

EDUCATIONAL CAMPAIGN TO REDUCE THE IMPACT OF ARTIFICIAL LIGHT ON SEA TURTLE NESTING BEACHES IN BRAZIL

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INTRODUCTION

Several important stages of reproduction by sea turtles normally take place at night, under the cover of darkness on beaches. Artificial lights on or near beaches often reduce the number of female sea turtles that emerge from the ocean to nest (Witherington, 1992; Ehrhart et al. 1996). When females do lay their eggs on beaches that are subject to artificial lighting, seafinding of the resultant hatchling turtles is often disrupted and they often go away from the sea (e.g. Philibosian, 1976; Peters and Verhoeven, 1994). Misoriented hatchlings face increased mortality from land predators, accidental trampling by people or vehicles, or desiccation following sunrise.

Development of coastal areas, in the form of homes, hotels, industrial complexes, and recreational areas, leads to an increase of nighttime lighting. Unchecked lighting on beaches used by sea turtles can have serious impacts on nesting populations, and as such management of lighting on or near beaches is a priority for most sea turtle conservation programs.

METHODS

On the mainland coast of Brazil, many sea turtle nesting beaches have been or are in the process of being developed for greater use residents and tourists. As such, the problem of "photopollution" on nesting beaches is an area of concern for Projeto TAMAR-IBAMA, the national sea turtle conservation program of Brazil. Beginning in 1989, Projeto TAMAR has worked on several different levels to help mitigate the tension between rational use and development of coastal areas in Brazil with the needs of nesting sea turtles and recently born hatchlings. The approach has been multifaceted and fluid, and has evolved to meet new or unanticipated needs in particular areas. Although not all photopollution on nesting beaches has been eliminated, the programs adopted by TAMAR have been largely successful, thereby lessening the negative impacts of lights on the reproductive cycle of sea turtles.

RESULTS AND DISCUSSION

The activities of Projeto TAMAR with respect to artificial lighting on beaches can be divided into 3 general areas, although there is overlap and interaction among them. The first level is legislation, whereby Projeto TAMAR has lobbied to have laws (state and federal) enacted that restrict the presence of light on the main nesting beaches. The idea was not only gain legal pressure to enact changes in existing lighting schemes in coastal areas, but also to provide a means to direct and oversee future lighting installations in development projects. As early as 1990, a national decree issued by IBAMA, the Brazilian Institute of the Environment and Renewable Natural Resources, part of the Ministry of Environment of the Federal Government of Brazil, prohibited the installation of any artificial light source on the beachfront of 63 different beaches along the mainland coast of Brazil. Following practical experience, the decree was modified in 1995, and currently states that on all sea turtle nesting beaches in Brazil (as identified by Projeto TAMAR), there can be no artificial light measuring greater than zero lux that reaches the beach from the ocean up to and including 50 meters above the spring high tide line (SHTL). In 1997, the state of Bahia passed a law that similarly prohibits the presence of artificial light with an intensity greater than zero lux within 50 meters of the SHTL on nesting beaches in the state. This level of action provides legislative power to reinforce the other activities of TAMAR in the area of photopollution.

The second level of activity involves public education. The central idea is to inform the public, including residents and visitors who live or spend time close to the beach and hence are directly involved with artificial lights, of the negative impact lights can have on sea turtles. In general, the overall experience has been that informed residents become willing allies in changing or reducing their lights as to minimize their negative effects on nesting beaches. Indeed, by reducing lights, they become active participants in turtle conservation. Largely based on visual aides, such as posters, videos, and announcements on television, for example, the education campaign targets a wide range of people, from local fishermen in small villages to wealthy tourists who have rented homes for the summer vacation, which coincides with the sea turtle

nesting and hatching seasons. In addition, visitors at different TAMAR bases are presented with informative panels and videos highlighting negative influence of artificial lights on sea turtles. Finally, door-to-door canvassing is used to directly reach residents in their homes or businesses which are located on beach-fronts. Thus public education becomes another tool to reduce the impact of artificial lights on sea turtles.

The third level of activity by Projeto TAMAR in the area of photopollution is research and technological design. There are various lines of research, including the following: the testing of newly introduced lights which have been advertised as "turtle friendly"; the development of methods to retrofit older street lights or housing lights in order to reduce or avoid the level of illumination reaching the nesting beach; the collaboration with developers to produce proactive lighting plans for future installations in coastal areas. As part of this, Projeto TAMAR has established accords with utility companies, such as COELBA (the Electric Company of Bahia), for collaborations and support during research and development. By bringing the lighting industry "onboard," TAMAR has gained important logistic support the effort to reduce artificial lights on beaches.

All three levels feed into one another (see diagram). For instance, ongoing research on the impact of different light types on the behaviour of hatchlings will help to redefine the laws and decrees, if necessary, while the public education campaign helps inform, increasing the level of voluntary compliance with lighting restrictions, thereby easing the necessity of legal enforcement. It is this type of multifaceted approach towards conservation that has the best results and the greatest chance for long-term success.

Despite the success, there are still some hurdles to overcome. One of the biggest difficulties is actual enforcement of the lighting restrictions. In the case of recalcitrant developers or homeowners, it may be necessary to issue citations and fines, although education and awareness campaigns of neighboring lots or even employees may also help (Kraus et al., 1998). We will also continue to test new technologies and lighting systems as they become available, to ensure they do not affect either nesting females or newly emerged hatchlings.

CONCLUSION

The campaign against photopollution in Brazil is an active process, that involves legislation, public education/awareness, and research and technical cooperation with utility companies. It is part of the larger conservation program headed by Projeto TAMAR that seeks greater harmony between coastal residents and sea turtles as a means to conserve and protect the marine coastal ecosystem.

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REFERENCES

- Ehrhart, L.M., Bagley, DA, Uong, L.T., and Owen, R.D. 1996. Marine turtle nesting at Archie Carr National Wildlife Refuge in 1994: another record-breaking year for loggerhead and green turtle nest production. *In: Proceedings of the 15th Annual Symposium on Sea Turtle Biology and Conservation* (J.A. Keinath, D.E. Barnard, J.A. Musick, and B.A. Bell, eds). NOAA Tech. Mem. NMFS-SEFSC-387, pp. 79-83.
- Kraus, M.C., Sutor, D.G., and Maheuron, J.K. 1998. "Lights out for turtles!" It can be done - beach lighting compliance at the local level. *In: Proceedings for the 16th Annual Symposium on Sea Turtle Biology and Conservation* (R. Byles and Y. Fernandez, compilers). NOAA Tech. Mem. NMFS-SEFSC-412, pp. 87-88.
- Peters, A. and Verhoeven, K.J.F. 1994. Impact of artificial lighting on the seaward orientation of hatchling loggerhead turtles. *Journal of Herpetology* 28:112-114.
- Philibosian, R. 1976. Disorientation of hawksbill turtle hatchlings, *Eretmochelys imbricata*, by stadium lights. *Copeia* 1976: 824.
- Witherington, B.E. 1992. Behavioral responses of nesting sea turtles to artificial lighting. *Herpetologica* 48: 31-39.