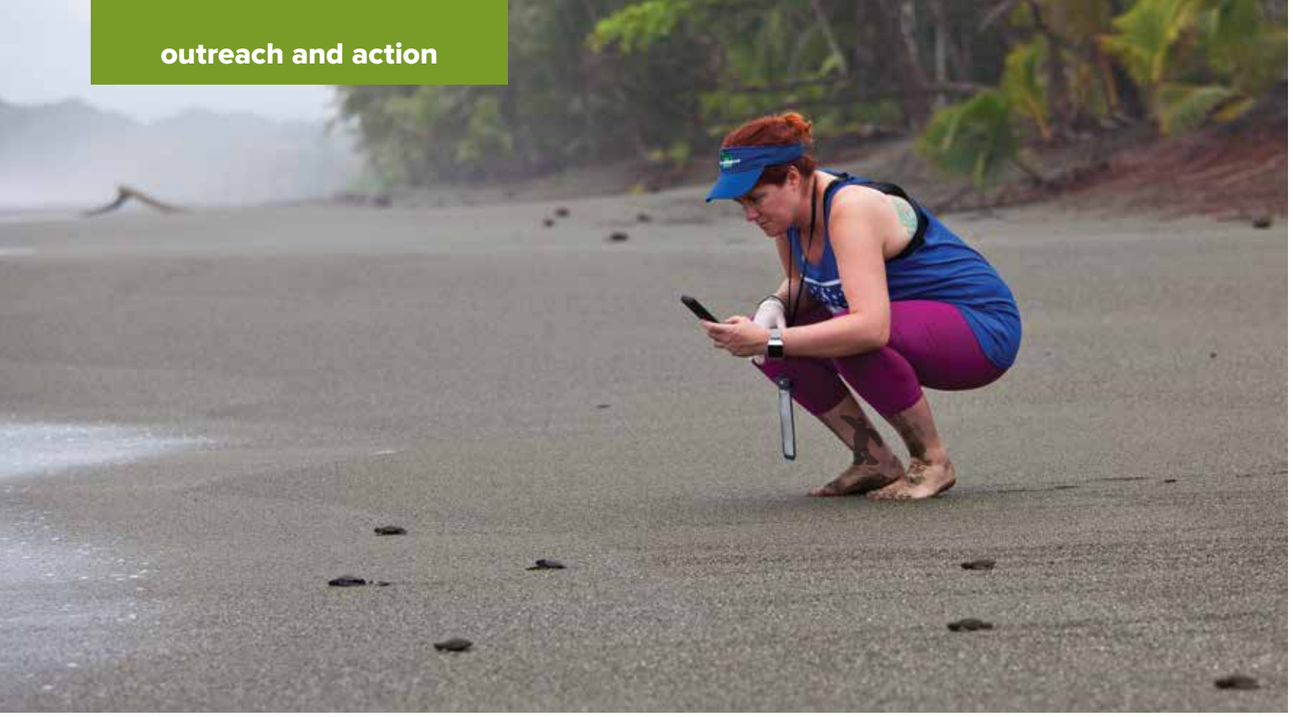

AT LEFT: A citizen scientist uses her smartphone to photograph olive ridley hatchlings on Piró Beach, Costa Rica. © Brian J. Hutchinson

Top Smartphone Apps for Sea Turtle Work

By Craig Turley

Smartphones and tablets have the potential to revolutionize the way we collect data on sea turtles and other species by putting powerful technology in the palms of our hands when and where we need it most. Although this field is still growing, a variety of mobile applications (apps) have already been developed to harness mobile technology for sea turtle research and conservation, taking advantage of the standard sensors and other tools that are found in today's mobile devices.

Apps offer a number of advantages to traditional paper-based data collection. They can minimize data input errors; reduce time-consuming manual data entry; quickly and automatically generate spreadsheets; capture lots of data automatically (e.g., time, date, location, photos, videos, and sound recordings, as well as weather, moon phase, and more); and automatically upload data to the cloud to reduce the risks of data loss. They also offer features and potential uses that traditional data collection methods do not, such as the ability to create and use interactive maps, to facilitate collaboration by uploading data to a shared database, and to harness the power of citizen scientists on a large scale.

HOW TO CHOOSE AN APP

With a growing number of mobile apps on the market, it can be difficult and time consuming to research the strengths and weaknesses of each and to determine the best app to support your goals. Many projects consider developing their own apps, but it is worth first exploring what already exists. This article provides an overview of some of the most popular apps that are currently available for sea turtle research and conservation, and it can be used as a starting place for researchers looking to incorporate this technology into their programs. Here are a few important things to consider when choosing an app:

Data accessibility and storage. Some researchers may need exclusive access to their data to allow for a more detailed analysis and eventual publication. They may therefore want to avoid apps that make data publicly available through open-source databases. However, apps that do make data publicly available can offer the potential for greater collaboration and public outreach and can also attract broader contributions of useful data. Some open-source apps make higher-resolution data available by request, using data protection protocols that ensure exclusivity when needed.

Cost and convenience. App development can be costly and time consuming, and it often requires technical know-how beyond that of most sea turtle researchers. Using an off-the-shelf app that is available through the Google Play Store or the Apple App Store may be the best choice for budget-constrained projects. However, there will generally be trade-offs, and paying more for a customized experience definitely has its advantages. Beyond the apps themselves, buying (and replacing) mobile phones or tablets can be a large investment, and access to mobile networks can require subscription fees.

Stability, support, and longevity. Before committing to an off-the-shelf app, it is a good idea to do some homework about the app developer and to research how widely used the app is. Some apps have huge communities of users, robust technical support, and a developer that is committed to maintaining the platform (for example, iNaturalist), whereas others may have been built by a small team with no plans or funding for future maintenance and little or no capacity for user support. With the high frequency of updates to mobile operating systems and to mobile devices themselves, unsupported apps are more likely to develop bugs over time.

TODAY'S SEA TURTLE APP OPTIONS

The table below summarizes some of the apps now available for sea turtle research and conservation and provides a brief overview of key features. This guide is not exhaustive, and the pace of technology makes it a moving target, but it can be a starting place for researchers and conservationists exploring using this valuable technology to enhance their work in 2020. Nearly all of the apps can be found online or in either the Apple App Store or Google Play Store. Instructions are provided for requesting those apps that are not readily available. •

AN OVERVIEW OF SEA TURTLE APPS

NESTING AND IN-WATER CENSUS	**RASTR (Records Assistant for Sea Turtle Researchers)**	This app collects data on nesting, bycatch, and turtle products, with fields for morphometry, biological samples, and more. (iOS)
	Siren Turtles	This app is used to centralize and standardize nesting data for comparative studies using SWOT minimum standards. (Android)
	Nest Tracker	Designed by the Cayman Islands Department of Environment (DOE) to monitor all turtle-related data collection (nesting, excavations, disorientations, and more), features include mobile network backup, as well as daily autogenerated spreadsheets sent directly to DOE staff. Available by request to nesttracker.ky@gmail.com. (iOS)
	Clutch Keeper	Able to monitor all aspects of beach monitoring and nest tracking, this app uses an interactive map alert when excavation is required. (Android and iOS)
	Iris	Designed for at-sea aerial surveys, this app allows users to simply and quickly record sightings data on multiple taxa, including sea turtles. For a copy, email info@mrf-asia.org. (Android)
CITIZEN SCIENCE	**Turtles Uniting Researchers and Tourists (TURT)**	This app is designed for use in reporting turtle sightings, and products using an interactive web-based map. (Android and iOS)
	eTurtle	Users can report sea turtle sightings in the Mediterranean. (Android)
	SEAlly	This app allows users to report sea turtle and shark sightings, bycatch, and entanglement in the Mediterranean region, and is linked to an online interactive map. (Android and iOS)
	Cero Carey	This app allows tourists in Cartagena, Colombia, to identify and report hawskbill products, in Spanish, directly to the environmental police. (Android)
	iNaturalist	Not specific to sea turtles, this widely used app allows users to identify, report, and catalog biodiversity using a personal profile linked to a global network of other users. (Android and iOS)
	HerpMapper	Used for reptile and amphibian sightings, this app can be customized for sea turtle–specific projects. (Android and iOS)
	Ghost Gear Reporter	Designed for fishers, divers, and citizen conservationists, this app allows users to report sightings, bycatch, or ghost gear entanglement. (Android and iOS)
CUSTOM PLATFORMS	**Fulcrum**	This highly customizable platform requires a monthly subscription and has 20 GB of cloud storage. (Android and iOS)
	Open Data Kit (ODK) Collect	This free, open-source app is powerful and customizable. (Android & iOS)

= AUTHOR'S PICK