AGA KHAN DEVELOPMENT NETWORK

PROGRESS REPORT

Scientific Component

PROGRESS REPORT Nº. #1

Period to which the report relates:

Start date: 01/01/2022

End date: 31/12/2022

PROJECT IDENTIFICATION

Project Acronym: LittleFish-STP

Researcher in Charge: Vânia Baptista

Leading Institution: Centro de Ciências do Mar do Algarve (CCMAR)

Project start date: 01/01/2022

Project end date: 31/12/2024

1. SUMMARY CHARACTERIZATION OF THE PROJECT

1.1 – Description of the activities carried out and the deviations to the work plan that occurred during the period to which the report relates

The coordination of the project (Task 1) of the Centre of Marine Sciences (CCMAR) responsibility showed a good progress with the daily agenda being implement regularly and problems solved. Tasks methodologies were agreed in detailed during first plenary meeting occurred during the kickoff in São Tomé and Príncipe (STP; 9 May 2022; Figure 1; https://m.facebook.com/story.php?story_fbid=pfbid0UCzcEoLv8LDjMQWxKzhHRCTaW2mqYLFpdnUZtknpBi9obnBCwKy2f5dh2nKgxrHbl&id=103813322310124&sfnsn=mo). Several management meetings were done online (Zoom), where the project's progress was analyzed and mitigation actions upon major deviations to the plan were presented and adopted.

Figure 1 – First plenary meeting in University of São Tomé and Príncipe (USTP; 9 May 2022).

In relation to the Task 2 (Little fish: monitoring, conservations and improve the quality of life), we started to study the life cycle of peixinho, including the coastal and riverine phases. We visited the most important rivers and communities (Praia Pesqueira, Iô-Grande, Paga-Fogo) where peixinho occurs and discuss with the communities the best sampling strategy (May 2022). Contrarily to the opinion of local communities that peixinho is the adult phase, we confirmed that the peixinho is a post-larval/juvenile phase, due to the morphological characteristics presented, like the lack of pigmentations and development of all fins. In Praia Pesqueira, we saw the peixinho post-larvae/juveniles climbing a waterfall and collected samples for genetic, otoliths, condition index (Rna:Dna) and feeding (isotopes and stomach contents) analyses. We also collected live specimens to describe their development. For that, we transported the peixinhos to the tanks in a laboratory in University of São Tomé and Príncipe (USTP) and observed their morphological changes along time (Figure 2). We observed an increase of individuals length, but after four months, we registered a massive mortality, probably due to poor feeding quality or lack of oxygenation associated with electricity problems at USTP. We will repeat the experiment in next year (2023). We also collected samples for genetic, otoliths, condition index and feeding analyses in all sampling locations (May 2022), and we are processing the laboratory analyses. We are working on the engagement of local communities in the conservation of the peixinho. For this we start to invite members of all the local communities fishing the peixinho to be present in the kickoff and talk about the peixinho fishery and actual state in their communities. Also, we are preparing a questionnaire about the quality of life of local communities involved in the peixinho fishery.

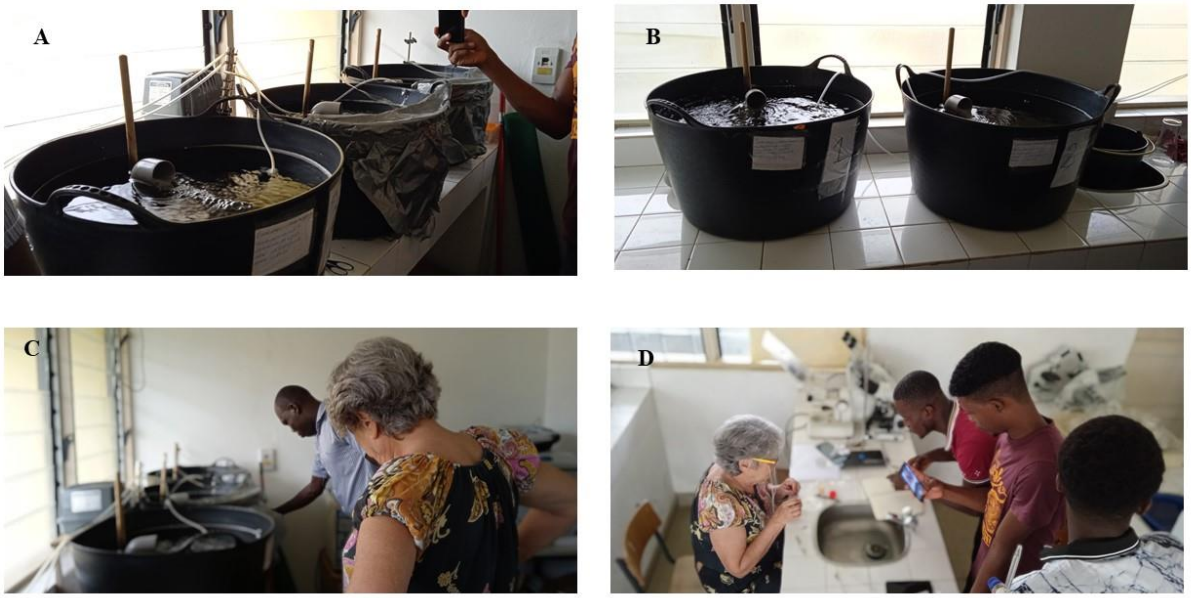

Figure 2 – Tanks in the Biology Laboratory of University of São Tomé and Príncipe (USTP) to observe the development of peixinho. (A) Sequence of five tanks; (B) Tanks with peixinho post-larvae/juveniles; (C) Water temperature check; (D) Measurement of peixinho post-larvae/juveniles in the laboratory.

In Task 3 (Surveys: Oceanography and Biodiversity), we selected four rivers, two in south (Martim Mendes and Iô-Grande rivers) and two in north of the São Tomé Island (Paga-Fogo and Lembá rivers). Two field surveys were done, a short and exploratory in May 2022 during wet season, and an intensive one in July 2022 during dry season. Concerning the availability of sampling sites and local fishing communities to collaborate with us verified after the first field survey, we decided to increase the number of sampling points and sampling days in the next surveys. In sampling design, we decided to use a local fishing art, called tchanga, used to catch peixinho, due to their low selectivity (Figure 3). We distributed the tchangas along the rivers, in three to six points (depending on the river dimension), starting near to the sea (coastal area) separated by 500 m to collect quantitative data of aquatic macrofauna. Zooplankton samples and abiotic parameters, such as, temperature, salinity and turbidity were also collected. Also, we made the habitat characterization in each season and sampling point of the river. In dry season, we registered eight species in the four study rivers, four fish and four crustacean species. The Lembá river showed a highest species richness (eight species), followed by the Iô-Grande river (seven species), Paga-Fogo river (five species) and Martim Mendes river (three species) (Figure 4).

Figure 3 – Use of the tchanga - traditional local fishing art used to catch peixinho in São Tomé and Príncipe (left), and the frontal view of the tchanga (right).

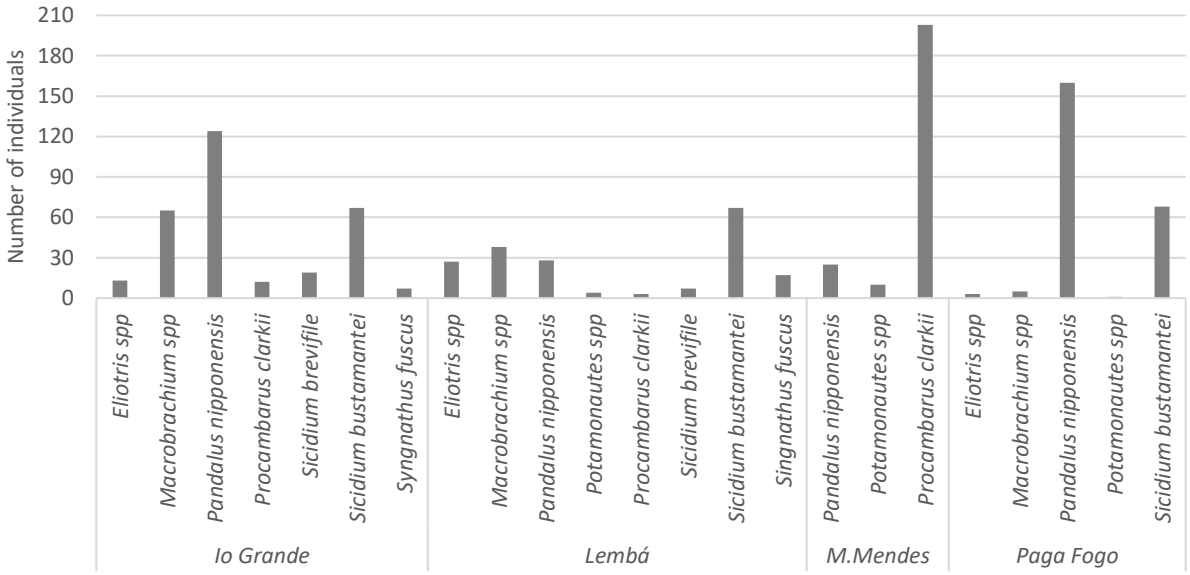

Figure 4 – Number of species sampled by tchangas in Iô-Grandes, Lembá, Martim Mendes and Paga Fogo rivers during July 2022 (dry season).

Withing the Task 4 (Monitoring and Assessment of Fisheries), we started to characterize the peixinho fisheries in Iô-Grande community by quantify catches (in kg and in number of individuals) and bycatch (number of individuals) during the period of fisheries (seven days) in April 2022. The preliminary results showed that during seven days, a total of 919 kg of peixinho post-larvae (*Sicydium bustamantei*, *Sicydium brevifile* and *Awaous* sp.), corresponding to 11.257.750 individuals, were caught in the small community of Iô-Grande (265 inhabitants), equivalent to a daily average of 131 kg (± 118 kg) or 1.608.250 individuals (± 1.415.487 individuals) (Figure 5). In relation to the bycatch, a total 256.725 individuals of juvenile crustaceans were caught during these seven days (Figure 6). Some young-adults and adults of *S. bustamantei*, *S. brevifile* and *Awaous* sp.) were also caught together with peixinho. We also collected information from fishermen about other species caught in the same place during the period of fisheries

of peixinho. These species were: toadfish (*Bostrychus africanus*, *Awaous lateristriga*, *Awaous bustamantei*, *Bathygobius burtoni*), sharks (juveniles), convocado (*Caranx sp.*), mullet (*Mugil curema*), sardine (*Sardinella sp.*), parente (*Parakuhlia macrophthalmus*), barbudo (*Galeoides deecadactylus*), roncador (*Pomadasys jubelini*), croaker (*Lutjanus goreensis*), comcom (*Dactylopterus volitans*), shrimp/prawn (*Macrobrachium sp.*), batu, cobra (*Muraena melonotis*), peixe sopa (*Kyphosus vaigiensis*), tintim (*Holocanthus africanus*), cococó (*Scarus hoefleri*), maiah (*Paranthis furcifer*), dada (*Chaetodipterus lippai*), clacla (*Macrobrachium sp.*), pata-pata (*Alectis alexandrina*), língua de porco (*Prionurus biafraensis*), tilapia (*Oreochromis mossambicus*), barracuda (*Sphyraena barracuda*) e moray eel (*Muraena robusta*). To evaluate the fishing activity of peixinho in São Tomé and Príncipe, a total of 228 questionnaires were applied in all the communities where the peixinho fishery occurs of both São Tomé and Príncipe Islands. Questions presented in these questionaries included topics about the fishing arts, the seasons, the amount of peixinho cauth, the moon phase, the time of the day, etc. These data are being analyzed by two students as final project (Bachelor) and Thesis (Master) works.

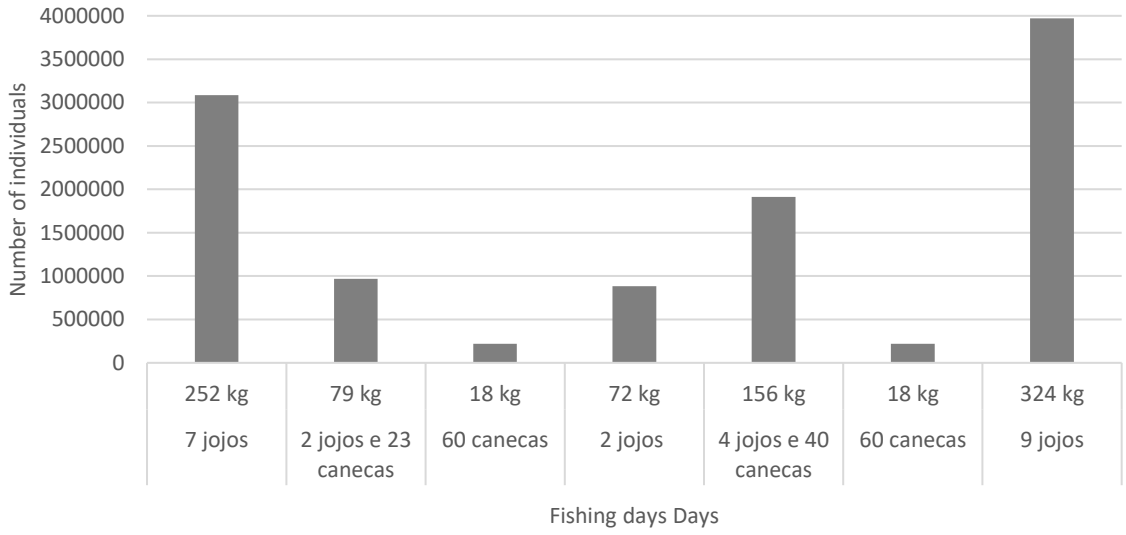

Figure 5 – Catch of peixinho in Iô-Grande River during the fishing period of April 2022, in number of individuals and kg caught by day (in a total of seven days period).

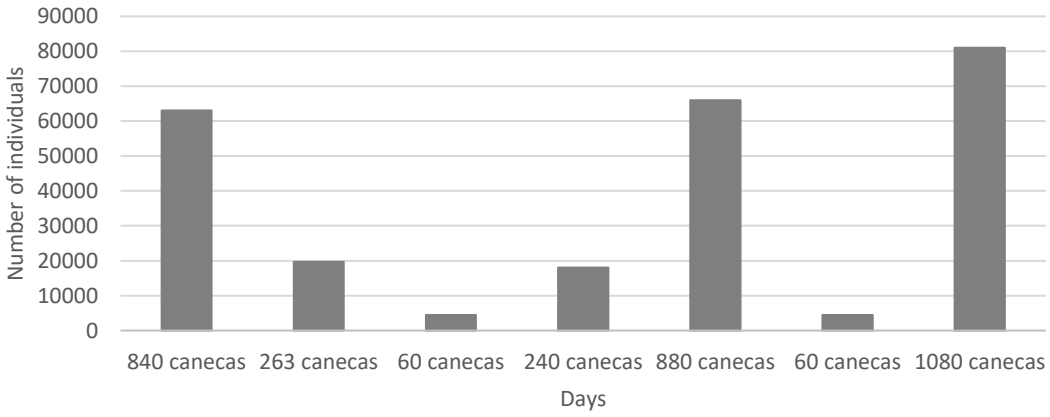

Figure 6 – Bycatch of peixinho fiching in Iô-Grande River during the fishing period of April 2022, in number of individuals by day (in a total of seven days period).

For the Dissemination (Task 5), the website was launched in November 2022 (https://littlefishstp.com/en/home/), and social media networks (https://www.facebook.com/LittleFishSTP; https://www.instagram.com/littlefishstp/) in April 2022. The kickoff meeting occurred on 11 May 2022, with the presence of the stakeholders including local communities (Figure 7). Stakeholder meetings were done in May 2022, including with the Ministry of Agriculture, Fisheries and Rural Development and Direction of Fisheries and Aquaculture of STP, Programa Tatô, communities of fishermen, sellers, and residents in areas where the peixinho is fished, to raise awareness about fisheries and conservation issues of peixinho (https://www.ccmar.ualg.pt/en/news/we-went-sao-tome-and-principe-important-mission). In the meetings with Ministry of Agriculture, Fisheries and Rural Development and Direction of Fisheries and Aquaculture of STP (Figure 8), the main topics discussed were the collaboration with the project and the authorizations to conduct the research and collect data, and the new collaboration protocol with University of Algarve (UAlg) (https://fct.ualg.pt/ualg-visita-sao-tome-e-principe-no-ambito-de-varios-projetos-de-cooperacao). We also used the national media from STP to disseminate project actions, including Radio and TV interviews (https://littlefishstp.com/en/littlefish-stp-project-presentation-tvs-interview-may-2022/). Regarding to the intensive courses/workshops, it was necessary to change the topics of the courses due to the availability of teachers for the entire duration of the project. An intensive course on Geographic Information Systems (GIS) occurred on 09 November 2022 (Zoom) with participation of 24 researchers, technicians and students from USTP, MARAPA, UAlg and CCMAR (Figure 9; https://m.facebook.com/story.php?story_fbid=pfbid037eXWTRbSPt8i9ie7cjpsaysv6JryBtDn6ge763g9KVSbcLR16YveBywg2aJUQti2l&id=100082999737325&sfnsn=mo). At least four courses are planned to next year (2023): Basic freediving, Scientific freediving (presential mode), New paradigms in environmental sciences: citizen science and social sciences, and How to do a systematic review of the literature (Zoom). Several academic works are in progress under the scope of the project: four Batch projects on the field of fisheries, peixinho life cycle and design and communication, and three Master Thesis on the field of peixinho larval/juvenile behavior and life cycle, marine and riverine biodiversity, and costal management and agroecology. This project also intended to integrate the Collaborative Centre of Excellence in Marine Sciences in Africa (CCEMAR) already under development throughout the Luandawaterfront project.

Figure 7 – Kickoff meeting of the project LittleFish-STP at University of São Tomé and Príncipe (USTP). (A) Group photo of the project team and stakeholders presented in the meeting in front of Faculty of Sciences and Technologies (FCT) of USTP; (B) Opening speech by the USTP Pro-Dean for Cooperation; (C) Presentation of the perspective of fisheries in in São Tomé and Príncipe by ONG MARAPA; (D) Walk in the FCT garden to observe different fishing gear presented by invited local communities.

Figure 8 – Meetings with Ministry of Agriculture, Fisheries and Rural Development (left) and Direction of Fisheries and Aquaculture (right) of São Tomé and Príncipe (May 2022).

Figure 9 – Intensive course on Geographic Information Systems (GIS) (09 November 2022; Zoom).

Other changes to the workplan, including the addition of new members to the scientific team of the project related to the need of reinforcing certain research topic were done:

- Contacts with local communities: Mariley Ceita (MARAPA technician) and Marina Branco (Technical Coordinator of Programa Tatô – informal partner)
- Data analyses: Maria do Céu Carvalho (Professor at USTP) and Ainda Almeida (USTP)
- Capacity building and dissemination: Alzira Rodrigues (Professor at USTP)
- Genetic and data analyses: Regina Cunha (Researcher at CCMAR)
- Consultants: Ester Dias (expert in isotopic procedures and data analyses – CIMAR Porto) and Ricardo Paris (freediving instructor – Miami University)
- Students: Diolay Rosário, Edson Santos, Fernando Umbelina (BSc students – Biology and Fisheries), Ednelson Salvador Dias (BSc student – design and communication), Wadmilton Fernandes, Jerónimo Bastos (MSc students – biology and biodiversity), and Abnilde Soares (MSc students – coastal management and agroecology)
- CCMAR Fellow: Diana Gonçalves.

1.2 Goals, Milestones and Impacts

We already reinforced the partnerships with STP Governmental bodies (M1), namely the Ministry of Agriculture, Fisheries and Rural Development and Direction of Fisheries and Aquaculture, ensuring long term support of monitoring, assessment and capacity building in marine sciences and quality of life (13, 18 May 2022; Figure 8; https://fct.ualg.pt/ualg-visita-sao-tome-e-principe-no-ambito-de-varios-projetos-de-cooperacao; https://www.ccmar.ualg.pt/en/news/we-went-sao-tome-and-principe-important-mission).

The kickoff meeting occurred in 11 May 2022 (M1), with the presence of 60 invited stakeholders, such as, Camões IP, Portugal Embassy in STP, Port authority, General Direction of Environment, Direction of Forests, local communities (Iô-Grande, Praia Pesqueira, Lembá, Santa Catarina, Monte Mário, Santana, Angolares, Neves, Lembá, Angra-Toldo, Ribeira Afonso), TVS, Federação das ONG's, ONG ADAPPA, Birdlife International, ONG Programa Tatô, ONG MARAPA, USTP, CCMAR, UAlg, (Figure 7; https://m.facebook.com/story.php?story_fbid=pfbid0DHBBN3og1gmA1kY6R49j4YQievGv2vDP7r1haBmTZa1BMKYgJifw5u3qcoB5CQAcl&id=103813322310124&sfnsn=mo).

During the kickoff, the local communities, were invited to participate and talk about the importance of peixinho for their lives, fishery technics, actual state in their communities and principal problems. We also did several local meetings engaging the communities to collaborate for an integrated assessment and monitoring (M1), that resulted in the decisions of the best sampling locations and methodologies (the use of the local fishing arts for sampling). At least one member of the community has been present in sampling campaigns (Figure 3; https://m.facebook.com/story.php?story_fbid=pfbid0cU6gbuNCtAofhfA4eRFXLGR1S2TLFjxiVF3kdbXc3SfjTgo3ToHSMs69cq7uAoXul&id=100082999737325&sfnsn=mo). We also applied for questionaries about fishing activity of peixinho in STP Islands, and we are preparing a questionnaire about the quality of life of these communities, to be applied in next year (2023). The project was contributing to the scientific development through the involvement of students (BSc/MSc) on tasks.

The first intensive survey in oceanography, biodiversity and fisheries occurred in May 2022 (wet season) (M1), in an exploratory way, to understand and decide the best sampling locations and methods for the development of the project, with the collaboration of local communities (https://m.facebook.com/story.php?story_fbid=pfbid0Kmx6c2133odPd8wjSc5a8LmBunX4Z2K28A8maDyGtPzGRmo6fQVxx2iuXZ3vaUrRl&id=103813322310124&sfnsn=mo; https://m.facebook.com/story.php?story_fbid=pfbid0sLkPwYNtEXRHkAUQ6sYhV6JrNyvqogB3VNyem4LbREFmByozR65Nshrhz3nM2o8Sl&id=103813322310124&sfnsn=mo; https://m.facebook.com/story.php?story_fbid=pfbid0BRGyiaVEwgfRkQV8Aewep34HrskT4B68LTeA5Y4DhJsyph2qAoRE9zHQe5Q1krmil&id=103813322310124&sfnsn=mo). Another intensive survey occurred in July 2022, during the dry season.

The website was launched in November 2022 (https://littlefishstp.com/en/home/), and social media networks (https://www.facebook.com/LittleFishSTP; https://www.instagram.com/littlefishstp/) in April 2022 (M1). The social media networks revealed a good way to share the project development with a diverse and international audience.

The topics of intensive courses are dependents of the availability of teachers, thus in 2022, we organized one on Geographic Information Systems (GIS; Figure 9; https://m.facebook.com/story.php?story_fbid=pfbid037eXWTRbSPt8i9ie7cjpsaysv6JryBtDn6ge763g9KVSbcLR16YveBywg2aJUQti2l&id=100082999737325&sfnsn=mo) (M1). The training on Biodiversity Surveys, is continuous, it started in May 2022 with the zooplankton sampling and will continue in the next years.

For the next year (2023) we are planning: (i) repeat the experiment on peixinho development; (ii) second sampling survey, including biodiversity, oceanography (including a collaboration with Portuguese Navy in STP), fisheries and behavior; (iii) courses/workshops on Basic freediving, Scientific freediving, New paradigms in environmental sciences: citizen science and social sciences, and How to do a systematic review of the literature; (iii) training fishing communities to improve their quality of life.

2. Institutions Participating in the Project and Team Leaders

Institution	Researcher in Charge	Participation Annulled or Ceased (end date)
Centro de Ciências do Mar do Algarve (CCMAR)	Vânia Baptista	
Universidade do Algarve (UALG)	Ana Barbosa	
Universidade de São Tomé e Príncipe (USTP)	Hugulay Maia	
ONG Mar Ambiente e Pesca Artesanal (MARAPA)	Manuel Jorge de Carvalho do Rio	

3. Publications

Status	Year	Description	URL
Presented	2022	V. Baptista, M.A. Teodósio, "LittleFish-STP – Coordination and management measures", Marine Africa - UN Ocean Conference Virtual Side Event (ID: OBZB53), June 2022.	https://blueroute2030.com/un-ocean-conference/
Presented	2022	H. Maia, V. Baptista, "LittleFish-STP – Local implementation", Marine Africa - UN Ocean Conference Virtual Side Event (ID: OBZB53), June 2022.	https://blueroute2030.com/un-ocean-conference/
Accepted	2023	V. Baptista, J. Cruz, H. Maia, D. Rosário, E. Santos, P. Wirtz, M.A. Teodósio, "What do we know about the little fish of São Tomé and Príncipe?", accepted (March 2023) for presentation at the 46th Larval Fish Conference, Lisbon, Portugal, May 2023.	
Accepted	2023	C.B. Paris, M.A. Teodósio, A. Syunkova, J. Encarnação, W. Fernandes, J. Bastos, V. Baptista, "Larval swimming and orientation behavior of the amphidromous goby, Sicydium pp., of São Tomé Island", accepted (March 2023) for presentation at the 46th Larval Fish Conference, Lisbon, Portugal, May 2023.	

4. Key Indicators of Physical Implementation

Key indicators	Quantitate
A – Publications	
Books	
Articles in international magazines	
Articles in national magazines	
B – Communications	
Communications in international scientific meetings	2
Communications in national scientific meetings	
C – Reports	1
D – Organization of seminars and conferences	2
E – Advanced Training	
PhD thesis	
Master thesis	
Other	
F – Models	
G - Computational applications	
H – Pilot installations	
I – Laboratory prototypes	
J – Patents	
L – Others	
Publications in conference proceedings	
Websites	1