breeding sites for the Mediterranean loggerheads (Zakynthos and Kyparissia Bay in Greece) have very similar magnetic signature with the breeding sites of Florida – the most important for the species globally.




Map of the intensity of earth's magnetic field. Areas the belong to the same lines have same intensity values. Source: Wikipedia




Roger Brothers' talk: Magnetic distance correlates with the genetic diversity among different geographical areas

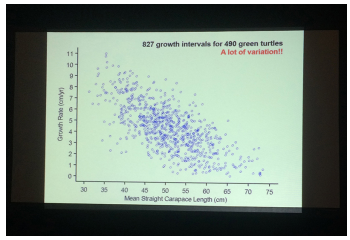
The afternoon session opened with a series of talks on "the Future of Sea Turtle Conservation". This is part of a continuous discussion that started at the last year's symposium in Japan. This discussion is not only about newly emerged and future threats, but also how to deal with successes. Continuous and dedicated conservation has led to increasing or stable population trends, and hence the question about what the next steps and the next targets should be, is a valid one. Jack Frazier once again highlighted the need for defining clear objectives.


A certainly thought provoking title by Jack Frazier, talk given at the session "the Future of Sea Turtle Conservation"

The next day, 7th February had also many interesting talks. An impressive one was given by Ryan Pearson, who explained how information from barnacles attached to sea turtles can be exploited in

order to answer questions about the turtle's foraging habitats as well as their migrations from them. Lorene Jeantet, presented a interesting application of machine learning to sea turtles' behavioural studies, where neural networks are trained to automatically assign acceleration-depth data to specific sea turtle activities. In other words, there can be ways to determine automatically what the turtle is exactly doing by just measuring its speed, acceleration and depth (without any use of cameras).

On a more analytical note, Karen Bjorndal introduced the idea of distributional regression models, which models the mean and variance of the response variable instead of just the mean like in most other regression models. The advantage of this modeling approach is that one can assess if the mean growth rate and the variance around that growth rate among individuals changes.




Karen Bjorndal explained how the large variance in growth rates can also be incorporated in ecological models

It was also very interesting to listen to updates from the Jumby Bay Hawskbill Project in Antigua, Caribbean, talk by Kathryn Levasseur, where genetic techniques have highlighted a very precise natal homing of the population there. Daughter-mothers as well as siblings are regularly found to be nesting on the same beach!

The final day, Friday 8th February, closed with two very optimistic talks given by Blair Witherington and Wallace J. Nichols. The human element in sea turtle conservation was highlighted once again, advocating that all the eight species have a lot to gain from this story.

Finally, it was announced that the next meeting is going to take place in the city of Cartagena, Colombia, March 2020, where we are hoping to see everyone again.