

Brussels, 13 November 2018

COST 083/18

DECISION

Subject: **Memorandum of Understanding for the implementation of the COST Action “The European Aquatic Animal Tracking Network” (ETN) CA18102**

The COST Member Countries and/or the COST Cooperating State will find attached the Memorandum of Understanding for the COST Action The European Aquatic Animal Tracking Network approved by the Committee of Senior Officials through written procedure on 13 November 2018.



MEMORANDUM OF UNDERSTANDING

For the implementation of a COST Action designated as

COST Action CA18102 THE EUROPEAN AQUATIC ANIMAL TRACKING NETWORK (ETN)

The COST Member Countries and/or the COST Cooperating State, accepting the present Memorandum of Understanding (MoU) wish to undertake joint activities of mutual interest and declare their common intention to participate in the COST Action (the Action), referred to above and described in the Technical Annex of this MoU.

The Action will be carried out in accordance with the set of COST Implementation Rules approved by the Committee of Senior Officials (CSO), or any new document amending or replacing them:

- a. "Rules for Participation in and Implementation of COST Activities" (COST 132/14 REV2);
- b. "COST Action Proposal Submission, Evaluation, Selection and Approval" (COST 133/14 REV);
- c. "COST Action Management, Monitoring and Final Assessment" (COST 134/14 REV2);
- d. "COST International Cooperation and Specific Organisations Participation" (COST 135/14 REV).

The main aim and objective of the Action is to ensure transition from loosely-coordinated existing regional telemetry initiatives to one sustainable, efficient and integrated Pan-European biotelemetry network embedded in the global arena of existing initiatives outside Europe. This network will stimulate excellence in science across Europe and provide advice for EU policies. This will be achieved through the specific objectives detailed in the Technical Annex.

The economic dimension of the activities carried out under the Action has been estimated, on the basis of information available during the planning of the Action, at EUR 96 million in 2018.

The MoU will enter into force once at least seven (7) COST Member Countries and/or COST Cooperating State have accepted it, and the corresponding Management Committee Members have been appointed, as described in the CSO Decision COST 134/14 REV2.

The COST Action will start from the date of the first Management Committee meeting and shall be implemented for a period of **four (4) years**, unless an extension is approved by the CSO following the procedure described in the CSO Decision COST 134/14 REV2.

OVERVIEW

Summary

Telemetry is a commonly applied method to investigate the ecology and movement behaviour of aquatic species in relation to their environment. It provides a scientific basis for management and conservation and has significantly improved our understanding of ecosystem functioning and dynamics. More specifically, telemetry provides valuable data that can be used in many policies and directives. As a result, large scale nationally and regionally managed initiatives were implemented around the globe in recent years. Although there is a large and growing number of researchers in Europe using biotelemetry to study aquatic animals and answer management-related questions, there is a stringent **lack of in-field telemetry collaborations** in Europe. This situation represents a substantial loss of opportunities for: scientific excellence, funding opportunities and competitiveness of European SME on the international biotelemetry market.

With this COST Action, we want to close this gap and the overarching objective is to ensure a transition from a loosely-coordinated set of existing regional telemetry initiatives to a sustainable, efficient, and integrated pan-European biotelemetry network embedded in the international context of already existing initiatives. This will be achieved through working group meetings, workshops, training courses and scientific missions focused on: 1) Implementing **a centralised European database** requirements and **policy** mapped to the data standards of existing international biotelemetry data systems, 2) improve the usefulness and **inter-applicability** of currently available technology and foster technological advancements, 3) promoting the **establishment of key telemetry infrastructure** and research on key species, and 4) provide continuous **training opportunities** and disseminate knowledge to the stakeholders' community.

Areas of Expertise Relevant for the Action	Keywords
<ul style="list-style-type: none"> ● Biological sciences: Ecology ● Earth and related Environmental sciences: Databases, data mining, data curation, computational modelling ● Environmental engineering: Remote sensing ● Biological sciences: Zoology, including animal behaviour ● Biological sciences: Environmental and marine biology 	<ul style="list-style-type: none"> ● Telemetry ● Network ● Database ● Biologging ● Data sharing

Specific Objectives

To achieve the main objective described in this MoU, the following specific objectives shall be accomplished:

Research Coordination

- Define data requirements and implement **a central data system** for aquatic animal telemetry with a common data policy, procedures and security rules in place. The database will serve as a host for a variety of electronic telemetry data types.
- Map ETN data standards to those of existing international biotelemetry data systems.
- Improve the usefulness and inter-applicability of currently available technology by promoting the **harmonisation of acoustic tag coding schemes** and **promoting the compatibility** between different acoustic telemetry equipment and brands.
- Foster novel technological developments in biotelemetry.

Capacity Building

- Promote ETN **infrastructure at strategic areas** by identifying possible research topics and sources of funding needed to implement the research infrastructure in terms of acoustic telemetry arrays at strategic locations in rivers, estuaries and ocean basins across Europe.
- **Stimulate scientific research** on key species by identifying possible research topics and sources of funding in support of tag deployment on key species that are likely to be monitored. Species with high interest to stakeholders (e.g. species protection, discard survival, vulnerable species) will be prioritised.

- Organise continuous training and network opportunities on all aquatic telemetry related aspects in the framework of life-long learning and strengthen in-situ skills and experiences for ETN participants.
- Encourage dissemination and publication activities to ensure the outcome of the research is disseminated to the wider scientific community, policymakers, the media and society at large.

TECHNICAL ANNEX

1. S&T EXCELLENCE

1.1. CHALLENGE

1.1.1. DESCRIPTION OF THE CHALLENGE (MAIN AIM)

Telemetry is an increasingly applied method to investigate the ecology of aquatic animals. Detailed observations on the movements and behaviour of aquatic animals have significantly improved our understanding of ecosystem functioning and dynamics. In addition, telemetry techniques help in assessing the effects of anthropogenic disturbance and structures and provide crucial and cost-efficient oceanographic data. In doing so, they often provide the scientific basis for management and conservation of species and habitats. More specifically, aquatic biotelemetry provides valuable data for national and international policies, including EU key policies (e.g. the Common Fisheries Policy and the Integrated Maritime Policy) and Directives (e.g. Natura 2000, Marine Strategy Framework Directive and Water Framework Directive) and assessments of the Good Environmental Status of specific descriptors. This contribution has led to the implementation of large scale nationally and regionally managed initiatives around the globe in recent years, with the development of aquatic telemetry networks in different environments and regions (e.g. IMOS Animal Tracking in Australia, OTN in Canada, ACT on the US east coast, iTAG in the Gulf of Mexico and ATAP in South Africa).

In Europe, there is also a large and growing number of researchers using biotelemetry as a tool to study aquatic animals and answer management-related questions. A search on the Web of Knowledge showed a five-fold increase during the last 25 years in the number of published papers using acoustic telemetry on marine and diadromous species alone. However, this community lacks a formal collaborative network structure such as those existing in other regions. Despite the increasing number of species studied and articles published, there is a stringent lack of in-field telemetry collaborations in Europe.

The overarching objective of this Action is to ensure a transition from a loosely-coordinated set of existing regional telemetry initiatives to a sustainable, efficient and integrated Pan-European biotelemetry network embedded in the global arena of already existing initiatives outside Europe. This network will stimulate excellence in science across Europe (including ITCs) and provide advice for EU policies and directives. This will be achieved through working group meetings, workshops, training courses and scientific missions focused on: 1) Implementing a centralised European database, with requirements and policy mapped to the data standards of existing international biotelemetry data systems, 2) foster technological advancements and improving the usefulness and inter-applicability of currently available technology of different brands, 3) promoting the establishment of key telemetry infrastructure and research on key species and 4) providing continuous training opportunities and disseminate knowledge to the stakeholders' community.

1.1.2. RELEVANCE AND TIMELINESS

In recent years, electronic telemetry applications and technologies evolved quickly and revolutionised our ability to study free-ranging aquatic animals in the wild. These detailed and data rich observations can be used to address crucial scientific, conservation and management questions on a global level. However, this requires expanded telemetry infrastructure and animal-tagging efforts over large scales and across national borders. Therefore, several large-scale initiatives were set up in different parts of the world (e.g. IMOS Animal Tracking in Australia, OTN in Canada, ATAP in South-Africa and GLATOS

in the Great Lakes). Europe is currently lacking such a coordinated, large scale, integrated approach, which represents a substantial loss of opportunities for:

- i) **Data gathering and sharing:** Coordinated data gathering using common infrastructure on a large-scale allows an optimised use of available resources and a scale-up of research questions to be addressed. In addition to enabling the sharing of infrastructure and data, it also promotes the development of multidisciplinary expertise.
- ii) **Funding opportunities:** Permanent, large-scale infrastructure provided by the networking approach allows for applications for international and longer-term (EU) funding and contributes to the EU blue growth agenda.
- iii) **Scientific excellence:** The first two opportunities automatically lead to scientific excellence and will provide valuable data and advice for national and international policies, including EU key policies and Directives.

The telemetry community experienced substantial growth in recent years and evolved from a pure ecological context (e.g. answering questions on species habitat use and behaviour) towards a more integrated science-management oriented focus. To answer these type of questions, large scale networks are needed to ensure that data sharing becomes equally common as in other research areas such as genetics, oceanography and meteorology. Several authors have already made a plea for this move and recent forums (e.g. international conferences and workshops in the field of fish telemetry) confirm that aquatic telemetry networks are moving into this direction. Thus, in a broader sense, these lost opportunities in Europe obscure the higher telemetry community voice. The benefits of a coordinated, large scale, and integrated approach would result in optimised scientific knowledge to make Europe part of contributing to Big Science in this research area.

Further, the scientific advancement in this field requires commitments from the industry to advance technologies and ensure compatibility between brands, but this demands a well organised scientific/end-user voice. The European telemetry scene is highly diverse, using multiple telemetric approaches and equipment from several brands. However, the different brands do not have any agreements regarding transmit protocols, ID allocation and tag serial numbers. Tags from one brand might thus not be recognised by receivers of another brand. This is notably the case in acoustic telemetry where most researchers globally and several large-scale networks solely use non-compatible equipment from one (non-European) manufacturer. This leads to the potential loss of data, tag code duplications and imposes a competitive barrier to other (European) manufacturers. To move forward towards a much-needed Pan-European collaborative network that could provide relevant information in support of decision making, compatibility between brands and agreements on transmit protocols and ID allocation are imperative. Therefore, a sustainable and integrated European tracking network, representing the European telemetry community voice, is needed to promote cooperation among and commitments from industry companies manufacturing aquatic telemetry technology.

With this COST Action we promote and launch a European Tracking Network (ETN) to unite researchers working with biotelemetry on aquatic animals in Europe. ETN will ensure the key benefits of data sharing and networking across Europe. Hence, the main aim of this COST Action is not only highly relevant but also timely.

1.2. OBJECTIVES

The overarching goal of ETN is to ensure the transition from a loosely-coordinated set of existing regional telemetry initiatives scattered in Europe to a **sustainable, efficient and integrated Pan-European biotelemetry network embedded in the international context** of already existing initiatives outside Europe. The specific objectives to reach this goal will be coordinated by and tackled in different working groups.

1.2.1. RESEARCH COORDINATION OBJECTIVES

1. Data management, requirements and policy

- **Define data requirements and implement a central data system** for aquatic animal telemetry with common data policy, procedures and security rules in place. The database will serve as a host for a variety of electronic telemetry data types
- **Map ETN data standards** to those of existing international biotelemetry data systems

The database will serve as a host for a variety of electronic telemetry data types ranging from acoustic telemetry to data loggers, PIT telemetry and satellite tags. Each will have unique data formats, but the data system will be mapped to best international practices for all types as the need develops. It will also serve to generate up-to-date metrics of the operational status and impacts of the network for policy makers and decision makers, scientists and other stakeholders.

2. Technology

- **Improve the usefulness and inter-applicability of currently available technology** by promoting the harmonisation of acoustic tag coding schemes and promoting the compatibility between different acoustic telemetry equipment and brands
- **Foster novel technological developments** in biotelemetry

Researchers and industry will work in close proximity to foster technological advancements in both optimisation and developments in biotelemetry. Agreements on transmit protocols, ID allocation and tag serial numbers are a first step towards this optimisation. The strong interaction between industry and the research community in combination with discussions and inquiries will lead to novel technological developments.

1.2.2. CAPACITY-BUILDING OBJECTIVES

3. ETN infrastructure

- **Promote ETN infrastructure at strategic areas**

ETN will develop **a series of proposals** by identifying possible research topics and sources of funding needed to **implement the research infrastructure** in terms of acoustic telemetry arrays at strategic locations in rivers, estuaries and ocean basins across Europe. Infrastructure in these key locations will foster cooperation and scientific excellence. An important aim of these proposals is to integrate ITC in international research programs.

4. Key species

- **Stimulate scientific research on key species**

ETN will develop a series of proposals by identifying possible research topics and sources of funding in support of **tag deployment on key species** that are likely to be monitored. Species with high interest to stakeholders (e.g. species protection, discard survival, vulnerable species) will be prioritised.

5. Training and knowledge dissemination

- Organise **continuous training and network opportunities**
- Encourage **dissemination and publication activities**

Organise continuous training and network opportunities on all aquatic telemetry related aspects in the framework of life-long learning and strengthen in-situ skills and experiences for ETN participants. Knowledge and experiences will be exchanged at workshops, training schools and conferences between ETN participants across Europe and among members of international partner initiatives. The Action will encourage dissemination and publication activities to ensure the outcome of the research is disseminated to the wider scientific community, policymakers, the media and society at large.

1.3. PROGRESS BEYOND THE STATE-OF-THE-ART AND INNOVATION POTENTIAL

1.3.1. DESCRIPTION OF THE STATE-OF-THE-ART

Much of the oceans' environment remains unexplored or poorly characterised due to limitations in our observing capacities. To understand, predict, protect and manage aquatic processes and resources, it requires a step change in oceanographic data gathering and availability. New insights and knowledge is required by managers and policymakers to address the challenges posed by the world's changing

aquatic ecosystems. Telemetry techniques can critically help to close these knowledge gaps both via animal observation and ocean observation (using animals as ‘oceanographers’). As a result, large-scale national and regional initiatives were implemented around the globe, with OTN in Canada as the leading player in this field. Comprised of fixed and mobile acoustic receivers, associated telemetry, ocean monitoring technologies, as well as a major data system and resources for data analytics and visualisation, OTN is a high-technology platform supporting an active research network. Along with OTN, several national and regional networks were developed (e.g. IMOS Animal Tracking in Australia, GLATOS in the Great Lakes, ACT on the US east coast) but a European counterpart is currently lacking. Despite the advanced (willingness for) collaboration of the European telemetry community, the level of direct coordination of investments, typically based on national resources, is rather low and generally uses a sectoral approach. However, important steps were taken in recent years to initiate a European counterpart to the leading telemetry networks in the world. The emerging ETN will adopt a broad and integrative perspective to incorporate the different aquatic (sub-)telemetry communities present in Europe.

1.3.2. PROGRESS BEYOND THE STATE-OF-THE-ART

ETN aims to develop an integrated, sustainable network to deliver excellent, cross-bordering science that, in turn, may contribute to policy and management needs and foster technological innovation. Engaging the telemetry community across Europe will in itself represent a major step forward and initialise concrete changes in the state-of-the-art of aquatic telemetry in Europe.

Reaching this goal will be done by **implementing a centralised European database, promote technological advancements and compatibility, submit proposals to perform excellent science on flagship species** and in key regions, **provide training** to (early career) researchers and **disseminate knowledge**. On the longer term, these actions will lead to substantial advancement in the network performance with respect to the quantity, quality and diversity of data that will be shared and disseminated in a timely fashion to stakeholders and the broader society.

Progress is expected to bear significant impact on the community’s capacity to provide assets to and contribute to the EU’s marine policies, including the Marine Strategy Framework Directive (MSFD) and the Blue Growth strategic challenge. The increased capacity of an organised telemetric network in Europe should be able to deliver critical science and advice on decisions regarding key aspects of those policies, e.g. management and conservation of endangered marine and freshwater species (including international cooperation in case of cross-bordering migratory species), protection of critical habitats and the detection and mitigation of climate change effects.

Finally, an impact is expected with regards to the actual implementation of the Galway and Belém declarations, which call for a trans-Atlantic cooperation on marine science and observation, namely by prompting collaboration with similar existing networks across the Atlantic.

1.3.3. INNOVATION IN TACKLING THE CHALLENGE

The Action excels in the way the challenge is approached. Two main innovative aspects in relation to the existing global networks are defined as follows.

Firstly, ETN will use an integrative approach to unite all types of aquatic telemetry that are used in Europe and support all brands commonly used per technology. Where other large-scale initiatives focus more specifically on one or a limited number of telemetry types and/or brands, ETN will be all-inclusive. This promotes interdisciplinary cooperation, stimulates technological advancements and allows to use integrative approaches to address the global ecological questions posed by the world’s changing aquatic ecosystems.

Secondly, ETN will foster **compatibility between brands and technologies**. The European telemetry community has a highly diverse character. The different brands are currently not compatible where tags from one brand might not be recognised by receivers from another brand. This situation leads to 1) a potential loss of data, 2) a lack of incentive to cooperate among researchers, 3) tag code duplications and 4) reduced competitiveness towards other large-scale initiatives. ETN’s ambition is to be the catalyst of cooperation among and commitments from industry companies resulting in compatibility and technological innovation through the use of common transmit protocols and tag serial numbers and have the ID allocation be controlled by ETN. Several brands have already acknowledged the need for

coordinating efforts on these issues, expressed their interest in contributing in these discussions and confirmed the willingness to make advancements on this.

In addition, data exchange will be promoted. Currently, the integration of ETN's telemetry data into more general ocean biodiversity data systems like EMODNET and OBIS is hampered by the absence of an efficient data exchange mechanism. Therefore, ETN will support the development of such a mechanism. ETN will implement this system and strive for a fluent data exchange between its database and EMODNET and OBIS.

1.4. ADDED VALUE OF NETWORKING

1.4.1. IN RELATION TO THE CHALLENGE

This COST Action is literally about 'creating a much-needed network': The European Tracking Network. Thus, networking is both obvious and at the core of this Action and thus the best approach to tackle the challenge of the ETN. The main objective of the ETN is to achieve a transition from a loosely-coordinated set of existing regional European telemetry initiatives to a sustainable, efficient and integrated Pan-European biotelemetry network embedded in international existing initiatives. The Action will allow the different researchers and stakeholders to communicate with each other and to develop a common language and goals. Networking will also help to review different approaches and best practices in different European countries.

To understand, predict, protect and manage aquatic ecosystem functioning and dynamics, integrated data from these environments are needed. Larger scale, transboundary networks (both in terms of equipment and people) and platforms are needed. Networking is thus essential to identify the research needs, gaps and priorities and to map expertise and resources of different researchers and stakeholders. Not only will the networking result in an integrated set of data needed to answer relevant policy and management questions, it will also foster transboundary cooperation between researchers, render investments more efficient and optimise resource use and provide the critical mass needed to give incentives to telemetry companies to make necessary commitments to improve compatibility between brands and technologies. This in turn will increase the competitiveness of European telemetry companies on the global market.

1.4.2. IN RELATION TO EXISTING EFFORTS AT EUROPEAN AND/OR INTERNATIONAL LEVEL

ETN, as a Pan-European initiative and its coordinated and integrated approach, will avoid the duplication of scientific efforts and increase the efficiency of related funds through optimised communication and data gathering/sharing within and beyond the network. For example, numerous migratory fish species are a priority on several EU strategies and considerable effort was committed in recent years to bring these species from the brink of extinction. But due to the lack of international coordination and compatibility between systems, these studies had limited success. ETN will overcome this bottleneck and open doors to a whole new range of research and innovation possibilities. Having a common infrastructure and data management platform in place reduces running costs significantly and optimises efficiency of available resources and funds.

No other European project on aquatic biotelemetry has been funded, making the effort of this Action much more valuable. However, ETN is planning to establish active collaborative relationships with other projects and initiatives that have some connections to this Action. Contacts will for instance be established with projects as "LifeWatch" (ERIC since 2017), "CoastNet" (Portuguese Roadmap of Research Infrastructures) and "AtlantOS" (H2020, 2015-2019).

ETN can also benefit from the knowledge generated and common pitfalls experienced by already existing telemetry networks outside Europe by fostering regular exchanges with them. This will in turn broaden the scope of ETN and make it a major player in the global context.

In addition, ETN will ensure compatibility between the ETN database and other data systems like EMODNET and OBIS. This will promote the uptake of telemetry data in international biodiversity and oceanographic databases.

2. IMPACT

2.1. EXPECTED IMPACT

2.1.1. SHORT-TERM AND LONG-TERM SCIENTIFIC, TECHNOLOGICAL, AND/OR SOCIOECONOMIC IMPACTS

This Action will lead to both short- and long-term impacts on the scientific, technological and economic levels. Firstly, the scientific telemetry community will benefit from the outcome of ETN. The network itself will increase the temporal and geographical coverage of observational data, while the integrative database will contribute to an enhanced use of aquatic telemetry data. Secondly, the **funding opportunities harnessed** during this Action will bring leadership to European researchers and strengthen the scientific output generated in the global context. This impact will be used to meet policy and management needs. Thirdly, ETN will increase competitiveness of European industry and SMEs on the global market within the telemetry and related industrial sectors (e.g. energy, communications, sensors). Finally, this Action will strengthen the excellence and inclusiveness of ECI and ITC in the field of aquatic biotelemetry. The Action will serve as a training ground for ECI providing them with opportunities to acquire competence that will greatly contribute to their career development, thereby securing the future know-how to further develop the explored fields of research. Few ITC countries had the opportunity to publish the results of their studies. By providing equal access to knowledge, data management tools, funding and resources for all countries across Europe, this Action widens opportunities for scientific excellence to all contributors.

Short-term impacts

- Access to an integrative database and data-management platform for aquatic biotelemetry
- Optimal use of available resources and funds
- Shared data, expertise and infrastructure
- Common language, analysis tools and best practices in aquatic biotelemetry across Europe
- Boost the volume and quality of research on aquatic biotelemetry in Europe
- Identified research needs, gaps and priorities in aquatic biotelemetry
- Map expertise and resources of different stakeholders
- Training opportunities
- Inclusiveness of ITC and ECI in the aquatic biotelemetry community in Europe
- Foster knowledge sharing and collaborations with decision/policy makers at the local, regional, national, EU and international level
- Encourage capacity building and dissemination of knowledge to all stakeholders and the public at large

Long-term impacts

- Scientific excellence of European researchers, including ITC and ECI
- Increased funding opportunities at local, regional, national and EU level
- Meet policy and management needs at the local, regional, national, EU and international level
- Address the key questions underlying the main societal challenges (e.g. climate change, ecosystem-based management, food security)
- Put European industries and SMEs on the global market within the telemetry and related industrial sectors
- Promotion of innovation in various technological fields (e.g. sensor development, miniaturisation, energy-efficiency, underwater communications)

2.2. MEASURES TO MAXIMISE IMPACT

2.2.1. PLAN FOR INVOLVING THE MOST RELEVANT STAKEHOLDERS

Researchers, the technology industry, the marine stewardship community, policy makers and NGOs are all important stakeholders of the ETN Action. The Action already includes researchers, SMEs, government institutions and NGOs from several COST countries. These organisations have a wide

geographic coverage and operate both towards scientific and policy improvements. The involvement of all stakeholders (on all levels) is highly important. Therefore, members of the above mentioned stakeholders will be invited to participate and contribute to the ETN. Communication channels will be established with them during the implementation of the Action, if no links are there yet. It should be noted that links between participants of the Action and the stakeholders already exist. Specifically, the plan for stakeholders' involvement includes the organisation of specific activities to identify needs of the sector with regard to aquatic biotelemetry.

To maximise the impact of this COST Action, engagement from and communication between stakeholders will be crucial and a continuous process. We will use several communication channels to reach all of our stakeholders:

- A web-page with general information on ETN (objectives, structure, procedures)
- Quarterly e-newsletters highlighting the project's developments and upcoming meetings, workshops and training opportunities
- Standard communication by email, blog, social media

These communication tools will aid to maximise the engagement of all stakeholders in the COST Action. In addition, several tools will be provided to members and stimulate their engagement:

- Front-end web-portal to facilitate data entry and (meta-)data management (see 3.1 M1)
- Web-based tools for data analysis and visualisation (see 3.1 M 1)
- Workshops and training opportunities (see 3.1 WG 5)
- Short-term scientific mission opportunities aiming at fostering collaboration and sharing new techniques and/or infrastructure (see 3.1 WG 5)

2.2.2. DISSEMINATION AND/OR EXPLOITATION PLAN

Dissemination

A key objective of publicly-funded research is that it should lead to the dissemination of results and progress made and engagement of society. Dissemination is addressed in WG 5 (see 3.1) and the specific goals are the 1) dissemination of concrete results and progress made in WG 1-4 as well as the active engagement of potential data users in the scientific, policy and public sectors, 2) implementation of communication activities including both traditional and more interactive media that encourage the development of a dynamic 'ecosystem' of actors and stakeholders, and 3) structuring an exchange between the network communities in Europe and in a global arena. This will be achieved by:

- A web-page where general information on ETN can be consulted
- Presentations at thematic workshops, seminars and international conferences to disseminate COST Action achievements to the scientific community and a broader audience
- Organising training and workshops to promote knowledge transfer (for early career scientists)
- Publications in scientific peer-reviewed journals
- Contributions to one (or more) special issues in a scientific journal on a topic selected by the Action
- Distribution of non-scientific reports
- Use of popular communication media (internet, radio and/or television)
- Posts on social network platforms (Instagram, Twitter, Facebook)

Exploitation

With the exploitation of results, we want to go one step further than the mere production and dissemination of new scientific knowledge. Innovation is understood as any activity aiming to promote not only the dissemination, but crucially, the subsequent exploitation of the results of the research and development projects. Therefore, the members of this Action will be encouraged to **instigate/participate in Horizon 2020 research projects** as well as other potential funding opportunities to build upon the knowledge generated during this Action. Two of the WGs (i.e. WG 3 and 4) are at the core of this goal. Priorities will be set and the funding/project landscape in the field of aquatic biotelemetry will be thoroughly screened. Members will be supported to contribute to **project writing seminars** as well as **project writing brainstorming retreats**.

The strategic use and management of intellectual property in international research initiatives and business is essential for strengthening the European scientific and technological base boosting innovation and ensuring growth in the EU. Early in the project, exploitation measures will be defined in an “Exploitation Plan” (deliverable of WG 1). The plan will contain measures for the setup and the implementation of an exploitation strategy related to the ownership of results to be adopted by the entire consortium.

2.3. POTENTIAL FOR INNOVATION VERSUS RISK LEVEL

2.3.1. POTENTIAL FOR SCIENTIFIC, TECHNOLOGICAL AND/OR SOCIO-ECONOMIC INNOVATION BREAKTHROUGHS

ETN was initiated because there was a clear need identified by the community (see 1.1). The attention of important stakeholders, including the tech industry and the marine stewardship community, which has already been generated, highlights the potential for a significant impact for the end-users; which is an effective approach for the medium-term future (see 1.1 and 1.3.2). Specifically, ETN bears significant potential for innovation-at-low risk in all three domains:

Scientific - the innovation potential is quite clear considering the current near absence of international, cross-bordering, Big Science (and big data) projects and initiatives involving aquatic biotelemetry in Europe. This innovation is exactly what ETN aims to bring to the table. Risks exist but are low: a certain lack of tradition in data sharing amongst the ecologist/biologist communities (when compared with the oceanographic or climatology community, for example) is rapidly changing given the pressure to have the large temporal, spatial and multi-species datasets needed to address the key questions underlying the main societal challenges (e.g. climate change, ecosystem-based management, food security). Iconic examples of questions that can only be tackled within a network approach can easily be identified: the **migratory routes and population dynamics of endangered species** (e.g. European eel, bluefin tuna, Atlantic cod, Atlantic salmon) or the **regional shift in distribution of species** in response to climate change. The success of this networking approach in other regional efforts further stresses this low risk.

Technological - aquatic biotelemetry has always used and promoted the innovation in various technological fields, whether they are more specific (e.g. sensor development) or transversal (e.g. miniaturisation, energy-efficiency, underwater communications). ETN will confer the community with a higher voice amongst the industry and inevitably foster innovation in this field. This can be in the form of technological advancement (e.g. new sensor development) or refinement (e.g. by forcing the industry to provide compatibility of equipment and data protocols). The historical tradition of the telemetric community in working with and actually invigorating the industry and its developments (via many spin-offs) and the EU policies towards blue-growth are great incentives and risk-reduction for this potential.

Socio-economic - both the scientific and technological innovation potentials bear potential impacts in the socio-economic innovation field. Blue growth has been defined as a key development and strategic direction for marine policies, given the potential for new economic developments at the global scale. The contribution of the aquatic biotelemetry field to this super endeavour is significant, given its potential to foster specific technological innovation and contribute to the broader blue growth scenario. The potential impacts of science emerging from this community if organised in a Pan-European network are also substantial, given the possibility that the higher level of cooperation (e.g. data sharing) offers for scientific breakthroughs, many of which bear clear potential impacts on EU and national policies and initiatives.

3. IMPLEMENTATION

3.1. DESCRIPTION OF THE WORK PLAN

3.1.1. DESCRIPTION OF WORKING GROUPS

The ETN Action focusses on networking and cooperation (doing more by joining forces). To do so, the Action is organised in five WGs. The first two WGs mainly focus on streamlining data and technology,

where WG 3 and 4 focus on prioritising future collaborations and key challenges to be answered. The last WG focuses more on life-long learning and sharing expertise and knowledge.

WG 1 Data management, requirements and policy

Objectives

A central data management platform will be hosted to allow the network to collaborate more efficiently. Not only infrastructure (i.e. telemetry devices) and detection data will be centralised, but also project information will be listed. Amongst the requirements, the Action already identified: 1) up-to-date lists of active receivers and tagged animals, 2) sharing of detection data, 3) systems to alert users about detections on other receivers but their own and of animals other than their tagged individuals, 4) tools for planning and managing the global network of receivers and 5) data analysis tools.

The data system development will be done in close collaboration with the European project LifeWatch, the Ocean Tracking Network (OTN), IMOS-Animal Tracking, EMODNET and the Horizon 2020 project AtlantOS.

The data management platform will be made available for the members of the network and will be further refined to the requirements identified during this COST Action. ETN data policy, data standards and security rules will be mapped to those of existing biotelemetry data systems outside Europe, which meet highest international standards.

Tasks

- **Inventory of existing European tracking project information** in the database
- Capture metadata on devices, animals, deployments in the database
- Capture detection data of the different biotelemetry technologies in the database
- Provide access to and organise **training workshops for network members**
- Refine data policy, procedures and security rules
- Identify requirements for new features, analysis tools and additional telemetry data types;
- Ensure compatibility with biotelemetry data systems outside Europe (e.g. OTN, ATN, IMOS Animal Tracking) and standards of biodiversity databases (e.g. EMODNET and OBIS)
- Set up an exploitation plan

Activities

- Organise online questionnaires
- Organise training workshops
- Organise working group meetings to prepare requirements list, exploitation plan and data policy among others
- Communication with stakeholders and (potential) network members

Milestones

- Integrative biotelemetry database (version 1) implemented throughout Europe (M1)
- ETN data standards mapped to those of OTN, ATN, IMOS Animal Tracking, EMODNET and OBIS (M2)

Deliverables

- Provide the necessary manuals and training material related to data management and data policy (D1)
- Documented exploitation plan and data policy including agreements on IPR, moratorium period for open data and access rights for research and commercial use (D2)
- Requirements list for database version 2. This includes both new technologies to be incorporated and additional features/updates to existing technologies (D3)

WG 2 Technology

Objectives

This WG has two key objectives: 1) improving the usefulness and inter-applicability of currently available technology by promoting the **harmonisation of acoustic tag coding schemes** and the compatibility between different acoustic telemetry equipment and brands; 2) foster novel technological developments in the various areas (sensors, miniaturisation, communications) and their integration in tag and receiving units. To do so, the WG will work in close proximity to the industry. Outcomes will both increase competitiveness of European industry and SMEs on the biotelemetry global market and related industrial sectors (e.g. energy, communications, sensors) and the scientific excellence of European researchers.

Tasks

- Technological needs: **updating the 'wish list'** of biotelemetry users in terms of technological developments and improvements in all fields of aquatic biotelemetry
- Industry: interactions with manufacturers to discuss future technological developments and possibilities and benefits of equipment compatibility and coding harmonisation

Activities

- Organise working group meetings
- Organise technological workshops with end-users/stakeholders
- Set up a forum/stakeholder group with the industry and the end-users at international symposia and conferences
- Foster the communication with stakeholders and network members
- Discuss and articulate efforts with other international (i.e. outside Europe) telemetry networks

Milestones

- A **scientific workshop** on future biotelemetry technological developments needs to address European aquatic science and policy challenges (M3)
- A workshop on tag code standardisation and compatibility between brands of acoustic telemetry with scientists and company representatives (M4)
- Transmitter ID allocation is controlled by ETN (M5)

Deliverables

- White paper on technological harmonisation with a focus on transmit protocols, ID allocation and tag serial numbers (D4)
- Position paper on future biotelemetry technological development needs to address European aquatic science and policy challenges (D5)

WG 3 ETN infrastructure and research on key species

Objectives

ETN will **develop a series of proposals to generate funding** needed to 1) implement research infrastructure in terms of acoustic telemetry arrays at strategic locations within Europe and 2) to support tag **deployment on flagship species** that are likely to be monitored by the proposed ETN research infrastructure and/or regional telemetry arrays of ETN participants. These species were already identified during the ETN launching workshop.

Tasks

- The WG will prioritise strategic locations, investigate funding possibilities and apply for funding to implement the research infrastructure.
- The WG will prioritise flagship species, investigate funding possibilities and apply for funding to conduct tagging studies.

Activities

The WG will have regular meetings, engage in scoping activities for opportunities with outside cross-sectoral stakeholders (tourism, energy and public sectors), write funding proposals and communicate developments to the coordination and other WGs.

Milestones

- Prioritisation of strategic locations and identification of benefits for ETN (M6)
- Development of research designs, identification of potential primary partners and estimation of total budget (to deploy and maintain acoustic telemetry curtains) for each identified strategic location (M7)
- Prioritisation of flagship species, their current status and identification of knowledge gaps for each of the species (M8)
- Identification of regions of interest, benefits for ETN and most appropriate telemetry tools for each flagship species (M9)
- Development of research designs for tagging studies for each flagship species and identification for potential primary partners, including outside cross-sectoral stakeholders and estimation of total budget to conduct tagging studies for each flagship species (M10)
- Writing of proposals (M11)

Deliverables

The WG will prepare two reports:

- 1) A report that outlines information on the identified strategic locations including benefits for ETN, research designs, potential primary partners and an estimated budget to deploy and maintain the research infrastructure (D6)
- 2) A report that outlines information on the identified flagship species and their current status including knowledge gaps, regions of interest, most appropriate telemetry tools, benefits for ETN, research designs, potential primary partners and an estimated budget to conduct the tagging studies (D7)

Each resulting funding proposal will be documented and outcomes will be communicated with the other working groups and with the stakeholders at large.

WG 4 Training and knowledge dissemination

Objectives

The WG will provide continuous **training opportunities on all aquatic telemetry** related aspects such as best practices on receiver deployments and maintenance, tagging procedures (consistent with EU and member nation regulations regarding animal welfare), research designs, data handling, data analysis and technological advancements among others. Training will be done through workshops and training schools and will **target both ECI and experienced researchers** in the framework of life-long learning. Special attention is given to ITC to strengthen excellence all across Europe. Short-term scientific missions will be developed and conducted to enhance and strengthen in-situ skills and experiences for ETN participants. Knowledge and experiences will be disseminated at regular workshop, training schools and conferences between ETN participants across Europe and among members of international partner initiatives. Participants will be encouraged to disseminate the outcome of their research to the wider scientific community, policymakers, the media and society at large.

Tasks & activities

The WG will organise regular **workshops, training/summer schools, and short-term scientific missions, attend conferences, investigate funding possibilities for these activities and apply for funding to conduct these**

Milestones

- Organise regular workshops and training schools (M12)
- Organise short-term scientific missions (STSM)(M13)
- Stimulate attendance at conferences by providing travel funds for ECI (M14)
- Investigate funding possibilities and apply for funding to conduct these activities (M15)

Deliverables

- Dissemination of results to a broad scientific audience through several peer-reviewed publications (D8).
- Production of non-scientific content and materials targeting dissemination to a broad audience (D9).

3.1.2. GANTT DIAGRAM

Figure 1 outlines the time schedule for the different activities, milestones and deliverables of the proposed Action. Whenever possible, meetings and workshops will be organised in succession. This allows optimal use of available funds and restricts time budget requirements of members and participants. No milestones and deliverables were indicated for WG4 as this is done on a continuous basis. STSM can be organised ad-hoc and on request of members; as a result, these were not incorporated in the timeline.

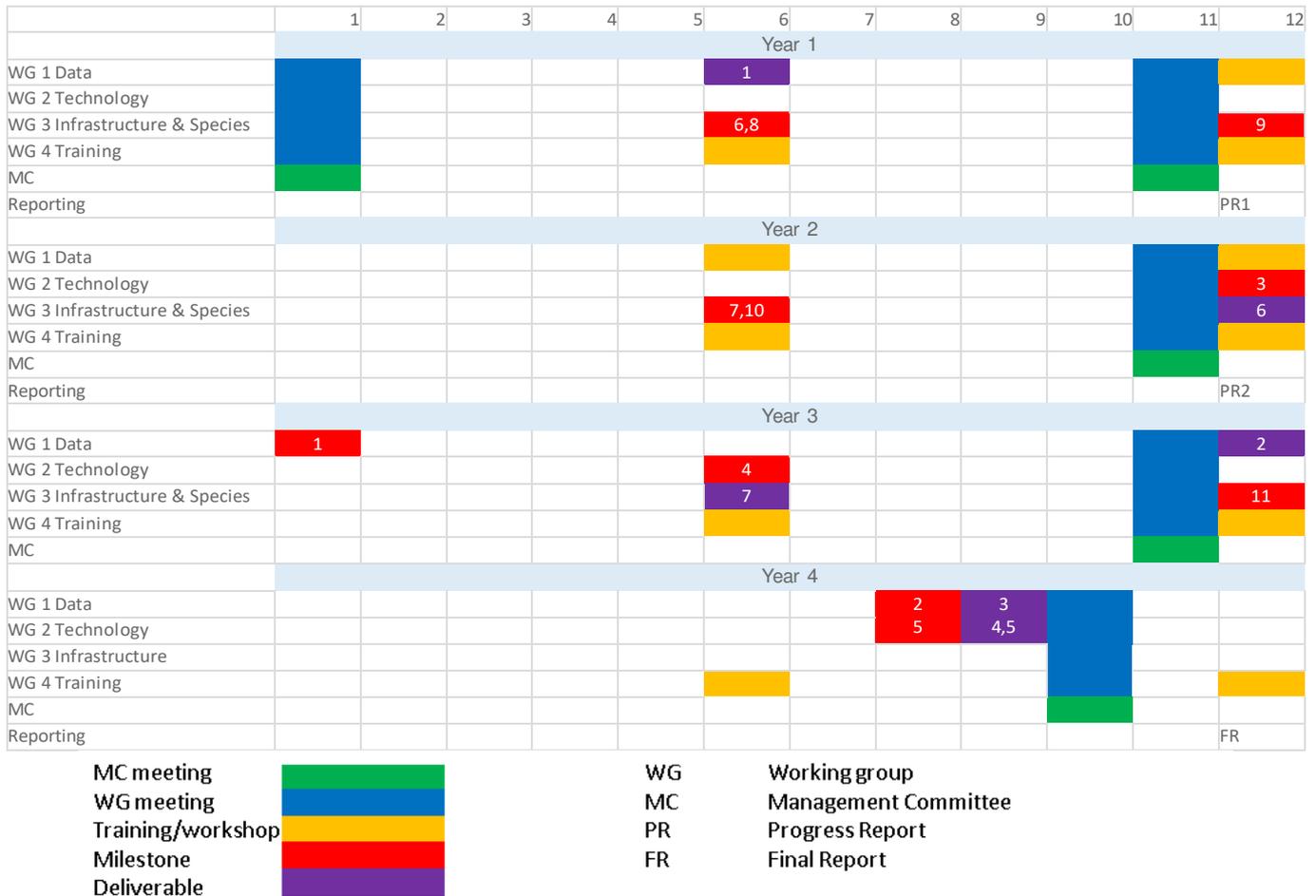


Figure 1. GANTT chart of the time schedule for the different activities within the proposed Action. It should be noticed that no milestones and deliverables are identified for WG4 as this is done on a continuous basis.

3.1.4. RISK AND CONTINGENCY PLANS

The main potential risks for the success of the work plan are 1) low geographic and profile representability of network members, 2) resistance for data sharing amongst the biotelemetry community and 3) unwillingness of the (dominant) manufacturers to engage in equipment and coding harmonisation and interoperability. The network's contingency plan foresees actions to mitigate all of these three risks.

1. A relatively appropriate representability is already ensured at the geographic level and to the profile (i.e. telemetry and habitat type), with members from all across Europe using various types of telemetric tools in the proposed consortium. Current gaps are mostly due to lack of time in disseminating this proposal given the very positive response rate and the feedback in previous workshops and fora. Thus, the communication and dissemination actions during the project will target new network memberships and representability gaps, including directed communication and dissemination at scientific fora after a mid-term evaluation. It should be

- noted that the group of participating members is already so large, that it is, even at this stage, too big to be ignored. Other participants are thus expected to join on a regular basis.
2. Data sharing is increasingly being demanded and adopted by funding agencies, scientists and end-users given the stringent need for large-scale and long-term datasets. Yet, a certain lack of tradition still exists in the community. We will therefore adopt **intellectual property and data ownership rules** that ensure prime access and control of data usage by the respective researchers (tag and receiver owners, when applicable) in line with what has been adopted in other regional networks. Furthermore, ETN will actively **promote and fund Open Access** (as cc-by) data usage and publication of key flagship studies that can demonstrate the usefulness of data sharing among users.
 3. The current scenario amongst acoustic telemetry manufacturers is characterised by a market dominance of one non-EU company. This does not serve the EU commitment for a blue growth initiative where the European industry can take a more prominent role. Furthermore, the consensual need amongst end-users of compatible, price competitive products might dictate a change in this scenario. The European emerging companies will engage in the Industry Group (as per their present interest) within the large European market with its extraordinary growth potential in this area. These companies will be a strong incentive to have other non-EU manufacturers changing the current state within this technology sector. This network might be able to steer the industry's engagement and willingness to advance towards a more inter-operable market. Strong emphasis will also be put on the communication at international fora. Several brands have already expressed their interest in the ETN and confirmed the willingness to make advancements on this issue.

Moreover, during each MC meeting, the Steering Committee (SC) will present the progress of the implementation of the various activities and report on potential deviations and corrective measures taken or measures that need to be taken. The WG leaders will submit brief but comprehensive reports to the SC twice a year so that the smooth implementation of the work is ensured. A brief written note on the progress will be prepared by the SC twice a year and communicated to the MC. The consequences of any member of the Action withdrawing and other potential risks will be minimised by deploying a balanced management structure as described in section 3.2. Differences in expertise and knowledge of the consortium partners are complementary and matched in each WG. Moreover, a number of milestones have been identified over the lifetime of the Action which serve as control points for monitoring the progress of the Action.

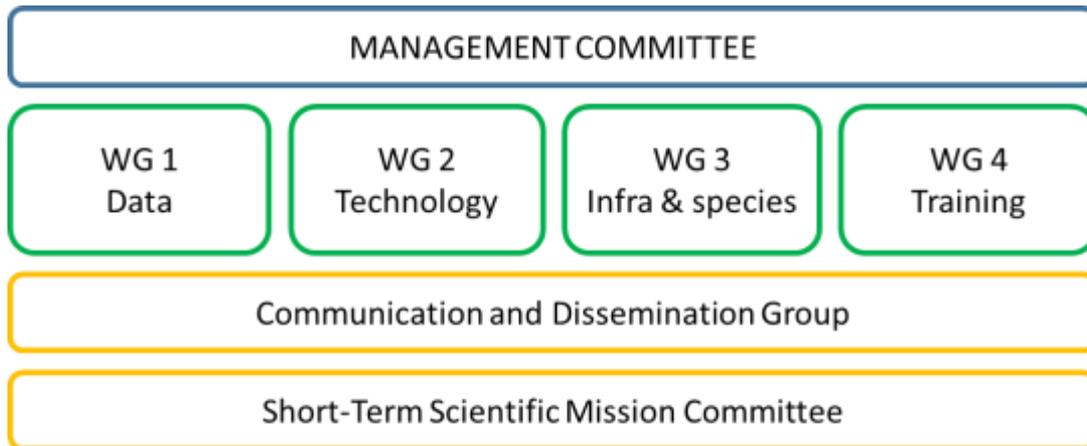
3.2. MANAGEMENT STRUCTURES AND PROCEDURES

General organisation and implementation of this COST Action will be performed according to the "COST Action structure" (COST Open Call - SESA guidelines). The Management Committee (MC) will coordinate the overall management of the Action and is responsible for the overall Action strategy, supervision of the WGs and coordination of milestones, deliverables and reports. The MC consists of an elected Chair, Vice-Chair, Grant Holder, up to two representatives from each participating COST country, up to three substitutes for each COST country and observers from International Partner Countries (IPCs) and Near Neighbour countries (NNCs). During the first MC meeting, the committee will elect the Action Chair, Vice-Chair and Grant Holder. The Chair will be responsible for coordinating the Action activities in line with the scientific objectives defined in the MoU and the Work and Budget Plan. In addition, the MC will elect Working Group Coordinators (and substitutes) and then decide on the composition of the different WGs. **The MC will meet annually (biannually in the first year). For** more urgent decisions, the MC will make use of E-VOTE or will organise ad-hoc meetings. The MC observers have no voting rights but do participate in the discussions related to the Action MC decisions. The WG coordinators are responsible for supervision, coordination and organisation of the WG meetings, milestones and deliverables and report back to the MC. Furthermore, the MC will set up a **Communication and Dissemination Group** and a **Short-Term Scientific Mission (STSM) Committee**. The Communication and Dissemination group will coordinate all communication and dissemination activities of the Action. The group will hold monthly teleconferences and will work closely together with the Working Groups (especially WG 4) in order to support the transfer of knowledge between Action participants and the stakeholder community. The STSM Committee will ensure that the application and selection processes for STSM are in line with the COST rules. They will be responsible for defining, with the agreement of the MC, transparent eligibility criteria for STSM applications (gender balance, enabling ECI and ITC) and the evaluation of the applications. The STSM Committee will hold teleconferences on

an ad-hoc basis. In addition, they will prepare **notes to outline the activities every three months** and communicate the selection of STSM grantees to the Action MC in subsequent MC meetings.

Within all levels of the organisation both gender balance and balance between early-career and experienced senior scientists will be strictly monitored. Furthermore, the Action will appoint leadership roles to members of ITC promoting the Pan-European collaborations.

Ad-hoc participants will be invited whenever specific additional expertise is required. The need for and the selection of individuals of ad-hoc participants will be discussed during MC meetings.



3.3. NETWORK AS A WHOLE

Completion of the aims of this ambitious Action requires bringing together complementary expertise from a variety of sectors including biotelemetry users, data managers, technology companies and NGOs. The countries involved represent a balanced geographical coverage across Europe and include national key experts active in these mentioned fields. Many of the contributors have a strong publication record, are involved in many cross-boundary (European) initiatives (e.g. COST Actions, Horizon 2020 projects, ICES working groups, ESFRIs), are collaborative and have strong international networking connections. It has been revealed that scientists that network and are collaborative towards data sharing are more efficient with the use of public resources, producing more and better papers.

The ETN network consists of a group of 67 contributors from 24 COST countries, including 11 ITC countries. There is a fair balance (57 % ECI) between experienced senior researchers and early-career scientists within the network. In addition, 46 % of the COST countries are ITC countries which will strengthen the excellence and promote the development of their capacities in these areas and throughout Europe. Currently, 34 % of the contributors are female. This should be improved and therefore every effort will be made during the Action to ensure that activities contribute to the promotion of gender equality wherever possible.

Representatives of OTN (Canada), PacIOOS (US), IMOS Animal Tracking (Australia) and ATAP (South Africa) are involved in this Action as IPC. All four are among the major players in the international telemetry community and pivotal partners in international marine research cooperation in the spirit of the Galway and Belém Declarations. As a result, ETN can build on their experience and has the advantage that it can use the knowledge gathered and pitfalls identified in these international networks. All the above prove that the ETN COST Action has the perfect network to address the identified challenges and objectives. It is however expected that ETN will attract more members in the future as it is an emerging network. If it appears that important representatives are missing, every effort will be made to include additional countries and expertise in this Action.