Assessing and enhancing ecosystem services provided by diadromous fish in a climate change context

Deliverable title: Tracking and Tagging of Diadromous Species

Deliverable reference: WP 6 – Action 2

Contributors and affiliations:

Ciara O'LEARY – IFI

Sean ROONEY – IFI

Jack O'CALLAGHAN – IFI

William ROCHE – IFI

& Project partners

This project is co-financed by the Interreg Atlantic Area Programme through the European Regional Development Fund.

Subsidy contract n°	EAPA_18/2018
Programme priority	4. Enhancing biodiversity and the natural and cultural assets
Start date of project	1st February 2019
End date of the project	30st June 2023
Work package n°	6
Indicator	Publications and technical reports
WP Leader	IFI
Partners involved	IFI, CMVNC, INRAE, UE-MARE, Cefas
Submission date (month)	June 2022

Dissemination level		
PU	Public	x
PP	Restricted to other programme participants (including the Programme Authorities)	
RE	Restricted to a group specified by the consortium (including the Programme Authorities)	
CO	Confidential, only for members of the consortium (including the Programme Authorities)	

This project is co-financed by the Interreg Atlantic Area Programme through the European Regional Development Fund.

Table of contents

This project is co-financed by the Interreg Atlantic Area Programme through the European Regional Development Fund.

1. Background and proposed activities

The tracking of fish using conventional and electronic tags is a powerful tool for fisheries biologists and managers to support the conservation and management of fish stocks. The capacity to 'mark' individual fish in order to follow their movements, in space and in time, has led to a major expansion of knowledge and understanding of fish movements and migrations and the impacts of environmental and anthropogenic factors on both individuals and populations.

Telemetry studies allow scientists to understand the full extent of habitat use in migratory species filling in the gaps from where species leave one habitat when migrating to another for feeding and/or development phases of their life cycle. For example, some may leave a nursery site until they return some years later to spawn. Understanding migratory pathways and the temporal aspects of migration can, for example, help with conservation planning for marine renewable energy to ensure the locations chosen are not intersecting important routes and locations.

As technology has developed so has the degree of sophistication of the types of 'marking devices' one can use. Over the last 30 years, the use of radio telemetry to study the migratory behaviour of fish in freshwater ecosystems and acoustic telemetry for research in transitional and marine environments has developed rapidly. More recently, archival or data storage tag (DST) have been developed to support the management of marine fisheries. DSTs can record data including depth, temperature or light (or combinations of these) but are fishery dependant and the tags need to be recovered to download the data. Although DST technological innovation continues to this day with the miniaturisation of the tags and inclusion of novel sensors, it was recognised that a fishery-independent method of data collection from free ranging fish was required. This has led to the development of pop-up satellite archival tags (PSAT or PAT). These tags are large versions of archival tags that are combined with an Argos transmitter. A recognized advantage of PSATs is their ability to collect data on temperature, depth, and light levels and then transmit those data directly through the Argos satellite system following their programmed release and emergence at the water's surface.

Bégout et al., 2016 presented a review of standard tagging methods used to investigate diadromous fish species movement. Within DiadES a range of these different 'marking' systems will be deployed, from numbered floy tags to radio and acoustic tags that are detected by strategically placed receivers/listening stations, and also satellite-linked pop-up tags. The suite of target fish species ranges from the large European sturgeon to the relatively small out-migrating immature river- and sea lamprey and the estuarine smelt. Some work is planned for Atlantic salmon and sea trout. All partners undertaking marking and tagging studies in DiadES will operate under the guidance of the EU Directive of 2010 on the protection of animals used for scientific purposes (DIRECTIVE 2010/63/EU). DiadES partners will have received appropriate training and licencing for undertaking the work identified here and will have appropriate authorisations under their own implementing national legislation.

This short document summarises the diadromous species tagging activity or tagging data analysis undertaken by partners under the DiadES programme. Tagging activity was curtailed due to restrictions on fieldwork imposed during the COVID-19 pandemic in 2020 and 2021.

2. Tagging workplan

Under work package 6, a Data Collection manual was developed in 2019 at the start of the project. Under the proposal, a number of partners outlined the workplan for marking and telemetry studies on diadromous species (Table 1).

This project is co-financed by the Interreg Atlantic Area Programme through the European Regional Development Fund.

Table 1 Marking and telemetry studies in DiadES. 'CS' = sampling in own case study (WP6.1 manual)

	INRAE	EHEC_USC	MARE-UÉ	CMVNC	IFI	CEFAS	MNHN	MNHN
	Gironde/ Garonne/ Dordogne system		**Mondego catchment**	**Minho catchment**	**Waterford harbour and the three sisters' rivers**	**Tamar, Frome and Taff rivers**	**Loire catchment**	**Normand-Breton Bay/Gulf**
Tagging - floy tags etc		CS			**CS (shad)**			
Telemetry	CS		CS	CS	CS	CS (Tamar, Frome, Taff- previous work + some new work on smelt)	CS (existing samples and data)	CS (existing samples and data)
Species	*A. sturio*	*Petromyzon marinus*	*Salmo trutta*	*Anguilla anguilla*	*Alosa fallax; Chelon ramada*	*A. anguilla/S. salar/S. trutta/Osmerus eperlanus*	*A. alosa/P. marinus/A. anguilla/S. salar*	

3. Results

To date, tagging projects from five partners have been collated (Table 2). The species included in the studies are Thin-lipped mullet, Twaite shad, European eel, Brown and Sea trout, Atlantic salmon and European sturgeon. The tag types range from passive integrated transponders (PIT) to pop-up satellite tags. Details by project are summarized in Appendix 1.

Table 2 Summary information of tagging undertaken during the DiadES programme.

Institute	Fish species	tag type	No. tagged	Location	location type
IFI	Thin-Lipped Mullet	Acoustic	7	Waterford	Estuary
IFI	Shad	Pit loaded floy tag	19	Waterford	Estuary
CIIMAR	European eel	PIT	8400	Minho River	Estuary & Tributaries
UEVORA	Brown trout & Sea trout	PIT	114	River Mondego	River & Tributaries
UEVORA	Brown trout & Sea trout	PIT-tags + Dual Mode Transmitters	18	River Mondego	River & Tributaries
CEFAS	Atlantic salmon	Acoustic	142	River Taff	River
INRAE (EX-IRSTEA)	European Sturgeon	PSAT	10	Gironde Estuary	Estuary

Some of the individual project data relate to historical tagging which continued over the life cycle of the DiadES project through some additional tagging or logging of tagged fish. Restrictions imposed in partner countries arising from the COVID-19 pandemic limited field activity generally and reduced the number of new tagging events at many case-study sites.

This project is co-financed by the Interreg Atlantic Area Programme through the European Regional Development Fund.

The study of thin-lipped mullet by IFI was to investigate habitat use by a rare and cryptic species in this northerly part of their range. Although thin-lipped mullet are common in more southerly countries they are infrequently encountered in Ireland being mainly confined to southerly sites. This study showed the challenges when sampling to source a full complement of fish to tag when targeting rarer species. Of the specimens tagged, results showed that the species was using the full extent of the estuary.

For the shad study, IFI piloted the use of pit mounted floy tags to complement both remote detection using stationary antennas in freshwater, and potential recapture by anglers or possibly as bycatch by commercial fishermen. The stationary antennae could not be deployed for technical reasons but this method of incorporating remote MR techniques (PIT tag), along with using citizen science (i.e. catch and release angling) to report on any angling recaptures, offers scope for future studies. (Fig. 1)

Fig. 1. Double anchor T- bar PIT tag (DTBA-PIT) used for shad. PIT tag enveloped by tag body.

Studies on pressures experienced by diadromous species are important to understand potential bottlenecks which may be dictated by habitat or environmental constraints. In that regard, a CEFAS study on mortality rates of salmon at a hydropower station can be used by management to understand where in a system the pressure is having the largest impact and where it is not. This knowledge also allows sampling resources (and potentially mitigatory actions) to be applied where and when they are needed.

The study by CMVNC on growth rates of European eel is essential to understanding the state of the eel population. The European eel is critically endangered and all EU Member States are subject to the requirements of the Eel Regulation (1100/2007). National stock assessments carried out to ensure compliance require age and growth information. Using mark recapture techniques to gather this information, as opposed to euthanizing specimens to bring back to the laboratory for otolith extraction, is costly but more humane when dealing with a critically endangered species.

Brown trout (*Salmo trutta*) has a resident and marine migrant form (i.e. sea trout). This migratory trait, while advantageous in terms of enhanced feeding opportunities at sea, may expose migrants to greater risks as they are exposed to more anthropogenic pressures during their outward and inward migrations. In Ireland sea trout numbers are in decline along the west coast despite the abundance of brown trout in inland waters (Ireland Red List Report 2022, in prep). Climate change is one of the main threats to *S. trutta* populations, especially those that occur in Iberian Peninsula, a region which is highly vulnerable to the consequences of such an impact. In Portugal, brown trout is relatively abundant throughout the upper areas of river basins located north from the Tagus River,

This project is co-financed by the Interreg Atlantic Area Programme through the European Regional Development Fund.

but abundances of its anadromous ecotype, the sea trout, are declining throughout the country where it is currently classified as Critically Endangered. The Mondego river basin represents the southern limit of the global distribution of these anadromous trout. The study by UE-MARE to investigate the movements of both population ecotypes and the corresponding environmental conditions experienced in Portugal, will help to improve our knowledge of the different pressures on these fish and highlight possible management solutions for fishery managers.

Defining management units for diadromous species using pop-up satellite tags allow monitoring fish species at a greater scale than other methods, where data collection from a tagged fish is often confined to the extent of the receiver array. Examples include the Eeliad project on eel migration which showed evidence for likely marine migration routes (Righton et al., 2016). INRAE used pop-up satellite tags to monitor sturgeon movements following their departure from French waters. This study highlighted the risk of poor satellite data returns and how the number of tags deployed needs to consider the percentage of likely zero data reports (i.e. potential tag failures) in order to ensure adequate data quantity. Nonetheless PSAT technology has provided detailed information on depth and temperature used during migrations, seasonal differences and particular behaviour such as surfacing behaviour were also highlighted for this species. This information on marine habitat use by sturgeon will be used to complete a modelling study about favourable habitats across the Atlantic Area. This study was co-funded by a separate project (MOMIE) assessing European sturgeon migration at sea and spawners return in freshwaters.

4. Conclusion

Tagging and associated tracking are important and efficient tools for providing insights into the ecology and behaviour of aquatic species. International collaborative research and data-sharing, as facilitated by initiatives such as DiadES, has been identified as an optimal strategy for protecting biodiversity and ecosystems (Cooke, 2008; Hussey et al., 2015). The DiadES project represents a unique opportunity to gather and combine data on a suite of European diadromous species, many of which are data-poor, across a range of habitats and scales. Telemetry studies can deliver invaluable data on the habitat use, migratory behaviour and ranges of endangered and cryptic species. Pressures and threats to diadromous species may be highly localised or widely dispersed and may vary with season and across geographic range. Tagging and tracking datasets can be directly utilised to inform management policy and planning at several scales, thereby allowing resources to be applied where most appropriate and effective. Mitigation can be formulated for recognised impacts in specific estuaries or at catchment level. Broader scale efforts can be directed towards population monitoring, defining meaningful management units and conservation planning across species ranges.

5. References

Bégout, M.L., Bau, F., Acou, A. & Acolas, M.L. (2016) Methodologies for investigating diadromous fish movements: conventional, PIT, acoustic and radio tagging. In: Morais, P., Daverat, F.e. (Eds.), An introduction to fish migration. CRC Press, pp. 214-250.

Cooke, S. J. (2008). Biotelemetry and biologging in endangered species research and animal conservation: relevance to regional, national, and IUCN Red List threat assessments. Endangered species research, 4(1-2), 165-185.

Hussey, N.E. et al. (2015). Aquatic animal telemetry: A panoramic window into the underwater world. Science 348: 1255642. DOI: 10.1126/science.1255642

Righton, D., Westerberg, H., Feunteun, E., Økland, F., Gargan, P., Amilhat, E., ... & Aarestrup, K. (2016). Empirical observations of the spawning migration of European eels: The long and dangerous road to the Sargasso Sea. Science Advances, 2(10), e1501694.

This project is co-financed by the Interreg Atlantic Area Programme through the European Regional Development Fund.

6. Appendices

IFI

Tagging Project No.	Tagging Project Title	Period of tagging activity
1.	*Habitat Use by Thin-Lipped Mullet*	*11/08/2017 to 31/07/2020*
Agency	*Inland Fisheries Ireland*	
Purpose of study	*To investigate habitat use by TLM in an estuarine setting*	
Principal Investigator & email	*William Roche* *william.roche@fisheriesireland.ie*	
Associated person 1	*Sean Rooney*	
Associated person 2		
Species	*Thin-Lipped Mullet*	
Waterbody	*Waterford Harbour*	
General Tagging location (Lat/Long)	*52.275790 N* *-6.9950294 W (Cheekpoint / Great Island)*	
Species Summary Project 1.		
Species Common Name	Thin-Lipped Mullet	
Species Scientific Name	*Chelon ramada*	
Life stage target fish	Adult	
No. of fish tagged	7	
Length Range (cm)	43.8cm – 54cm	
Length Type	*Fork Length (FL)*	
Weight Range (g)	1140g – 1900g	
Sex (Ratio)	N/A	
Release Date(s)	11/08/17 (n=5) & 24/10/19 (n=2)	
Tag Info Project 1.		
Tag Type(s) Used	Acoustic	
Tag Model	Vemco V92L A69-1601 https://www.oceans-research.com/wp-content/uploads/2016/09/v9-coded-1.pdf	
Tag Serial (range)	48865-48869, 48877, 48879	
Tag battery life (if relevant)	400 days	
Tag Implant Type	*Internal body cavity*	
Tagger Name	Sean Rooney	
Relevant Sources Project 1.		
Online Links/Reports		
Paper Citation		
Summary of Results Project 1.		
Huge variation in number of detections recorded for individual tagged Thin Lipped Mullet, for instance n=3 for #48867 *vs*. n=14,931 for #48865. Variety of behaviours exhibited for those with adequate detections. #48865 particularly active in R. Suir u/s of Waterford City, #48869 more active in the lower estuary, #48879 also active here but eventually exited into outer harbour and open sea. Preliminary data processing carried out to date – further detailed analyses to follow.		
Other remarks/comments: Tagging activity negatively impacted by COVID-19 restrictions. Hoping to capture and tag more Thin Lipped Mullet during 2022.		

This project is co-financed by the Interreg Atlantic Area Programme through the European Regional Development Fund.

IFI

Tagging Project No.	Tagging Project Title	Period of tagging activity
2.	*Repeat spawners and spawning behaviour of Twaite Shad*	*22/05/2019 to 28/05/2019*
Agency	*Inland Fisheries Ireland*	
Purpose of study	*To investigate spawning behaviour of Twaite Shad and determine proportion of repeat spawners*	
Principal Investigator & email	*Jimmy King* jimmy.king@fisheriesireland.ie	
Associated person 1	*Nicola O'Gorman*	
Associated person 2	*James Barry*	
Species	*Twaite Shad*	
Waterbody	*Waterford Harbour*	
General Tagging location (Lat/Long)	*52.48806 -6.9310521*	
Species Summary Project 2.		
Species Common Name	Twaite Shad	
Species Scientific Name	*Alosa fallax*	
Life stage target fish	Adult	
No. of fish tagged	19	
Length Range (cm)	43.8cm – 54cm	
Length Type	*Fork Length (FL)*	
Weight Range (g)	Not recorded	
Sex (Ratio)	N/A	
Release Date(s)	22/05/19 (n=5), 23/05/19 (n=11), 29/05/19 (n=3)	
Tag Info Project 2.		
Tag Type(s) Used	Pit mounted floy tag https://hallprint.com/fish-tag-products/2014/8/26/t-bar-anchor-tags	
Tag Model	HallPrint	
Tag Serial (range)	1317 - 1338	
Tag battery life (if relevant)	Not relevant	
Tag Implant Type	*external*	
Tagger Name	Nicola O'Gorman	
Relevant Sources Project 2.		
Online Links/Reports		
Paper Citation		
Summary of Results Project 2.		
One tagged shad was recaptured in 2021; the fish was 34cm when tagged and on recapture was 35.5cm. Biofouling may render the tags difficult for anglers to see which affect recapture numbers in all such studies. It is believed that the impact of Covid-19 restrictions may also have affected the level of reporting of recaptures in 2020.		
Other remarks/comments:		

This project is co-financed by the Interreg Atlantic Area Programme through the European Regional Development Fund.

CMVNC

Tagging Project No.	Tagging Project Title	Period of tagging activity
3.		2007 -
Agency	CMVNC	
Purpose of study	Eel growth and age validation in River Minho basin	
Principal Investigator & email	Carlos Antunes / cantunes@ciimar.up.pt	
Associated person 1	Ana Moura	
Associated person 2		
Species	European eel	
Waterbody	River Minho basin	
General Tagging location (Lat/Long)	Estuary and tributaries (after 2018)	
Species Summary Project 2.		
Species Common Name	Eel	
Species Scientific Name	*Anguilla anguilla* (Linnaeus, 1758)	
Life stage target fish	Yellow eel	
No. of fish tagged	8400	
Length Range (cm)	16-92	
Length Type	Total length	
Weight Range (g)	2 - 1830	
Sex (Ratio)		
Release Date(s)		
Tag Info Project 2.		
Tag Type(s) Used	Pit tag	
Tag Model	Biomark APT 12 Pit tag	
Tag Serial (range)		
Tag battery life (if relevant)		
Tag Implant Type	abdominal	
Tagger Name	Mafalda Fernandes & Carlos Antunes	
Relevant Sources Project 2.		
Online Links/Reports		
Paper Citation		
Summary of Results Project 2.		
A total of 1052 eels were recaptured. Partial results and considering the tagging-recapture period coinciding with the DiadES project, we found an average growth length / year of 4.3 cm [0 - 17,8] in estuary and 2.1 cm [0.1 - 5,3] in tributaries. Furthermore, higher length dispersion over an age class for estuarine eels, sex ratio and otolith shape differences suggest the existence of at least two distinct groups of eels in the Minho River, associated with different types of habitats: estuary vs. tributaries.		
Other remarks/comments:		

This project is co-financed by the Interreg Atlantic Area Programme through the European Regional Development Fund.

UE-MARE

Tagging Project No.	Tagging Project Title	Period of tagging activity
4.	*Movement patterns of Salmo trutta in the Mondego River basin*	*04/07/2020 to 30/06/2022*
Agency	*University of Évora/MARE*	
Purpose of study	*Study the movements patterns and migratory behaviour of S. trutta in the southern limit of its distribution, using telemetry.*	
Principal Investigator & email	Carlos M. Alexandre (cmea@uevora.pt)	
Associated person 1	Pedro R. Almeida	
Associated person 2	Sara Silva	
Species	Brown trout/Sea trout *(Salmo trutta* L.*)*	
Waterbody	River Mondego	
General Tagging location (Lat/Long)	*Between Coimbra Dam, 8º26'27,9"W, 40º12'55.0"N to Raiva Dam 8º14'56,5"W, 40º18'34,3"N*	
Species Summary Project 3.		
Species Common Name	Brown trout/Sea trout	
Species Scientific Name	*Salmo trutta* L.	
Life stage target fish	Juveniles (Pit-tags) and adults (Pit-tags + Dual Mode Transmitters)	
No. of fish tagged	Up until now: Pit tags: #114 specimens; Dual Mode Transmitters: #18 specimens.	
Length Range (cm)	Between 102 mm and 560 mm. Dual Mode Transmitters only above 400 mm.	
Length Type	Total length (Lt, mm).	
Weight Range (g)	Between 12.32 g to 2000 g	
Sex (Ratio)	-	
Release Date(s)	Immediately after fish tagging.	
Tag Info Project 3.		
Tag Type(s) Used	Pit-tag and Dual Mode transmitter.	
Tag Model	Pit-tag: Biomark APT 12 Pre-Load Tray; https://www.biomark.com/product/apt12-pre-load-tray/ Dual Mode transmitters (LOTEK, MM-RC-11-28 & MM-RC-11-45) https://www.lotek.com/wp-content/uploads/2017/10/CART-Series-Spec-Sheet.pdf	
Tag Serial (range)	Dual Mode transmitters: Radio Frequencies (142.000 - 143.400); Acoustic IDs (12300 – 12319).	
Tag battery life (if relevant)	Dual Mode transmitters: MM-RC-11-28 – 384 days; MM-RC-11-45 – 598 days.	
Tag Implant Type	The tag was attached internally on the fish.	
Tagger Name	Carlos Alexandre & Sara Silva	
Relevant Sources Project 3.		
Online Links/Reports	-	
Paper Citation	-	
Summary of Results Project 3.		
The results obtained allow to analyse the movement dynamics and the migratory behaviour of *S. trutta*, namely the differences between anadromous and holobiotic trout ecotypes and the environmental factors related with these movements. Since July 2020, we tagged 114 specimens of trout with pit-tags, 18 of them also tagged with Dual Mode transmitters (with acoustic and radio telemetry components). Pit-tagging allowed to detect four trout		

This project is co-financed by the Interreg Atlantic Area Programme through the European Regional Development Fund.

recaptures and estimate their range growth rates: (between 0.60 g per day to 1.25 g per day). From trout tagged with Dual Mode transmitters, we calculated the median size of their home range (i.e., 317.67 m), and the median size of their core range (i.e., 100.5 m). The maximum distance travelled by one trout was 12 km in December from river Mondego to its tributary, the river Alva.
Flow, water temperature and precipitation are the main environmental factors associated to trout movements. Due to the DiadES project extension it is planned to continue this study by tagging 10-12 additional trout in the study area with PIT tags and Dual Mode transmitters.

Other remarks/comments:
Trout adults tagged with Dual Mode transmitters were captured with the help of flyfishing anglers collaborating in the DiadES project.

This project is co-financed by the Interreg Atlantic Area Programme through the European Regional Development Fund.

CEFAS

Tagging Project No.	Tagging Project Title	Period of tagging activity
5.	*Impact of hydropower on salmon smolts*	*18-20 April 2018*
Agency	*Cefas*	
Purpose of study	*To investigate the impact of a small hydropower scheme on Atlantic salmon smolts*	
Principal Investigator & email	*Andy Moore: andy.moore@cefas.co.uk*	
Associated person 1		
Associated person 2		
Species	*Atlantic salmon*	
Waterbody	*River Taff, Wales*	
General Tagging location (Lat/Long)	*Radyr Weir*	
Species Summary Project 4.		
Species Common Name	Atlantic salmon	
Species Scientific Name	*Salmo salar*.	
Life stage target fish	Smolt	
No. of fish tagged	142	
Length Range (cm)	162-205	
Length Type	*Fork length*	
Weight Range (g)	N/A	
Sex (Ratio)	N/A	
Release Date(s)	18th and 20th April 2018	
Tag Info Project 4.		
Tag Type(s) Used	Acoustic	
Tag Model	Thelmbiotel 69 kHz ID-LP7 tags https://www.thelmabiotel.com/transmitters/7mm/	
Tag Serial (range)		
Tag battery life (if relevant)	40 days	
Tag Implant Type	*Stomach*	
Tagger Name	Andy Moore	
Relevant Sources Project 4.		
Online Links/Reports	N/A	
Paper Citation	N/A	
Summary of Results Project 4.		
The study indicated that the survival of tagged salmon was high during their subsequent seaward migration in the lower river and impounded estuary. Total survival of the released smolts was around 60%. However, survival of those smolts migrating across Cardiff Bay was again high ~ 96%. A high number of the released fish migrated through the turbines. Of the fish that were recorded downstream of Radyr Weir 40% of the smolts had migrated downstream through the turbines.		
Other remarks/comments:		

This project is co-financed by the Interreg Atlantic Area Programme through the European Regional Development Fund.

INRAE

Tagging Project No.	Tagging Project Title	Period of tagging activity
6.	*Habitat Use by European sturgeon*	*18/04/2020 to 29/4/2020*
Agency	*INRAE EABX*	
Purpose of study	*To investigate habitat use and migratory behaviour of European sturgeon at sea*	
Principal Investigator & email	*Marie-Laure Acolas marie-laure.acolas@inrae.fr*	
Associated person 1	*Romaric Le Barh romaric.lebarh@inrae.fr*	
Associated person 2		
Species	*European sturgeon*	
Waterbody	*Gironde estuary, Sea*	
General Tagging location (Lat/Long)	*Gironde estuary* *45°30'N / 0°55' O*	
Species Summary Project 5.		
Species Common Name	*European sturgeon*	
Species Scientific Name	*Acipenser sturio*	
Life stage target fish	Juvenile	
No. of fish tagged	10 (5 from DiadES project, 5 from MOMIE project)	
Length Range (cm)	140-180 cm	
Length Type	*Total length*	
Weight Range (g)	14 000 / 30 000	
Sex (Ratio)	unidentified	
Release Date(s)	From 9 September 2020 to 26 November 2021	
Tag Info Project 5.		
Tag Type(s) Used	PSAT	
Tag Model	Minipat (Wildlife computer) https://static.wildlifecomputers.com/product-pages/MiniPAT-Product-Sheet.pdf	
Tag Serial (range)	19P0736 / 19P0764 / 19P0815 / 21P0986 / 21P0992 / 21P0967 / 21P0939 / 21P0949 / 21P0963 / 21P0983	
Tag battery life (if relevant)		
Tag Implant Type	*External*	
Tagger Name	Romaric Le Barh and Marie-Laure Acolas	
Relevant Sources Project 5.		
Online Links/Reports		
Paper Citation		
Summary of Results Project 5.		
MINIPAT were programmed to record for 6 months before starting to send data. Currently 3 tags were supposed to send data, however only 2 have reported. One was physically retrieved which allow access to the complete records; the second emit only a very short time and few data were recovered. In addition, one tag supposed to pop up in June is emitting since early March. At the beginning of June, all data should be collected. First data shows seasonality trends in depth and temperature use with a maximum depth recorded at 116 m. Most time was spend above 55 m between September and November at 12/15°C and above 15 m between December and March (6/12°C). Regular surfacing behaviours were detected. However, the reconstruction of the tracks through GPE3 location process provided by the supplier is not satisfying at that stage.		

This project is co-financed by the Interreg Atlantic Area Programme through the European Regional Development Fund.

Other remarks/comments: Half of the tags were purchased thanks to the DiadES project and the other half thanks to the MOMIE (Migratory movement of European sturgeon: habitat at sea and spawners return in fresh water) project (funding INRAE & OFB). Whole results will be shared within the two projects.

This project is co-financed by the Interreg Atlantic Area Programme through the European Regional Development Fund.