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Oceanographic In-situ Interoperability Project

Deliverable 1.2

TAG METADATA REVIEW & RECOMMENDATIONS DOCUMENT

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Table of Contents

1	Overview	4
2	Methods	5
3	eTag Metadata.....	6
4	File Implementation of eTag Metadata	22

List of Tables

Table 1.	Vetted Inventory and Specification of Categorized eTag Metadata Attributes	6
Table 2.	eTag File Metadata Template documentation. In the eTag subgroups, Value fields contain attribute definition and priority information (R=required, r= recommended, o=optional).....	23

List of Figures

Figure 1.	Structure of the self-describing file template showing the eTag attributes implemented within Groups together with blocks of standard CF and ACDD metadata attributes.	22
Figure 2.	Alternate design in which CF and ACDD attributes themselves are packaged in "Meta_" (metadata) groups of their own.	23

1 Overview

Electronic tagging datasets and oceanographic *in situ* dataset more generally suffer acutely from the following interoperability and metadata issues:

- Heterogeneous, non-science file formats (vary b/w Manufacturers/instrument types)
- Paucity of metadata and/or non-standards compliant metadata
- Lack of support for community specific metadata

OIIP addresses the need to package within self-describing data files (eg. netCDF) not only the data and associated geospatial metadata consistent with earth science interoperability standards such as CF/ACDD, but also (“domain specific”) metadata associated with *in situ* datasets. These are important for properly documenting aspects of the *in situ* sampling and data recording processes critical to archival and correct interpretation of data values long term. In the case of data from electronic tagging (eTag) studies, which is the focus of OIIP project as a representative, complex use case, these domain specific attributes include information on the tagged animal, device, tag attachment, deployment, recovery, post-processing etc. Such domain specific information is poorly accommodated in existing file metadata models at present. Both the range of necessary attributes are insufficiently characterized and the manner by which these should be packaged as attributes in self-describing data files inadequately defined for purposes of preservation and interoperability.

The objective of the work described here is to address these current limitations initially in the context of electronic tagging datasets as a model for potential extension to oceanographic *in situ* datasets more generally. More specifically, the specific goals and approach of the work summarized here include:

- With community input, develop an inventory of ancillary eTag metadata, categorized by type, to be captured with observational data in self-describing data files
- Map eTag metadata attributes to existing CF/ACDD/NODC-template attributes where possible.
- Use nc4/hdf5 Group hierarchical structure(s) to store eTag metadata by category in coordination with standards communities.
- A separate, future project task will explore the use of ISO and subject-based markup languages (eg. sensorML, EML-ecological markup language- etc) for more standard representation of eTag metadata in coordination with standards communities.

The resulting vetted inventory of eTag metadata presented in this report below provides a comprehensive list of attributes by category and priority level with associated terminology/vocabularies that shall be the basis of an enhanced metadata recording and entry capability for eTag datasets. Additionally, we present a framework for the packaging of such “rich” metadata in a manner that takes advantage of the nc4/hdf5 hierarchical data model to both logically and parsimoniously organize and present complex sets of domain specific attributes and accommodating CF/ACDD geospatial metadata. The approach follows from internal team discussions plus consultations and guidance from external experts A. Jelenak and T. Habermann (HDF-Group/ESDSWG Data Interoperability Working Group). The current methodology for attribute encoding is simple but a useful and practical first step. A follow-on OIIP task will explore more standardized encodings based on mappings where possible to ISO and subject-based markup language attributes.

Finally, it is important to understand the benefit of application the aforementioned developments to other project technical components and for the end-user community more generally. The complexity/mechanics of generating netCDF files at a lower level with valid geospatial and important tag-related metadata is not something users should be burdened with and is a for role that tools can support, ROSETTA in particular.

Part of the OIIP project tasks relating to enhancement of the ROSETTA tool, which converts columnar ascii data into netCDF and augments with the necessary metadata via web-form interface to produce a standards compliant file, is to extend its support for “rich” metadata and their packaging in a standards compliant manner. This will provide a mechanism for users to easily catalog relevant metadata that they want to associate/preserve with the data from individual tags but in a standards compliant way that insures interoperability of the resulting data product file.

2 Methods

Compilation of Inventory for eTag Metadata

The following describes the process by which this inventory of rich domain-specific metadata was derived:

- 1) Based on the experience of project tagging expert (T. Lam) and additionally a review of tag-related attributes from Tagbase and IOOS/ATN (Animal Tracking Network) data management documentation, a list of attributes was derived, categorized, defined and qualified iteratively.
- 2) The resulting [spreadsheet](#) was then reviewed by the project data scientist (Vardis Tsonetos) and Rosetta developer (Sean Arms) and mappings where possible to CF/ACDD metadata standards were captured.
- 3) The updated inventory spreadsheet was then independently circulated to our external collaborators at IATTC (Schaefer/Fuller), SWFSC (Dewar et al), and Wildlife Computers (Vo/Holland/Wilson) for review and input.
- 4) Their feedback and suggested changes were documented, and have been folded back into the inventory spreadsheet, outputs from which are summarized below.

Implementation of eTag Metadata Attributes in Self-Describing Files

- 1) Prior familiarity (V. Tsonetos) with the framework adopted by the SMAP mission for storage of granule metadata within HDF5 group structures suggested an approach for packaging rich eTag metadata within self-describing data files.
- 2) Supplemental expert guidance resulting from consultations with A. Jelenak and T. Habermann (HDF-Group/NASA ESDSWG Data Interoperability Working Group) provided confirmation of the approach and additional recommendations in terms of future possibilities for standardized metadata encodings based on ISO and domain-specific markup language attribute specifications.
- 3) The “Group” approach to eTag metadata attribute packaging was adopted and implemented using the [HDF-Product Designer tool](#) (v1.5). This tool proved useful for efficiently and interactively developing a self-describing file format template containing both these domain-specific metadata attributes and standard geospatial CF/ACDD attributes consistent with the HDF5/nc4 data model. Designer’s HDF5 file generation capability was used to generate sample .h5 output file. The tool’s design documentation features were used to produce the template specification outputs presented below in section 4.

3 eTag Metadata

The following (Table 1) is the inventory of eTag metadata attributes broken down by category, with definitions, entry value vocabularies, examples, and assigned attribute priority/necessity level (required, recommended, optional). This inventory and specification has been vetted both internally and by our external collaborating tag experts at IATTC, SWFSC and Wildlife Computers and reflects the consolidated community recommendation. Containing a total of 147 attributes, 28 of which have been deemed required, this master-list is unequivocally comprehensive but also potentially onerous. Concerns expressed by all teams relate to the practical challenge of metadata entry and tagging community uptake. The importance of a tool (ROSETTA) facilitating metadata entry in a stepwise, structured, efficient and potentially customizable/automated manner is clearly apparent. The same is true in terms of the mechanics of generating the standards compliant netCDF/HDF output file itself including both metadata and the eTag/*in situ* data values themselves. Availability of a tool such as ROSETTA that achieves this while hiding the underlying complexities again will be critical to widespread community adoption of proposed standards.

Table 1. Vetted Inventory and Specification of Categorized eTag Metadata Attributes

(1= applicable, -1 = n/a, 0 = possible)

Category/ Group	Attribute name	Description	Example	Comments	Necessity	fish shark	turtle	mam mal	bird	Notes
device	device_type	Type of device	archival, popup, satellite, acoustic tag, or acoustic receiver	Should be restricted to the examples provided.	required	1	1	1	1	If any of the metadata can be populated by manufacturer, we need to provide a "map" to connect the manufacturer names to our names here. We should consider mapping to possible device specification metadata record in http://cor.esipfed.org/ont#/ system (Vardis to investigate with MMI/COR -XDOMES project)

device	manufacturer	Name of manufacturer	Wildlife Computers, Microwave Telemetry, Lotek Wireless, Desert Star Systems, CEFAS, StarOddi, Sea Mammal Research Unit, Vemco, Loggerhead Instruments, Biologging Solutions, Little Leonardo, Teleonics etc.		required	1	1	1	1	Some edits to the example list made by IATTC
device	model	Model name	MiniPAT		required	1	1	1	1	
device	serial_number	Serial number	16P0100		required	1	1	1	1	
device	device_name	Append an identifier that is unique within your organization. This is essential if a device is recycled.	16P0100-Refurb2	Devices might be reused, so the serial number will be the same. The only way to distinguish is by providing a unique name for the recycled product.	required	1	1	1	1	
device	person_owner	Researcher/ organization owning the device		PI/scientist/organization is used interchangeably here. But best to have a first-last name specified here.	required	1	1	1	1	Comma separated
device	owner_contact	Contact email/ telephone/ address			required	1	1	1	1	Comma separated
device	project	Name or identifier for project/ grant number			recommended	1	1	1	1	Comma separated
device	firmware	Version number of the firmware used to build the device			required	1	1	1	1	
device	specs	Specification document name/ URL/ file (e.g., in xml)		Need input from manufacturer. May allow attachment or upload. Or grab it from an online archive.	recommended	1	1	1	1	Possible device specification metadata record in http://cor.esipfed.org/ont#/ system

device	date_shipment	Date (yyyy-mm-dd) of receiving the device from manufacturer		The device can be fresh off the production line or refurbished with some parts replaced.	recommended	1	1	1	1	
device	ptt	Platform Transmitting Terminal (PTT) number for Argos transmission.			recommended	1	1	1	1	
device	ptt_hex	PTT in hexadecimal			recommended	1	1	1	1	
device	code_map	Placeholder for acoustic tags		Refer to ATN spec.	no	1	1	1	-1	
device	ping_code	Placeholder for acoustic tags		Refer to ATN spec.	no	1	1	1	-1	
programming	programming_software	Programming software with version number			required	1	1	1	1	
programming	programming_report	File/ URL to a report listing the details of programming		- May allow attachment or upload. - Or grab it from an online archive. - Need input from manufacturer	required	1	1	1	1	WC: "With our newer tags that are programmed using our portal, we aren't really offering reports anymore"
programming	date_programming	Date (yyyy-mm-dd) of programming			recommended	1	1	1	1	
programming	person_programmer	Person responsible for the programming			recommended	1	1	1	1	
programming	seconds_sampling	Sampling rate (seconds) for sensor sampling	15	For basic sensors, e.g., pressure, temperature, light	recommended	1	1	1	1	WC: "Some sensors within a tag may sample at different frequencies." OIIP: This could be accommodated/implemented as a comma separated list of sensor frequency in a Global attribute or probably as Variable level sensor frequency attributes
programming	seconds_sampling_highfreq	Sampling rate (seconds) for sensor sampling at a higher frequency		For sensors that sample in Hertz (Hz), e.g., accelerometer, magnetometer	optional	1	1	1	1	WC: "Some sensors within a tag may sample at different frequencies." OIIP: This could be accommodated/implemented as a comma separated list of sensor frequency in a Global attribute or probably as Variable level sensor frequency attributes

programming	seconds_writingdata	Time interval in seconds when sampled data are written to onboard storage memory	300	This specifies how frequent data will be stored, and subsequently available for download or summarizing.	recommended	1	1	1	1	
programming	minutes_summary	Interval in minutes during which data are summarized for that period	1440	Data are summarized because of Argos transmission constraint.	recommended	1	1	1	1	WC: "Could have multiple summary periods for a tag" OIIP: This could be accommodated/implemented as a comma separated list
programming	days_mission	Programmed mission length in days	365		recommended	1	1	1	1	
programming	days_constantdepth	Days at a constant depth before release is initiated	1	This represents a time lag in days after the tag is floating/ detached/ sunk before the release procedure will be initiated.	recommended	1	0	0	-1	
attachment	attachment_method	Method used to put the tag on/ in the animal	tow, glue, suction, anchor, mount, implant, harness, backpack	Should be restricted to the examples provided. Tow includes tethered for popup or towed for satellite tags . Glue is using adhesive or epoxy. Mount is using screw, bolt, button, sleeve or backpack. Anchor is equivalent to applying a conventional tag or using a gun (air, spear etc.). Implant implies surgery, ingestion or insertion.	required	1	1	1	1	
attachment	attachment_product	Brand name and/ product for attachment materials used	VetBond, Peel Ply, tesa®	Brand and product name of suture, stainless steel wire, monofilament, bolt, tape, adhesive, epoxy, suction cup, air gun, speargun, pole, applicator and tip.	recommended	1	1	1	1	Comma separated. Some edits/additions to the example list made by IATTC

attachme nt	antifouling_pro duct	Brand name and/ product of antifouling paint or coating applied	PropSpeed		optional	1	1	1	1	
attachme nt	antiseptic_pro duct	Brand name and/ product of antiseptic or sterilizing agent used during the attachment	Iodine, Cicatrin		optional	1	1	1	1	
attachme nt	anesthetic_pro duct	Brand name and/ product of anesthesia used during the attachment	metomidate, Aqua-S		optional	1	1	1	1	
attachme nt	anchor_type	Type of anchor	Domeier, Wilton, Titanium		recomme nded	1	-1	0	-1	
attachme nt	anchor_materia l	Material of anchor	nylon, urethane, stainless steel, titanium		recomme nded	1	-1	0	-1	
attachme nt	anchor_dimensi ons_mm	Dimensions (millimeter) as length, width, thickness or diameter.	20 L x 14 W	Can be used loosely as size: small, medium and large.	optional	1	-1	0	-1	
attachme nt	anchor_depth_ cm	How deep (centimeter) should the anchor be in the animal?	8	May be used for cetacean tagging.	optional	1	-1	0	-1	
attachme nt	tether_material	Tether material for a towed tag	stainless steel wire, monofilament	Use brand name and/ product when possible.	recomme nded	1	1	0	-1	
attachme nt	tether_assembl y	Materials and methods in constructing a tether	heat-shrink or silicon tubing	Use brand name and/ product when possible.	recomme nded	1	1	0	-1	
attachme nt	tether_length_ cm	End to end length (centimeter) of a tether			optional	1	1	0	-1	
attachme nt	float_additional	Specify any additional floation used		Float might be added to archival tags for external use.	optional	1	1	0	-1	
attachme nt	mount_type	Type of mount	Fin, tail, carapacial ridge		recomme nded	1	1	1	1	

attachme nt	release_metho d	Method to get a tag detached from the animal/ anchor	corrosive burn wire, oxidative/ explosive, galvanizing metal, acoustic release		recomme nded	1	1	1	0	
attachme nt	release_forced	If a mechanical release is engaged at depth (too avoid crushing the tag), specify the mechanism and depth at which the release is engaged.	Wildlife Computers RD1800		optional	1	-1	-1	-1	
deploye nt	datetime_relea se	Local date time (yyyy-mm-dd hh:mm:ss) of deployment			required	1	1	1	1	WC: "Not sure how others do it, but it may be easier to keep the dates in UTC?"
deploye nt	UTCoffset_rele ase	Time difference (+/- hh:mm) to UTC for the release datetime. Include daylight saving time if observed.	-08:00	If lon_release is known and can be trusted, we convert local time to UTC as the standard.	required	1	1	1	1	ftp://ftp.iana.org/tz/releases/tzdata2016f.tar.gz
deploye nt	lon_release	Longitude (decimal degree) of deployment			required	1	1	1	1	
deploye nt	lat_release	Latitude (decimal degree) of deployment			required	1	1	1	1	
deploye nt	location_captur e	Name or standard identifier of location			recomme nded	1	1	1	1	
deploye nt	method_captur e	Type of gear used to catch the animal	Longline, purse seine, troll, trawl, rod and reel, handline, set net, trap, gillnet, harpoon, hoop net, anesthesia, tangle net, dip net, vertical line entanglement (commercial fisheries, aquaculture, mooring), dredge, pound net/weir (for turtles)		recomme nded	1	1	1	1	http://www.spc.int/oceanfish/en/data-collection/241-data-collection-forms https://www.iccat.int/en/ICCATManual.asp

deployment	Method_landed	how was animal put aboard the vessel	net, sling, lifted		optional	1	1	1	-1	-
deployment	school_capture	Type of school in which the animal was caught	Free school, log, anchored FAD, drifting FAD	Include FAD number if possible.	optional	1	-1	-1	-1	
deployment	vessel_capture	Name or standard identifier of vessel			optional	1	1	1	1	
deployment	flag_capture	The vessel's country of registration			optional	1	1	1	1	
deployment	cruise_capture	Name or standard identifier of cruise			optional	1	1	1	1	
deployment	station_capture	Name or standard identifier of station			optional	1	1	1	1	
deployment	set_float_capture	If caught on longline, include set number and float number		It's very unlikely to tag turtle, bird/ mammal off longline.	optional	1	0	-1	-1	
deployment	depth_m_capture	Depth (meters) at which the animal was caught		Can use estimated depth from hook number on longline	optional	1	0	-1	-1	
deployment	hook_capture	Type of hook used	18/0 circle	Use brand name and/ product when possible.	recommended	1	0	-1	-1	Some edits/additions to the Necessity made by IATTC (from Optional to Recommended)
deployment	baitlure_capture	Bait, chum, lure or decoy used	sardine	Use brand name and/ product when possible.	optional	1	0	-1	-1	
deployment	temp_degC_capture	Air or sea surface temperature (Celcius) when the animal was caught			recommended	1	1	1	1	Some edits/additions to the Necessity made by IATTC (from Optional to Recommended)
deployment	wind_knots_capture	Wind speed (knots) when the animal was caught			optional	1	1	1	1	
deployment	seastate_capture	World Meteorological Organization sea state code (0-9)		Similar to Douglas Sea Scale	optional	1	1	1	1	
deployment	person_angler_capture	Person responsible for angling			optional	1	-1	-1	-1	
deployment	person_tagger_capture	Person responsible for tagging or surgery		Can be the name of vet, observer, crew, spear fisherman or scientist	required	1	1	1	1	Some edits/additions to the Necessity made by IATTC (from Recommended to Required)

deployment	othertags_capture	List tag IDs for conventional, acoustic, PIT, band or satellite tags for multi-tagged situation, photoID, photo/video footage file names	Hallprint PAR007007		optional	1	1	1	1	Comma separated.
animal	species_capture	Common name(s) or FAO code for species name		Refer to www.itis.gov or FAO species list	required	1	1	1	1	
animal	speciesTSN_capture	Taxonomic Serial Number (TSN) from ITIS (www.itis.gov)			required	1	1	1	1	
animal	lifestage_capture	Life stage of the animal	adult, juvenile, subadult, weaner		recommended	1	1	1	1	
animal	sex	Sex of the animal	male, female, unknown	Likely only applicable to sharks upon visual confirmation	optional	1	1	1	1	
animal	length_capture	Length of the animal	300		recommended	1	1	1	1	
animal	length_unit_capture	Unit of length measurement	centimeter	May need to compile a list of types and abbreviations	recommended	1	1	1	1	
animal	length_type_capture	Type of length measurement	Curved fork length, Straight fork length, total length. for turtle the standard measurements are Curved Carapace Length (CCL), Straight Carapace Length (SCL), Curved Carapace Width (CCW) and Straight Carapace Width (SCW), and researchers occasionally measure girth as well.	May need to compile a list of types and abbreviations	required	1	1	1	1	Some edits/additions to the example list made by IATTC. Some edits/additions to the Necessity made by IATTC (from Recommended to Required)

animal	length_method_capture	Method used to obtain the measurement	measured caliper, measured tape, estimated, calculated	Calculated means it's calculated from length-weight relationships or other conversions.	required	1	1	1	1	Is this good enough? Or have to specify how the measurement is made: tape/ estimated etc. Some edits/additions to the example list made by IATTC. Some edits/additions to the Necessity made by IATTC (from Recommended to Required)
animal	weight_capture	Weight of the animal	1200		optional	1	1	1	1	Some edits/additions to the Necessity made by IATTC (from Recommended to Optional)
animal	weight_unit_capture	Unit of weight measurement	pound		optional	1	1	1	1	Some edits/additions to the Necessity made by IATTC (from Recommended to Optional)
animal	weight_type_capture	Type of weight measurement	whole	May need to compile a list of types and abbreviations: whole, dressed, gilled & gutted	optional	1	1	1	1	Some edits/additions to the Necessity made by IATTC (from Recommended to Optional)
animal	weight_method_capture	Method used to obtain the measurement	measured, estimated, calculated	Calculated means it's calculated from length-weight relationships or other conversions.	optional	1	1	1	1	Some edits/additions to the Necessity made by IATTC (from Recommended to Optional)
animal	condition_capture	Description of condition/ injury. Or specify scoring system and a score.	good	Can be generic: good, bad, gut hooked, eye hooked, bleeding. Scoring system for fish/ shark: reflex action mortality predictor (RAMP), Kerstetter's lab ACES. Measurement: Bioelectrical Impedance Analysis (BIA) gives phase angle and composition index. Fat: Distell Fatmeter	required	1	1	1	1	Some edits/additions to the Necessity made by IATTC (from Recommended to Required)
animal	hours_soaktime_capture	If caught on longline, specify soak time In hours			optional	1	0	-1	-1	
animal	minutes_fighttime_capture	If caught on rod and wheel or handline, specify fight time			optional	1	-1	-1	-1	

animal	minutes_operation	Time used (minutes) in carrying out the attachment or surgical procedure.			optional	1	1	1	1	
animal	minutes_revival	If the animal is revived, specify revival time in minutes		Can be time used in swimming the animal before release.	optional	1	1	1	1	
animal	tag_placement	Description of where the tag was placed.	second dorsal fin		recommended	1	1	1	1	
animal	mount_numbolts	Number of bolts used for mounting			optional	1	0	0	-1	
animal	implant_numsuture	Number of suture used to close the wound		Internal archival only	optional	1	-1	-1	1	
animal	tissue_sample_capture	List other sample types and sample IDs if collected	Blood-ID02101	Tissue can be any issue: fin clip, blood, scale, biopsy etc.	optional	1	1	1	1	Comma separated
animal	fate_recapture	Fate of the animal upon recapture	harvested, released, tag and release, missing, unknown; observed/ photo ID		recommended	1	1	1	1	
animal	lifestage_recapture	Life stage of the animal			recommended	1	1	1	1	
animal	length_recapture	Length of the animal			required	1	1	1	1	Some edits/additions to the Necessity made by IATTC (from Recommended to Required)
animal	length_unit_recapture	Unit of length measurement		May need to compile a list of types and abbreviations	required	1	1	1	1	Some edits/additions to the Necessity made by IATTC (from Recommended to Required)
animal	length_type_recapture	Type of length measurement	SFL, CFL, TL, etc...	May need to compile a list of types and abbreviations	required	1	1	1	1	Some edits/additions to the Necessity made by IATTC (from Recommended to Required)
animal	length_method_recapture	Method used to obtain the measurement	measured Caliper, measured tape, estimated, calculated	Calculated means it's calculated from length-weight relationships or other conversions.	required	1	1	1	1	Some edits/additions to the Necessity made by IATTC (from Recommended to Required)
animal	weight_recapture	Weight of the animal			optional	1	1	1	1	Some edits/additions to the Necessity made by IATTC (from Recommended to Optional)

animal	weight_unit_recapture	Unit of weight measurement			optional	1	1	1	1	Some edits/additions to the Necessity made by IATTC (from Recommended to Optional)
animal	weight_type_recapture	Type of weight measurement		May need to compile a list of types and abbreviations: whole, dressed, gilled & gutted	optional	1	1	1	1	Some edits/additions to the Necessity made by IATTC (from Recommended to Optional)
animal	weight_method_recapture	Method used to obtain the measurement	measured, estimated, calculated	Calculated means it's calculated from length-weight relationships or other conversions.	optional	1	1	1	1	Some edits/additions to the Necessity made by IATTC (from Recommended to Optional)
animal	condition_recapture	Description of condition/ injury. Or specify scoring system and a score.		Can be generic: good, bad, gut hooked, eye hooked, bleeding. Scoring system for fish/shark: reflex action mortality predictor (RAMP), Kerstetter's lab ACES. Measurement: Bioelectrical Impedance Analysis (BIA) gives phase angle and composition index. Fat: Distell Fatmeter	recommended	1	1	1	1	
animal	hours_soaktime_recapture	If caught on longline, specify soak time in hours			optional	1	0	-1	-1	
animal	minutes_fighttime_recapture	If caught on rod and wheel or handline, specify fight time			optional	1	-1	-1	-1	
animal	tissue_sample_recapture	List other sample types and sample IDs if collected		Tissue can be any issue: fin clip, blood, scale, hard parts, stomach, muscle, biopsy etc.	optional	1	1	1	1	Comma separated
end_of_mission	end_type	Description of how the end point is derived for the device.	first reported, recaptured, last transmission, recovered		required	1	1	1	1	

end_of_mission	end_details		GPS, Argos, estimated, calculated, modeled, recovered on animal, floater at sea, recovered on land, recovered by fishing fleet, recovered in port, transfer in transshipment, found in well number X, recovered in processing plant		required	1	1	1	1	http://www.spc.int/TAGGING/en/publications/tagging-publications/viewcategory/13
end_of_mission	datetime_end	End date time (yyyy-mm-dd hh:mm:ss) or date range (BETWEEN yyyy-mm-dd AND yyyy-mm-dd) if estimated/ guessed.			required	1	1	1	1	WC: "Not sure how others do it, but it may be easier to keep the dates in UTC?"
end_of_mission	UTCOffset_end	Time difference (+/- hh:mm) to UTC for the release datetime. Include daylight saving time if observed.	+00:00	If datetime is extracted from the tag itself, it's in UTC time already.	required	1	1	1	1	ftp://ftp.iana.org/tz/releases/tzdata2016f.tar.gz
end_of_mission	datetime_death	If mortality occurs before end datetime, specify date time (yyyy-mm-dd hh:mm:ss)			optional	1	1	1	1	WC: "Not sure how others do it, but it may be easier to keep the dates in UTC?"
end_of_mission	UTCOffset_death	Time difference (+/- hh:mm) to UTC for the release datetime. Include daylight saving time if observed.	+00:00	If datetime is extracted from the tag itself, it's in UTC time already.	required	1	1	1	1	ftp://ftp.iana.org/tz/releases/tzdata2016f.tar.gz
end_of_mission	lon_end	End longitude			required	1	1	1	1	
end_of_mission	lat_end	End latitude			required	1	1	1	1	
end_of_mission	locationclass_end	Argos location class for popup location or satellite transmission			recommended	1	1	1	1	

recovery	location_recapture	Name or standard identifier of location			recommended	1	1	1	1	
recovery	method_recapture	Type of gear used to catch the animal	Longline, purse seine, troll, trawl, rod and reel, handline, set net, trap, gillnet, harpoon, hoop net, anesthesia, tangle net, dip net, vertical line entanglement (commercial fisheries, aquaculture, mooring), dredge, pound net/weir (for turtles)		recommended	1	1	1	1	
recovery	school_recapture	Type of school in which the animal was caught	Free school, log, anchored FAD, drifting FAD	Include FAD number if possible.	optional	1	-1	-1	-1	
recovery	vessel_recapture	Name or standard identifier of vessel			optional	1	1	1	1	
recovery	flag_capture	The vessel's country of registration			optional	1	1	1	1	
recovery	cruise_recapture	Name or standard identifier of cruise			optional	1	1	1	1	
recovery	station_recapture	Name or standard identifier of station			optional	1	1	1	1	
recovery	set_float_recapture	If caught on longline, include set number and float number			optional	1	0	-1	-1	
recovery	depth_m_recapture	Depth (meters) at which the animal was caught		Can use estimated depth from hook number on longline	optional	1	0	-1	-1	
recovery	hook_recapture	Type of hook used		Use brand name and/product when possible.	optional	1	0	-1	-1	
recovery	baitlure_recapture	Bait, chum, lure or decoy used		Use brand name and/product when possible.	optional	1	0	-1	-1	

recovery	temp_degC_recapture	Air or sea surface temperature (Celcius) when the animal was caught			optional	1	1	1	1	
recovery	wind_knots_recapture	Wind speed (knots) when the animal was caught			optional	1	1	1	1	
recovery	seastate_recapture	World Meteorological Organization sea state code (0-9)		Similar to Douglas Sea Scale	optional	1	1	1	1	
recovery	person_recapture	Person responsible for the recapture		Name of angler, observer, scientist, fisher, beach comber etc.	recommended	1	1	1	1	
recovery	person_tagger_recapture	Person responsible for tag-and-release		Very unlikely to re-tag turtle or mammal	optional	1	0	-1	1	
recovery	retagged_recapture	List tag IDs for conventional, acoustic, PIT, band or satellite tags for multi-tagged situation, photoID, photo/video footage file names			optional	1	1	1	1	Comma separated
waypoints	waypoints_source	State the source for waypoints	Argos, GPS, acoustic detections, manufacturer, modeled	Waypoints are "points" along the trajectory of the tagged animal between the start and end dates.	required	1	1	1	1	
waypoints	waypoints_method	If "waypoints_source" = "modeled", specify the method used to estimate the positions. Include citation/reference/ url if available	kftrack, ukfst, trackit, tripEstimation, SSM, GPE3, Track & Loc, GeoLight, BASTrack, IKNOS		recommended	1	1	1	1	
waypoints	waypoints_software	Software packages used with version number			recommended	1	1	1	1	

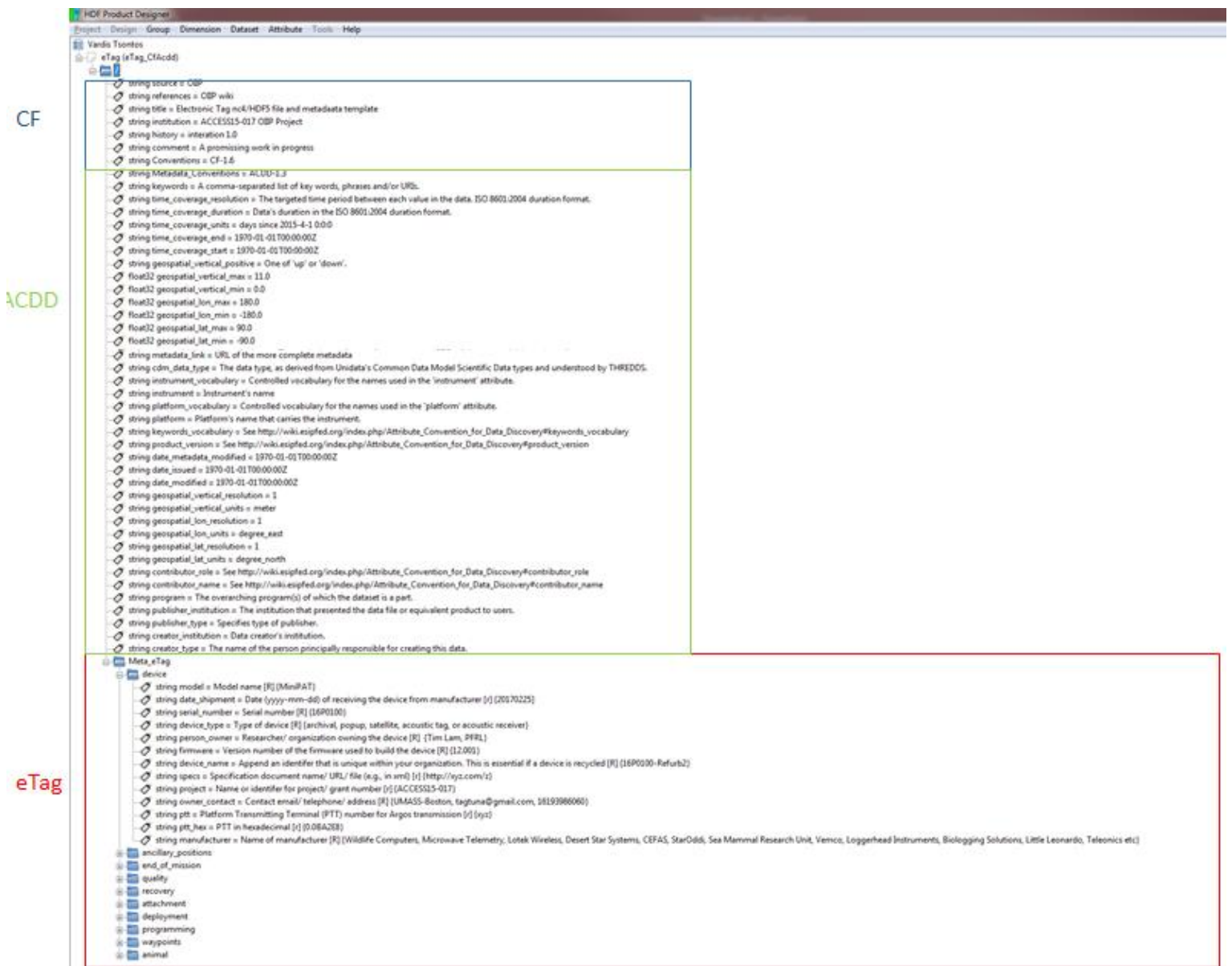
waypoints	geolocation_parameters	List of Geocorrection Parameters and associated values implemented. Comma separated list in format 'parameter1:value', 'parameter2:value',...	eg. 'diffusion_coefficien:0.3', 'satellite_sst': https://podaac.jpl.nasa.gov/dataset/NCDC-L4LRblend-GLOB-AVHRR_OI', ...	Assuming only 1 set of waypoints per tag data file.	recommended	1	1	1	1	
waypoints	geolocation_output	URL/URI to any relevant geocorrection output file(s) produced	eg. ftp://myserver/myfiles.zip		optional	1	1	1	1	
waypoints	interpolation_method	None if no interpolation. Otherwise, specify method/ software used.	None, crawl, Bézier curves, Hermite splines and cubic splines		recommended	1	1	1	1	
waypoints	interpolation_time	Specify the time interval for interpolation	0, 1 hour, gap filling	Use 0 for no interpolation or gap filling for data points without any coordinates.	recommended	1	1	1	1	
ancillary_positions	ancillary_position_source	List available source(s) for other known position(s)	Acoustic detections	If an animal is tagged and then released again, this can be included here as well.	optional	1	1	1	1	
ancillary_positions	ancillary_position_deviceid	List chronologically the devices collecting the ancillary position(s)	receiverID1003, receiverID1008, receiverID1121		optional	1	1	1	1	Comma separated
ancillary_positions	ancillary_position_datetime	List chronologically the datetime (yyyy-mm-dd hh:mm:ss) for ancillary position(s)	2016-01-04 22:32:21, 2016-02-01 02:41:11, 2016-03-29 09:15:31		optional	1	1	1	1	Comma separated
ancillary_positions	ancillary_position_UTCOffset	List chronologically the UTC offset (+/- hh:mm) for known position(s)	+00:00, +00:00, +00:00							Comma separated
ancillary_positions	ancillary_position_lon	List chronologically the longitude for ancillary position(s)	-153.42,-152.42,-152.49		optional	1	1	1	1	Comma separated
ancillary_positions	ancillary_position_lat	List chronologically the latitude for ancillary position(s)	42.131,41.135,42.422		optional	1	1	1	1	Comma separated

ancillary_ positions	ancillary_position_quality	List chronologically the quality (location class/ accuracy/ range etc.) for ancillary position(s). Can be qualitative.	good,good,good	Can be Argos location class	optional	1	1	1	1	Comma separated
quality	found_problem	Is there any problem found in this dataset? One of 3 responses: yes, no, unexamined.	yes		required	1	1	1	1	
quality	person_qc	Person responsible for quality control			required	1	1	1	1	
quality	problem_affect_dates	Date range (BETWEEN yyyy-mm-dd AND yyyy-mm-dd) in which data quality is in doubt			recommended	1	1	1	1	
quality	problem_number_of	Number of problems found	1	Hard to cover all problems here, e.g., date of post-release mortality/ predation, broken light stalk, broken hardware, tag failure modes	recommended	1	1	1	1	
quality	problem_summary	List short description(s) for the problem(s)	Temperature sensor drift		recommended	1	1	1	1	
quality	problem_details	Provide details for the problem(s)	Daily drift after sunset by 1.5 degC		recommended	1	1	1	1	
quality	calibration_file	Files/ URLs used for calibration of sensors			optional	1	1	1	1	

4 File Implementation of eTag Metadata

The HDF Product designer tool was used to create a self-describing file template design (“eTag”) implementing the aforementioned set of categorized eTag attributes within a hierarchical set of Group structures at the global/root level. Then the tool’s automated CF1.6 and ACDD1.3 global metadata creation capability was used to populate the template attributes from those standards successfully. A screenshot of the resulting file template is given in figure 1, showing the blocks of attributes by type. The “Meta_eTag” group, containing 7 sub-groups corresponding to the tag metadata categories with their constituent attributes as described in table 1 above, is highlighted in red in the figure below. The detailed contents of the eTag metadata groups are fully documented in table 2.

Figure 1. Structure of the self-describing file template showing the eTag attributes implemented within Groups together with blocks of standard CF and ACDD metadata attributes. Only the contents of the "Device" subgroup is exposed in this view.



An alternative template eTag design, in which CF and ACDD attributes themselves are packaged in “Meta_” (metadata) groups of their own, is illustrated in figure 2. While more readable, it is important to recognize that current CF interoperability standards do not cover the usage of groups. The standard would need to be extended to also cover the representation of domain specific attributes within group and sub-group containers as implemented here for tagging metadata.

Figure 2. Alternate design in which CF and ACDD attributes themselves are packaged in "Meta_" (metadata) groups of their own. Only the attributes comprising the CF group are expanded and exposed in the this view.

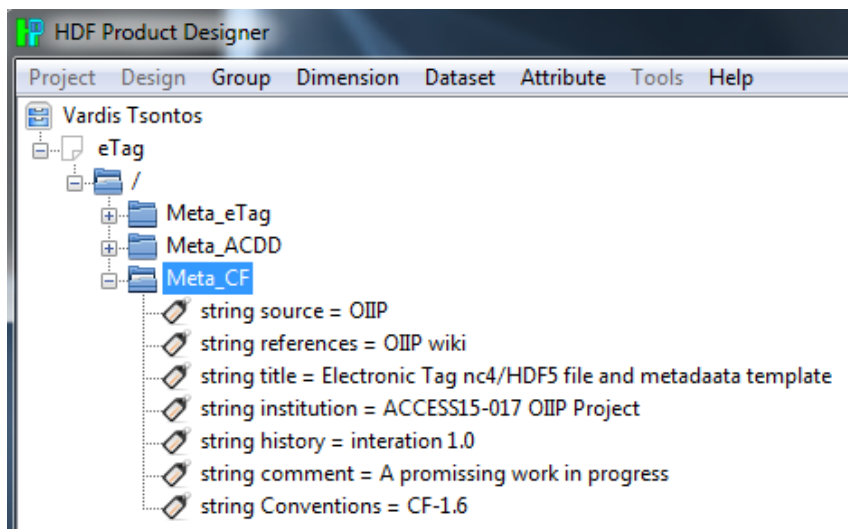


Table 2. eTag File Metadata Template documentation. In the eTag subgroups, Value fields contain attribute definition and priority information (R=required, r= recommended, o=optional). In cases where the attribute Datatype is not of type string, the required type is indicated (eg. [uint32], [f32] for 32-bit integer and floating point number values respectively). Example attribute values are also presented inline within { }. Additional comments in select cases are prefixed by “!”.

Group: / {root}

CF & ACDD Attributes

Attribute	Datatype	Shape	Value
source	string	()	OIIP
references	string	()	OIIP wiki
title	string	()	Electronic Tag nc4/HDF5 file and metadaata template
institution	string	()	ACCESS15-017 OIIP Project
history	string	()	interation 1.0
comment	string	()	A promissing work in progress
Conventions	string	()	CF-1.6
Metadata_Conventions	string	()	ACDD-1.3
keywords	string	()	A comma-separated list of key words, phrases and/or URIs.

time_coverage_resolution	string	()	The targeted time period between each value in the data. ISO 8601:2004 duration format.
time_coverage_duration	string	()	Data's duration in the ISO 8601:2004 duration format.
time_coverage_units	string	()	days since 2015-4-1 0:0:0
time_coverage_end	string	()	1970-01-01T00:00:00Z
time_coverage_start	string	()	1970-01-01T00:00:00Z
geospatial_vertical_positive	string	()	One of 'up' or 'down'.
geospatial_vertical_max	float32	()	11.0
geospatial_vertical_min	float32	()	0.0
geospatial_lon_max	float32	()	180.0
geospatial_lon_min	float32	()	-180.0
geospatial_lat_max	float32	()	90.0
geospatial_lat_min	float32	()	-90.0
geospatial_bounds_vertical_crs	string	()	The vertical coordinate reference system (CRS) of the geospatial_bounds attribute.
geospatial_bounds_crs	string	()	Coordinate reference system (CRS) of the geospatial_bounds attribute.
geospatial_bounds	string	()	Data's 2D or 3D geospatial extent in OGC's Well-Known Text (WKT) format.
publisher_url	string	()	The email address of the person responsible for publishing the data.
publisher_email	string	()	The email address of the person responsible for publishing the data.
publisher_name	string	()	The name of the person responsible for publishing the data.
project	string	()	The name of the project(s).
creator_url	string	()	The URL of the person principally responsible for creating this data.
creator_email	string	()	The email address of the person principally responsible for creating this data.
creator_name	string	()	The name of the person principally responsible for creating this data.
date_created	string	()	1970-01-01T00:00:00Z
standard_name_vocabulary	string	()	The name and version of the controlled vocabulary from which variable standard names are taken.
license	string	()	Data distribution and/or access license.
acknowledgment	string	()	Acknowledge various types of support for the work that produced this data.
processing_level	string	()	Textual description of the data's processing (or quality control) level.
naming_authority	string	()	The organization that provides the initial id.
id	string	()	gen21
metadata_link	string	()	URL of the more complete metadata
cdm_data_type	string	()	The data type, as derived from Unidata's Common Data Model Scientific Data types and understood by THREDDS.
instrument_vocabulary	string	()	Controlled vocabulary for the names used in the 'instrument' attribute.
instrument	string	()	Instrument's name
platform_vocabulary	string	()	Controlled vocabulary for the names used in the 'platform' attribute.
platform	string	()	Platform's name that carries the instrument.
keywords_vocabulary	string	()	See http://wiki.esipfed.org/index.php/Attribute_Convention_for_Data_Discovery#keywords_vocabulary
product_version	string	()	See http://wiki.esipfed.org/index.php/Attribute_Convention_for_Data_Discovery#product_version
date_metadata_modified	string	()	1970-01-01T00:00:00Z
date_issued	string	()	1970-01-01T00:00:00Z
date_modified	string	()	1970-01-01T00:00:00Z
geospatial_vertical_resolution	string	()	1
geospatial_vertical_units	string	()	meter
geospatial_lon_resolution	string	()	1
geospatial_lon_units	string	()	degree_east
geospatial_lat_resolution	string	()	1

geospatial_lat_units	string	()	degree_north
contributor_role	string	()	See http://wiki.esipfed.org/index.php/Attribute_Convention_for_Data_Discovery#contributor_role
contributor_name	string	()	See http://wiki.esipfed.org/index.php/Attribute_Convention_for_Data_Discovery#contributor_name
program	string	()	The overarching program(s) of which the dataset is a part.
publisher_institution	string	()	The institution that presented the data file or equivalent product to users.
publisher_type	string	()	Specifies type of publisher.
creator_institution	string	()	Data creator's institution.
creator_type	string	()	The name of the person principally responsible for creating this data.

Group: /Meta_eTag

Sub-Group: /Meta_eTag/device

Attribute	Datatype	Shape	Value
model	string	()	Model name [R] {MiniPAT}
date_shipment	string	()	Date (yyyy-mm-dd) of receiving the device from manufacturer [r] {20170225}
serial_number	string	()	Serial number [R] {16P0100}
device_type	string	()	Type of device [R] {archival, popup, satellite, acoustic tag, or acoustic receiver}
person_owner	string	()	Researcher/ organization owning the device [R] {Tim Lam, PFRL}
firmware	string	()	Version number of the firmware used to build the device [R] {12.001}
device_name	string	()	Append an identifier that is unique within your organization. This is essential if a device is recycled [R] {16P0100-Refurb2}
specs	string	()	Specification document name/ URL/ file (e.g., in xml) [r] {http://xyz.com/z}
project	string	()	Name or identifier for project/ grant number [r] {ACCESS15-017}
owner_contact	string	()	Contact email/ telephone/ address [R] {UMASS-Boston, tagtuna@gmail.com, 16193986060}
ptt	string	()	Platform Transmitting Terminal (PTT) number for Argos transmission [r] {xyz}
ptt_hex	string	()	PTT in hexadecimal [r] {0.0BA2E8}
manufacturer	string	()	Name of manufacturer [R] {Wildlife Computers, Microwave Telemetry, Lotek Wireless, Desert Star Systems, CEFAS, StarOddi, Sea Mammal Research Unit, Vemco, Loggerhead Instruments, Biologging Solutions, Little Leonardo, Teleonics etc}

Sub-Group: /Meta_eTag/ancillary_positions

Attribute	Datatype	Shape	Value
ancillary_position_source	string	()	List available source(s) for other known position(s) [o] {Acoustic detections}
ancillary_position_deviceid	string	()	List chronologically the devices collecting the ancillary position(s) [o] {receiverID1003, receiverID1008, receiverID1121}
ancillary_position_datetime	string	()	List chronologically the datetime (yyyy-mm-dd hh:mm:ss) for ancillary position(s) [o] {2016-01-04 22:32:21, 2016-02-01 02:41:11, 2016-03-29 09:15:31}

ancillary_position_UTCOffset	string	()	List chronologically the UTC offset (+/- hh:mm) for known position(s) [o] {+00:00, +00:00, +00:00}
ancillary_position_lon	string	()	List chronologically the longitude for ancillary position(s) [o] {-153.42,-152.42,-152.49}
ancillary_position_lat	string	()	List chronologically the latitude for ancillary position(s) [o] {42.131,41.135,42.422}
ancillary_position_quality	string	()	List chronologically the quality (location class/ accuracy/ range etc.) for ancillary position(s). Can be qualitative. [o] {good,good,good; Argos location class}

Sub-Group: /Meta_eTag/end_of_mission

Attribute	Datatype	Shape	Value
lon_end	string	()	End longitude [R] {+80.246}
UTCOffset_end	string	()	Time difference (+/- hh:mm) to UTC for the release datetime. Include daylight saving time if observed [R] {+00:00}
datetime_end	string	()	End date time (yyyy-mm-dd hh:mm:ss) or date range (BETWEEN yyyy-mm-dd AND yyyy-mm-dd) if estimated/ guessed [R] {2017-02-25 02:23:45 UTC}
end_type	string	()	End mode category [R] {first reported, recaptured, last transmission, recovered}
locationclass_end	string	()	Argos location class for popup location or satellite transmission [r] {2}
lat_end	string	()	End latitude [R] {+17.235}
end_details	string	()	Description of how the end point is derived for the device [R] {GPS, Argos, estimated, calculated, modeled, recovered on animal, floater at sea, recovered on land, recovered by fishing fleet, recovered in port, transfer in transshipment, found in well number X, recovered in processing plant}
UTCOffset_death	string	()	Time difference (+/- hh:mm) to UTC for the release datetime. Include daylight saving time if observed [o] {+00:00}
datetime_death	string	()	If mortality occurs before end datetime, specify date time (yyyy-mm-dd hh:mm:ss) [o] {20170225 02:22:35}

Sub-Group: /Meta_eTag/quality

Attribute	Datatype	Shape	Value
problem_numof	string	()	Number of problems found [r] {1}
problem_summary	string	()	List short description(s) for the problem(s) [r] {Temperature sensor drift}
problem_details	string	()	Provide details for the problem(s) [r] {Daily drift after sunset by 1.5 degC}
calibration_file	string	()	Files/ URLs used for calibration of sensors [o] {ftp://xy.com/}
found_problem	string	()	Is there any problem found in this dataset? One of 3 responses: yes, no, unexamined. [R] {yes}
person_qc	string	()	Person responsible for quality control [R] {Tim Lam}
problem_affecteddates	string	()	Date range (BETWEEN yyyy-mm-dd AND yyyy-mm-dd) in which data quality is in doubt [r] {20170201 AND 20170215}

Sub-Group: /Meta_eTag/recovery

Attribute	Datatype	Shape	Value
location_recapture	string	()	Name or standard identifier of location [r] {San Pedro Channel}
method_recapture	string	()	Type of gear used to catch the animal [r] {Longline, purse seine, troll, trawl, rod and reel, handline, set net, trap, gillnet, harpoon, hoop net, anesthesia, tangle net, dip net, vertical line entanglement (commercial fisheries, aquaculture, mooring), dredge, pound net/weir (for turtles)}
school_recapture	string	()	Type of school in which the animal was caught [o] {Free school, log, anchored FAD, drifting FAD}
vessel_recapture	string	()	Name or standard identifier of vessel [o] {HMS Royal}
flag_recapture	string	()	The vessels country of registration [o] {Panama}
cruise_recapture	string	()	Name or standard identifier of cruise [o] {SPURS1}
station_recapture	string	()	Name or standard identifier of station [o] {stn1}
set_float_recapture	string	()	If caught on longline, include set number and float number [o] {15}
depth_m_recapture	string	()	Depth (meters) at which the animal was caught [o] {f32} {50}
hook_recapture	string	()	Type of hook used [o] {j}
baitlure_recapture	string	()	Bait, chum, lure or decoy used [o] {fly}
temp_degC_recapture	string	()	Air or sea surface temperature (Celcius) when the animal was caught [o] {f32} {24.6}
wind_knots_recapture	string	()	Wind speed (knots) when the animal was caught [o] {f32} {14.7}
seastate_recapture	string	()	World Meteorological Organization sea state code (0-9) [o] {int32} {3}
person_recapture	string	()	Person responsible for the recapture [r] {Tim Lam}
person_tagger_recapture	string	()	Person responsible for tag-and-release [o] {Tim Lam}
retagged_recapture	string	()	List tag IDs for conventional, acoustic, PIT, band or satellite tags for multi-tagged situation, photoID, photo/video footage file names [o] {tg1900}

Sub-Group: /Meta_eTag/attachment

Attribute	Datatype	Shape	Value
anchor_depth_cm	string	()	How deep (centimeter) should the anchor be in the animal? [o] {8}
release_forced	string	()	If a mechanical release is engaged at depth (too avoid crushing the tag), specify the mechanism and depth at which the release is engaged. [o] {Wildlife Computers RD1800}
attachment_method	string	()	Method used to put the tag on/ in the animal [R] {tow, glue, suction, anchor, mount, implant, harness, backpack}
antiseptic_product	string	()	Brand name and/ product of antiseptic or sterilizing agent used during the attachment [o] {Iodine, Cicatrin}
tether_material	string	()	Tether material for a towed tag [r] {stainless steel wire, monofilament}
attachment_product	string	()	Brand name and/ product for attachment materials used [r] {VetBond, Peel Ply, tesa}
anchor_material	string	()	Material of anchor [r] {nylon, urethane, stainless steel, titanium}
antifouling_product	string	()	Brand name and/ product of antifouling paint or coating applied [o] {PropSpeed}
release_method	string	()	Method to get a tag detached from the animal/ anchor [r] {corrosive burn wire, oxidative/ explosive, galvanizing metal, acoustic release}
tether_assembly	string	()	Materials and methods in constructing a tether [r] {heat-shrink or silicon tubing}
anchor_type	string	()	Type of anchor [r] {Domeier, Wilton, Titanium}
anesthetic_product	string	()	Brand name and/ product of anesthesia used during the attachment [o] {metomidate, Aqua-S}
float_additional	string	()	Specify any additional floatation used [o] {}
tether_length_cm	string	()	End to end length (centimeter) of a tether [o] {20}

anchor_dimensions_mm	string	()	Dimensions (millimeter) as length, width, thickness or diameter. [o] {20 L x 14 W}
mount_type	string	()	Type of mount [r] {Fin, tail, carapacial ridge}

Sub-Group: /Meta_eTag/deployment

Attribute	Datatype	Shape	Value
datetime_release	string	()	Local date time (yyyy-mm-dd hh:mm:ss) of deployment [R] {20170226 12:35:59}
UTCOffset_release	string	()	Time difference (+/- hh:mm) to UTC for the release datetime. Include daylight saving time if observed [R] {-08:00}
lon_release	string	()	Longitude (decimal degree) of deployment [R] {+87.56}
lat_release	string	()	Latitude (decimal degree) of deployment [R] {-17.23}
location_capture	string	()	Name or standard identifier of location [r] {San Pedro Channel}
method_capture	string	()	Type of gear used to catch the animal [r] {Longline, purse seine, troll, trawl, rod and reel, handline, set net, trap, gillnet, harpoon, hoop net, anesthesia, tangle net, dip net, vertical line entanglement (commercial fisheries, aquaculture, mooring), dredge, pound net/weir (for turtles)}
Method_landed	string	()	how was animal put aboard the vessel [o] {net, sling, lifted}
school_capture	string	()	Type of school in which the animal was caught [o] {Free school, log, anchored FAD, drifting FAD}
vessel_capture	string	()	Name or standard identifier of vessel [o] {HMS Royal}
flag_capture	string	()	The vessels country of registration [o] {Panama}
cruise_capture	string	()	Name or standard identifier of cruise [o] {SPURS2}
station_capture	string	()	Name or standard identifier of station [o] {stn2}
set_float_capture	string	()	If caught on longline, include set number and float number [o] {13}
hook_capture	string	()	Type of hook used [o] {18/0 circle}
baitlure_capture	string	()	Bait, chum, lure or decoy used [o] {sardine}
temp_degC_capture	string	()	Air or sea surface temperature (Celcius) when the animal was caught [r] [f32] {12.6}
depth_m_capture	string	()	Depth (meters) at which the animal was caught [o] [f32] {55.5}
wind_knots_capture	string	()	Wind speed (knots) when the animal was caught [o] [f32] {18.5}
seastate_capture	string	()	World Meteorological Organization sea state code (0-9) [o] [int32] {2}
person_angler_capture	string	()	Person responsible for angling [o] {Tim Lam}
person_tagger_capture	string	()	Person responsible for tagging or surgery [R] {Tim Lam}
othertags_capture	string	()	List tag IDs for conventional, acoustic, PIT, band or satellite tags for multi-tagged situation, photoID, photo/video footage file names [o] {Hallprint PAR007007}

Sub-Group: /Meta_eTag/programming

Attribute	Datatype	Shape	Value
programming_software	string	()	Programming software with version number [R] {WC-prg-v3}
programming_report	string	()	File/ URL to a report listing the details of programming [R] {ftp://xy.com/}
date_programming	string	()	Date (yyyy-mm-dd) of programming [r] {20170226}
person_programmer	string	()	Person responsible for the programming [r] {Tim Lam}
seconds_sampling	string	()	Sampling rate (seconds) for sensor sampling [r] [f32] {15}
seconds_sampling_highfreq	string	()	Sampling rate (seconds) for sensor sampling at a higher frequency [o] [f32] {60}
seconds_writingdata	string	()	Time interval in seconds when sampled data are written to onboard storage memory [r] [f32] {15}
minutes_summary	string	()	Interval in minutes during which data are summarized for that period [r] [f32] {1440}

days_mission	string	()	Programmed mission length in days [r] [f32] {365}
days_constantdepth	string	()	Days at a constant depth before release is initiated [r] [f32] {1}

Sub-Group: /Meta_eTag/waypoints

Attribute	Datatype	Shape	Value
waypoints_source	string	()	State the source for waypoints [R] {Argos, GPS, acoustic detections, manufacturer, modeled}
waypoints_method	string	()	If waypoints_source = modeled, specify the method used to estimate the positions. Include citation/ reference/ url if available [r] {kfrack, ukfst, trackit, tripEstimation, SSM, GPE3, Track & Loc, GeoLight, BASTrack, IKNOS}
waypoints_software	string	()	Software packages used with version number [r] {kfrack v4}
geolocation_parameters	string	()	List of Geocorrection Parameters and associated values implemented. Comma seperated list in format parameter1:value, parameter2:value,.. [r] {diffusionRate:0.1, ancillary:SST}
geolocation_output	string	()	URL/URI to any relevant geocorrection output file(s) produced [o] { ftp://myserver/myfiles.zip}
interpolation_method	string	()	None if no interpolation. Otherwise, specify method/ software used [r] {None, crawl, Bezier curves, Hermite splines and cubic splines}
interpolation_time	string	()	Specify the time interval for interpolation [r] {0, 1 hour, gap filling}

Sub-Group: /Meta_eTag/animal

Attribute	Datatype	Shape	Value
tissue_sample_capture	string	()	List other sample types and sample IDs if collected [o] {Blood-ID02101}
hours_soaktime_capture	string	()	If caught on longline, specify soak time in hours [o] [f32] {2.5, }
length_capture	string	()	Length of the animal [r] [f32] {300}
length_type_capture	string	()	Type of length measurement [R] { Curved fork length, Straight fork length, total length. for turtle the standard measurements are Curved Carapace Length (CCL), Straight Carapace Length (SCL), Curved Carapace Width (CCW) and Stra}
fate_recapture	string	()	Fate of the animal upon recapture [r] {harvested, released, tag and release, missing, unknown; observed/ photo ID}
hours_soaktime_recapture	string	()	If caught on longline, specify soak time in hours [o] [f32] {0.6}
weight_unit_capture	string	()	Unit of weight measurement [o] {kg} !CF-UDunits
weight_method_recapture	string	()	Method used to obtain the measurement [o] {measured, estimated, calculated}
minutes_fighttime_capture	string	()	If caught on rod and wheel or handline, specify fight time [o] [f32] {23}
weight_method_capture	string	()	Method used to obtain the measurement [o] {measured, estimated, calculated}
length_method_capture	string	()	Method used to obtain the measurement [R] {measured caliper, measured tape, estimated, calculated}
length_unit_capture	string	()	Unit of length measurement [r] {cm} !CF-UDunits
length_type_recapture	string	()	Type of length measurement [R] {SFL, CFL, TL, etc}
minutes_revival	string	()	If the animal is revived, specify revival time in minutes [o] [f32] {3.5}
tag_placement	string	()	Description of where the tag was placed. [r] {second dorsal fin}
weight_recapture	string	()	Weight of the animal [o] [f32] {2.6}
minutes_fighttime_recapture	string	()	If caught on rod and wheel or handline, specify fight time [o] [f32] {21.5}
implant_numsuture	string	()	Number of suture used to close the wound [o] [int32] {10}
weight_capture	string	()	Weight of the animal. [o] [f32] {1200}
condition_recapture	string	()	Description of condition/ injury. Or specify scoring system and a score. [r]
speciesTSN_capture	string	()	Taxonomic Serial Number (TSN) from ITIS (www.itis.gov) [R] {172421}

weight_type_capture	string	()	Type of weight measurement [o] {whole}
weight_type_recapture	string	()	Type of weight measurement [o] {whole, dressed, gilled & gutted}
condition_capture	string	()	Description of condition/ injury. Or specify scoring system and a score. [R?] {good}
sex	string	()	Sex of the animal [o] {male, female, unknown}
lifestage_recapture	string	()	Life stage of the animal [r]
tissue_sample_recapture	string	()	List other sample types and sample IDs if collected [o] {Tissue can be any issue: fin clip, blood, scale, hard parts, stomach, muscle, biopsy etc.}
species_capture	string	()	Common name(s) or FAO code for species name [R] {bluefin tuna}
weight_unit_recapture	string	()	Unit of weight measurement [o] {kg} !CF-UDunits
mount_numbolts	string	()	Number of bolts used for mounting. [o] [int32] {4}
length_unit_recapture	string	()	Unit of length measurement [R] {cm} !CF-UDunits
length_recapture	string	()	Length of the animal [R] [f32] {400}
length_method_recapture	string	()	Method used to obtain the measurement. [R] {measured Caliper, measured tape, estimated, calculated}
lifestage_capture	string	()	Life stage of the animal [r] {adult, juvenile, subadult, weaner}
minutes_operation	string	()	Time used (minutes) in carrying out the attachment or surgical procedure. [o] [f32] {12}