



Supporting information

Phase	Operation step	Step description	Step operator
Pre-Deployment	Order tags	Decide which type of tags to order. Multiple types of biologging instruments are currently available: satellite/GSM tags, pop-up satellite tags, acoustic tags and receivers, and archival tags. When ordering instruments researchers should decide whether to sign an agreement ('auto-sharing request') with the manufacturer to share their instrument manufacturing metadata and tag data with affiliated data centers.	Researcher
	Set up communication account	<i>Required step for GSM and satellite tags, VR4G acoustic receivers, and autonomous vehicles</i> Establish a communication account with the satellite or mobile phone company that will receive tag data. Also for Argos specify which location algorithm to use (Least Squares or Kalman Filter). Should also provide permission to share their tag data with affiliated data centers if willing to.	Researcher
	Build, configure and calibrate tags	Produce tags based on researchers' specifications and study aims.	Tag manufacturer (e.g. Wildlife Computers, SMRU, Lotek, Vemco)
	Generate communication ID	<i>Required step for GSM and satellite tags, VR4G acoustic receivers, and autonomous vehicles</i> 1. Researcher provides order for manufacture and tag specifications 2. Tag manufacturers must contact the company whose satellites/mobile network will receive tag data so that a unique ID may be assigned to each tag for transmitting data. 3. Once available those communication IDs must be provided to the tag manufacturer to finalize tag configuration.	Communication company (e.g. GSM mobile phone, Argos, Horizon, Iridium)
	Generate tag metadata	Generate tag manufacturing metadata. Tag manufacturing metadata includes: <ul style="list-style-type: none"> Tag model, serial number, PTT, tag ID. Firmware name and version for hardware Software name and version used to configure tag/receiver. Sensor specifications and calibration procedures. Invoice number, along with manufacture and shipping dates. 	Tag manufacturer (e.g. Wildlife Computers, SMRU, Lotek, Vemco)
	Ship tags to researcher	Program tag based on researchers' study objectives and ship tag to researcher.	Tag manufacturer (e.g. Wildlife Computers, SMRU, Lotek, Vemco)
	Ingest tag metadata	Harvest manufacturer tag metadata into a database. A unique pre-deployment ID is generated for each tag for subsequent identification at the time of instrument deployment.	Data center (e.g. ATN, IMOS)
	Pre-deployment tests	Perform pre-deployment tests to ensure instruments work, comply with original specifications, and capture data.	Researcher
	Program tags	Configure tags and sensors, and capture attachment strategy metadata.	Researcher
	Generate programming metadata	Generate tag configuration metadata.	Researcher
	Ingest tag programming metadata	Ingest tag programming metadata into a database	Data center (e.g. ATN, IMOS)

Deployment	Deploy tags	<p>Deploy biologging tags:</p> <ul style="list-style-type: none"> attach conventional tags for subsequent animal identification take morphological measurements, DNA/RNA, isotopic, and blood samples record animal characteristics (<i>e.g.</i> life stage, sex, species) record animal handling and release, and the overall tagging procedure (<i>e.g.</i> GPS coordinates, date/time). record environmental data <p>For acoustic receiver deployment the following information is typically recorded: receiver ID, mooring type, receiver orientation, initialization and deployment date/time and GPS coordinates, receiver and bottom depth.</p>	Researcher
	Generate deployment metadata	Using a mobile app, a web form or a standardized csv file researchers compile and publish tag deployment metadata. When doing so researchers should decide on the appropriate data policy for their tagging data, <i>e.g.</i> open, embargo metadata, embargo metadata and data.	Researcher
	Ingest tag deployment metadata	Ingest tag deployment metadata into a database. A unique, permanent, ID is then assigned to each tag deployment to unify all entries in the database.	Data center (<i>e.g.</i> ATN, IMOS)
	Receive and store transmitted tag data	<p><i>Required step for GSM and satellite tags, VR4G acoustic receivers, and autonomous vehicles</i></p> <p>Satellite/GSM tags start transmitting data shortly after deployment while pop-up satellite tags transmit data once detached from the animal and floating at the surface. In both cases data is then relayed to telemetry ground stations for decoding, processing and archiving. Raw data is then directly downloaded from communication company servers.</p>	Communication company (<i>e.g.</i> GSM mobile phone, Argos, Horizon, Iridium)
	Download transmitted tag data	<p><i>Required step for GSM and satellite tags, VR4G acoustic receivers, and autonomous vehicles</i></p> <p>Tag manufacturers download raw data from communication company servers and may process those so that researchers and data centers have either access to raw (Wildlife Computers) or processed (SMRU) data. Raw data from pop-up satellite tags are systematically decoded by tag manufacturers.</p>	Tag manufacturer (<i>e.g.</i> Wildlife Computers, SMRU, Lotek, Vemco)
	Download data	<p><i>Required step for GSM and satellite tags, VR4G acoustic receivers, and autonomous vehicles</i></p> <p>Researchers download transmitted tag data from the communication company's or the tag manufacturer's web services.</p>	Researcher

Recovery	Recover tags	<p>When an animal with a biologging tag is recaptured the following information may be recorded:</p> <ul style="list-style-type: none"> • recovery date/time and GPS coordinates • recovery conditions (<i>e.g.</i> gear, weather, SST) • morphological measurements • animal characteristics (<i>e.g.</i> life stage, sex, species) • tag recoverer's contact details along with vessel type and name <p>For acoustic receiver recovery the following information is typically recorded: receiver ID, recovery date/time and GPS coordinates, and receiver status.</p>	Researcher, or the person who recovered the tag
	Generate recovery metadata	Using a mobile app, a web form or a standardized csv file researchers compile and publish tag recovery metadata.	Researcher
	Ingest tag recovery metadata	Ingest tag recovery metadata into a database.	Data Center (<i>e.g.</i> ATN, IMOS)
Data processing	Download data	<p>For archival tags: data may be downloaded if the tag's battery is not flat, otherwise the tag is sent back to the manufacturer for data recovery.</p> <p>For acoustic receivers: event and detection data are offloaded and the receiver may be re-deployed later unless the battery is flat. The latter also applies to recovered acoustic tags</p>	Researcher
	Send tags back to manufacturer	For recovered GSM, satellite and pop-up satellite tags: tags are typically sent back to the manufacturer to download high resolution data.	Researcher
	Process data	Convert raw archival data using the manufacturer's proprietary software into light-level and physical (<i>e.g.</i> temperature, depth) time series data. Light-level data is then processed into geolocation data. Data is subsequently made available to data centers.	Researcher
	Download data	Download high resolution time series data.	Tag manufacturer (<i>e.g.</i> Wildlife Computers, SMRU, Lotek, Vemco)
	Process data	Convert raw archival data into sensor time series data. Light-level data is processed into geolocation data and subsequently made available through manufacturer's web services.	Tag manufacturer (<i>e.g.</i> Wildlife Computers, SMRU, Lotek, Vemco)
	Refurbish tag	When recovered GSM, satellite and pop-up satellite tags may be re-battered for new deployments.	Tag manufacturer (<i>e.g.</i> Wildlife Computers, SMRU, Lotek, Vemco)

Data Processing	Ingest tag data	<p>Ingest tag data into the data center database. Data may be obtained from various sources: the communication company's servers, the tag manufacturer's servers or from researchers. The ingestion system should be flexible enough to deal with a variety of data types including:</p> <ul style="list-style-type: none"> • animal locations, <i>i.e.</i> raw/processed/SSM, Argos/Fastloc/geolocation • oceanographic measurements • dive profiles and summary statistics • haulout events • engineering data, <i>i.e.</i> tag status and transmission performance • acoustic detections and sensor data 	Data center (<i>e.g.</i> ATN, IMOS)
	Process data for online publication	<p>Publish processing scripts to a GitHub repository and run those scripts to:</p> <ul style="list-style-type: none"> • process raw data (<i>e.g.</i> filter Argos locations, run SSM on light level data) • generate data products (<i>e.g.</i> maps, CTD profiles, detection plots) • summarise data and metadata for online visualisation in web browser • archive and publish original data files • notice researcher of data availability 	Data center (<i>e.g.</i> ATN, IMOS)