AFTER-LIFE CONSERVATION PLAN

SAMBAH

Static Acoustic Monitoring of the BAltic Harbour porpoise
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Content

SAMBAH After Life Conservation Plan

Part 1. New innovative methodology

Project history

The SAMBAH project was initiated as a response to the dire situation of the Baltic Sea harbor porpoise. It is classified as critically endangered by IUCN and HELCOM, yet this classification is based on very scarce survey data. This is due to the fact that there are so few porpoises and that the density is so low, and traditional survey methodology, such as aerial or ship-based visual transect surveys therefore fail to generate enough observations for solid abundance estimates and distribution maps. A consortium of concerned people from most EU countries bordering the Baltic Sea was formed to explore the potential of an innovative approach to survey this population. We came to the conclusion that Static Acoustic Monitoring would be able to provide the data necessary for good abundance and distribution estimates. This approach relies on the logging of the porpoises' species-specific echo-location click trains by a large number of anchored click detectors, so-called C-PODs, distributed over the entire Baltic Sea.

The project started in 2010 with a lot of technical and administrative preparations and the data collection was carried out from May 2011 until April 2013. It had four main aims:

1. Estimates of population density and abundance, i.e. the number of porpoises in the Baltic Sea, calculated for the entire study area and for each country
2. Distribution maps showing hotspots, habitat preferences, areas of conflicts with human activities,
3. Increased awareness of the harbour porpoise in society
4. Demonstration of "best practice" for surveying low density echo-locating toothed whale (odontocete) populations

The main finding was that there were two population clusters during the summer, one on the shallow, offshore banks in central Baltic Proper and one in the south-western part, roughly between Bornholm and the Danish mainland. Since this coincided in time with parturition and mating, the offshore banks cluster, numbering a mere 500 porpoises, may be the important genetic basis for the remnant of the "true" Baltic Proper harbour porpoises.

The project has attracted a lot of media and public attention which has resulted in an increased awareness of the porpoise in general and Baltic Sea porpoise in particular.

Current situation

The SAMBAH project was a combination of implementing a best practice project aiming at demonstrating a relatively new way to survey a very low density odontocete population and a survey to provide managers with the information needed for effective conservation measures, such as the designation of Natura2000 areas for the harbour porpoise and defining in which areas and during which time periods by-catch mitigation might be most effective.

The project is now finished and contains no After-SAMBAH conservation or management actions. It is now up to the national and international authorities responsible for the management of the marine environment, as well as other actors in this field, to make use of the results provided by SAMBAH. In the paragraphs below we give suggestions and recommendations for such actions.

SWOT analysis

- **Strengths**: One big advantage with the SAMBAH methodology is that the click loggers can work around the clock, in good weather and bad, and throughout the year and hence obtain high logging effort with relatively low man power. Since it was logging over two full years, it also produced good data for describing seasonal variations, which is extremely useful for managers of the marine environment. Visual surveys only work in daytime and in very good weather (sea state 0-2), which in reality means only in summer time. Another passive acoustics approach with towed hydrophone arrays have the same advantage regarding weather and darkness but since the porpoises are so scattered in the Baltic Sea too few observations have been obtained to allow for solid abundance estimates and distribution maps. An additional important asset with the C-POD system is that it includes a module for automated data processing and analysing of the huge dataset that is generated by this long-term and multi-station approach. As a result the project has successfully created the first density and abundance estimates for almost the entire range of the Baltic Sea porpoise population, and has also produced the first maps of spatial distribution of this population.

- **Weaknesses**: The most important difficulty during the data collection was to avoid the click detectors from being removed by trawling, or by severe storms in shallow areas with big fetch, and the marker buoys being hit and destroyed by ships. There were also problems with foul weather and ice preventing planned servicing of the C-PODs, rendering the batteries in the C-PODs and/or acoustic releasers going flat. Several adjustments to the anchoring setups were done to address these problems, with varying success. In spite of this, we achieved 65% of the theoretically possible logging effort, which we consider a huge

achievement. Another weakness was to obtain enough good data for the effective detection area of the C-PODs. It is related to the detection function which gives the probability of logging a porpoise relative to its distance to the click detector. Measuring this should rather be done as an integrated part of the main data collection, to accommodate for the different hydrological and topographic conditions and seasonal variations that exist in the Baltic Sea, but the technical means for doing this did not exist. Instead a separate project was carried out with the intention to acoustically track porpoises in an area where C-PODs were deployed and hence make it possible to correlate their distance to C-PODs and their swim pattern with the C-POD click loggings. This experiment was first set up in Wales, UK, since earlier studies in this area had shown it to be a good site for porpoise studies, with a stable population of porpoises coming rather close to shore. However no results were achieved since only bottlenose dolphins were observed during the whole field period; it is known that porpoise avoid bottlenose dolphins. A second field experiment was then done in the Great Belt, Denmark, where there are only porpoises. Even though this time there were lots of porpoises that were tracked, this area differs from the Baltic Proper in that the population density is very high, which may not be representative for the low density Baltic porpoises. Also it was limited to a short period of time in the summer and the hydrological conditions then and there, and with the depth limited to ~20m. An attempt to partially compensate for this was done in western Kattegat, this time using visual tracking of the porpoises. These results are not fully compatible with underwater acoustic tracking, but could still be used to give support the results obtained from the Great Belt experiment. Also the playback experiments carried out in Great Belt and in a number of the SAMBAH stations in the Baltic Sea were an attempt to obtain a conversion factor between the Great Belt and the Baltic Proper conditions and to make it possible to compensate for seasonal hydrological factors.

- **Opportunities**: There are several international agreements that require member states to implement conservation measures for the Baltic Harbour porpoise to ensure its long term sustainability. In order to target such conservation measures information on the status of the population and its distribution is of utmost importance and managers in the participating countries have been severely hampered by the lack of such information. SAMBAH can now provide this and managers in the surrounding countries are ready to act as soon as results are available. Also it is vital to be able to control the impact of threats as well as the effect of conservation measures, and hence an effective method to survey the population and its response to such measures is needed. SAMBAH has provided a baseline

survey and the method to monitor the response to conservation measures. Many potentially harmful anthropogenic activities may be restricted in space and time and their negative impact can be reduced or eliminated by timing them to periods were there are no or very few porpoises. SAMBAH has provided the spatial and temporal information that makes this possible.

- **Threats**: The most serious threat to the harbour porpoise in the Baltic Sea, as well as in other parts of its distribution, is by-catch in fishing gear, in particular in large-mesh bottom-set nylon nets, targeting e.g. cod, flatfish and lumpfish. Even though the designation of Natura 2000 areas, with a ban on net fishing inside, will prevent by-catch there, porpoises are mobile and may get entangled and drown in nets outside the protected area. Hence supplementary measures outside protected areas are vital, e.g. the implementation of pinger programs that have been proven to eliminate by-catch. However, in the Baltic Sea pingers are controversial, since they act as "dinner bells" to grey seals that raid and destroy the nets. A possible solution is to develop so called "seal safe" pingers, which are inaudible to seals. Kolmården and the Swedish University of Agriculture are currently carrying out experiments to this end. Another serious threat is the very strong impulsive sounds generated when wind mill foundations are hammered down into the seabed or by so called airguns used during the seismic explorations for gas and oil deposits, deep under the seabed. These sounds may permanently deafen a porpoise if it comes too close, and force more distant porpoises to leave a large area around the construction or exploration sites. It has been shown in some cases of windmill constructions that it takes several years for the porpoises to return. The shallow offshore banks that have been shown to be an important breeding ground for porpoises are also selected for wind power exploitation so eliminating or at least minimizing this conflict must be given the highest priority.

Part 2. The after-LIFE objectives and methodology

Here we discuss the needs, challenges and prioritizations after the end of SAMBAH.

Environmental benefits.

The direct conservation benefit from this project is primarily the new knowledge gained on abundance as well as distribution of porpoises in the Baltic Sea. The results on spatial and temporal distribution will allow for designation of Natura 2000 sites for porpoises, or adding of porpoises on the species lists of relevant existing Natura 2000 sites. This process has already started in Sweden, and Denmark is prepared to designate areas for porpoises in their Baltic EEZ when the SAMBAH results become available. Hence the process to designate new protected areas in the Baltic Sea is

expected to start within the near future. The knowledge on distribution will also make it possible to localize conservation measures to the areas where they have the most effect.

SAMBAH and its results are relevant for several industries and sectors in the marine environment, for example fisheries and marine constructions such as offshore wind energy companies, because the results are expected to affect the legal and regulatory conditions under which they operate, e.g. fisheries regulations and environmental impact assessments (EIAs) required for offshore constructions.

The SAMBAH results will also have impact on the development of Baltic regional policies, such as the further development of indicators in the Marine Strategy Framework Directive (MSFD), follow-up of the ASCOBANS Recovery Plan for Baltic Harbour Porpoises (the Jastarnia plan) and the HELCOM Baltic Sea Action Plan, as well as affecting national policies in the member states around the Baltic Sea. The designation of Natura 2000 sites obviously has impact on the member states' ability to fulfil the requirements of the Habitats Directive in relation to the harbour porpoise. SAMBAH also has bearing on the 7th EU Environment Action Programme which has, as two of nine priority objectives:

- to maximize the benefits of Union environment legislation by improving implementation
- to improve the knowledge and evidence base for Union environment policy

Long-term benefits and sustainability.

The long-term environmental benefit of SAMBAH is primarily the new knowledge gained, on both abundance and distribution of porpoises in the Baltic Sea. With these results, the chances of implementing relevant conservation measures for this population increases considerably, and the prospect for the population improves greatly, although such measures has to be taken without further delay given the small size of the population and the need to mitigate the most immediate threats towards it. The actions within SAMBAH are considered finished but results will be continued to be disseminated by the SAMBAH project partners in different ways, for example through scientific publications and through information being available at two of the public tourist destinations that were active as project partners (Kolmården and Hel Marine Station). SAMBAH data has been made available through action D6, and the wealth of information in this dataset ensures that it will be used for further studies in the future. For example a small study on the spatial distribution of feeding behaviour has been funded by ASCOBANS and will be carried out during 2016. Additionally, the proposed MAMBO project was initiated to use the results from

SAMBAH to develop tools for a transnationally coherent management plan of the Baltic Sea harbour porpoise population.

There are requirements, from both the Habitats Directive and the MSFD, to monitor harbour porpoises. Again, SAMBAH results serve as a baseline here, and the methods used in SAMBAH are likely to be used in future monitoring. The national competent authorities were partners in SAMBAH, and they are therefore well informed on results and methods when faced with the task to carry out this monitoring. Monitoring is currently being discussed both nationally and within regional bodies such as HELCOM, and the issue has been raised in the ASCOBANS Jastarnia group to have repeated SAMBAH-like surveys every ten years or so.

Through EU regulations such as the Habitats Directive, the management of the harbour porpoise population in the Baltic Sea rests on the shoulders of national authorities, and efforts are also taken within the framework of HELCOM. The results of SAMBAH will be used extensively in the management planning and carrying out of conservation actions in the project area. All competent authorities in project countries were involved as partners in SAMBAH and the project results have been urgently asked for by both national bodies and international organizations such as HELCOM and ASCOBANS.

The threats to the Baltic Sea harbour porpoise remain the same as before SAMBAH; by-catch in fisheries is the most immediate threat, but environmental contaminants, underwater noise and ecosystem changes are also serious threats. By-catch in fisheries and underwater noise is addressed in the proposed MAMBO project, where (if funding is granted) these threats will be investigated and localised, and relevant mitigation measures be proposed.

Replicability, demonstration, transferability and cooperation.

The methods used in SAMBAH are clearly replicable and can be transferred to other geographical areas all over the world. They are well suited for studies of abundance and distribution of small cetaceans that emit echo-location clicks, especially so for low-density populations, where visual or towed acoustic survey methods do not render sufficient data. Economically, the SAMBAH methodology is cost-efficient compared to other methods in such low-density populations.

Similar methodology have already been implemented to assess the status of the vaquita (*Phocoena sinus*) population in the Gulf of Mexico, and a project proposal was submitted in February, 2016, designed to investigate the distribution of the Fransiscana dolphin (*Pontoporia blainvillei*) in Brazil using C-PODs. The latter will be done in cooperation with SAMBAH project coordinator Mats Amundin. SAMBAH has been presented at numerous scientific conferences both in Europe and scientific fora outside Europe. This has raised the awareness in the scientific community about the

project and the methods used, and it has rendered great interest. The scientific community is the primary target for spreading knowledge of the methods used in this project, since this type of surveys is not a commercially viable product at this point in time.

Best practice lessons.

The best practice methodology used in SAMBAH were based on well-established practical Static Acoustic Monitoring (SAM) methods for local or regional monitoring of relative population densities and seasonal variations of cetaceans , combined with recently developed or refined analytical methods for estimating absolute density and abundance from SAM data and established species distribution modelling methods. Estimation of absolute density was based on a concept from the distance sampling survey literature, i.e. that of the Effective Detection Area (EDA), supplemented by auxiliary data necessary for the C-POD detection function (see below). General Additive Modelling was used to investigate spatial distribution of porpoises in the study area.

In future SAMBAH-type surveys the experienced problems with the data collection need to be seriously addressed. The obtained logging 65% effort was indeed a great success, considering the very harsh conditions in the Baltic Sea, especially during the winter season. Storms and ice delayed planned servicings and with the employed servicing schedules this sometimes led to data losses. More frequent servicings (approximately every 3 months) are recommended, which would give bigger margins for delays, both by ensuring that batteries do not go flat and that if the C-POD is lost, the lost data is for a shorter period of time. Of course this will have economic consequences.

Also the trawling problem needs to be solved so enough effort can be obtained even in heavily trawled areas, such as the Riga Bay and around Bornholm. The Polish “trawl-resistant” anchoring system hold promise and should be further refined, although the problem will likely never be fully resolved.

With the employed single C-POD stations no data on distance to a logged porpoise could be obtained, and hence traditional distance sampling analysis methods could not be applied. To solve this elaborate compensatory experiments and data collection in waters outside the surveyed area was carried out. This was not optimal. Therefore a “ranging SAM” unit should be developed, and deployed in a big enough proportion of the stations to generate statistically valid distance data (approximately 10% of stations). A limited number of such units can be rotated between stations, in order to get samples from as many stations as possible; in this scheme the seasonal variations in hydrological conditions should be taken into account. This may require more frequent servicing of these stations and longer handling during hauling and re-deployment adding costs.

Protection of the reproduction area in central Baltic Proper.

SAMBAH has identified a population cluster during the summer on and around the offshore banks (North and South Mid Sea Banks; Hoburg Bank) in central Baltic Sea. This cluster coincides temporally with parturition and mating. Hence, since there seems to be very little connection with the cluster in the south-western part of the Baltic Sea, these banks may constitute an important breeding site, and maybe the main genetic basis for the remaining Baltic Proper porpoises. Hence we strongly recommend that this area will be designated as a Natura2000 area, with specific and targeted conservation provisions that ensure that harbour porpoise reproduction is not hampered in any way. Activities that should be completely prevented at least in this period (May-October) are pile driving of wind mill foundations, underwater blasting work, and gillnet fishing. Since porpoise by-catch is virtually impossible to monitor directly in the Baltic Sea, its potential impact in areas outside Natura 2000 areas can be assessed by temporal and spatial overlap analyses where fishing effort is compared with porpoise distribution, as described for Swedish EEZ in Action C5 and the Appendix II of the Non-Technical Report. This will enable e.g. targeted use of pingers, and maybe lead to recommendations of fishing closure in some areas in some periods, unless alternative fishing gear with no by-catch is used. Also it should provide a strong incentive for the development of such porpoise-safe (as well as seal- and bird-safe) fishing gear.

Baseline for future surveys.

The obtained density and abundance data provided here will serve as a baseline for future surveys in order to detect population trends and/or the effect of conservation or mitigation measures. The scale of SAMBAH should be compared to that of the SCANS surveys, and it can be argued that like them, future SAMBAH needs not be repeated more often. However, there is still a need for more frequent monitoring, since the Baltic Proper harbour porpoise population is so small and hence very sensitive to negative impacts. Therefore smaller-scale, SAMBAH-type monitoring (“mini-SAMBAH”) in selected areas in the Baltic is highly recommended. “Mini-SAMBAH” surveys should be carried out in areas shown to be of great importance for the population. It is important to coordinate these monitoring actions between countries, so the results can be useful in their reporting according to the Habitats Directive, article 17 (every 6th year), to follow up ASCOBANS’ Jastarnia plan and to make it possible to develop new predictors for the Marine Strategy Framework Directive. One possibility would be to run full scale SAMBAH-style surveys every 12th year and smaller scale surveys in between. The needs for future monitoring should be coordinated internationally, as suggested by the MAMBO proposal submitted to LIFE in October 2015.

"Mini-SAMBAH" design.

Using a "mini-SAMBAH" type survey on and around the shallow offshore banks in central Baltic Proper as an example, this area is almost entirely in the Swedish EEZ and hence this survey can be entirely carried out by Swedish personnel. With the same grid as in SAMBAH, around 25 C-PODs would be needed. By using the same grid as in SAMBAH, the data from such a smaller survey can be analysed by applying the statistical models developed by SAMBAH, to generate density and abundance estimates, provided that the assumption that the SAMBAH EDA values will still be valid holds true. If not relative densities will still make it possible to trace trends. Including travel from e.g. Karlskrona (which is a big port situated in southern Sweden, and hence a good starting point) to the study area a servicing cruise would take ca. 4 days, provided an around the clock schedule for the servicing. Another option would be to use the Swedish research vessel Skagerak II, which has its home port in Gothenburg on the Swedish west coast. The cost assessments for these two options are shown in Table 1 and 2 under "Financial Outlook". The research personnel have to be trained in advance in handling the C-PODs and the anchoring equipment, and according to Swedish maritime regulations they should have completed a sea safety course. As mentioned above a SAMBAH type survey needs to be planned and carried out by a consortium of scientific experts, like the SCANS surveys, since the methods used are not yet part of a commercial product.

Institutional issues.

Monitoring and managing the harbour porpoises in the Baltic Sea are ruled by international agreements, such as ASCOBANS, HELCOM, the Habitats Directive and the Marine Strategy Framework Directive. This requires the responsible authorities in each of the member states to cooperate and to coordinate monitoring and mitigation measures. SAMBAH has significantly expanded the knowledge base on the Baltic Sea harbour porpoise, thereby improving the possibilities to execute legislative decisions such as designating Natura 2000 sites for the species. In October 2015 a proposal was submitted to LIFE Nature and Biodiversity for a project called MAMBO – Management Actions and Conservation Measures for the Baltic Sea Odontocete. This project aims at using SAMBAH results to enable cost-effective transnational management of the harbour porpoise populations in the Baltic region, hence improving implementation of environmental legislation related to porpoises in this region. MAMBO will also carry out a Population Viability Analysis and estimate the Potential Biological Removal for the population in order to assess the impact of by-catch. It will include a number of local surveys, targeting for example the shallow offshore banks in central Baltic Sea. Like mentioned above, this area lies almost entirely within the

Swedish EEZ and hence it is recommended that the Swedish Agency for Marine and Water Management takes the responsibility to make sure that future surveys will be carried out here.

We also recommend that an ASCOBANS sub-group, for example the Jastarnia group, takes the responsibility for planning the full-scale SAMBAH II survey in 2025-26. When these two surveys have been carried out, a coordinated evaluation should be done by the responsible managing authorities in the Baltic region.

Political challenges.

Like stated above, important threats to the harbour porpoise are by-catch in fishing gear and noise from offshore constructions such as wind power parks and oil and gas explorations. Commercial fishermen generally claim that by-catch is not a problem because they believe that there are no porpoises in the Baltic Sea. Now that SAMBAH has proven this to be false, it remains to be seen how fishermen will respond to reiterated demands on them and their organizations to contribute actively to a substantial reduction in by-catch. This will be a challenge since so far it has been impossible to assess the extent of the by-catch, because on-board observers in most cases are impossible due to the small size of the fishing boats. Instead risk assessment will have to be carried out, based on statistical comparisons of fishing effort and porpoise density in space and time. The optimal solution would be to replace gillnets with alternative fishing gear, such as cod pots, which have no by-catch of porpoises, seals or sea birds. But until this can be fully implemented, it may be possible to convince gillnetting fishermen to eliminate porpoise by-catch by using pingers, and provided that the new “seal-safe” pingers (not to be used inside the protected areas), that Kolmarden and the Swedish University of Agriculture in Sweden are developing, will work, this will hopefully be easier. However, since the Council Regulation (EC) No 812/2004 only requires fishing vessels longer than 12m to use pingers, there is also an urgent need to expand this regulation to also include smaller boats, because these boats also have porpoise by-catch. Until this has been achieved, campaigns targeting the small-boat fishermen to convince them to voluntarily use pingers are urgently needed. In Sweden this would be a task for the Swedish Agency for Marine and Water Management.

When it comes to offshore constructions, SAMBAH has identified the offshore banks in central Baltic Proper to be an important breeding ground. Theoretically it would be easy to just prohibit construction works during the summer, but in practice moving this to the fall-winter is not trivial considering the prevalence of foul weather and ice in this period. It may be difficult for the authorities that are responsible for issuing permits for such constructions to resist the economic pressure from the industry and the political pressure from society, since “green” power production,

in the light of global climate change, is of such big national importance. Sweden has recently, in a decision for permit for a wind power installation on the Swedish west coast, adopted a German regulation, which states maximum noise source levels of piling noise that must not be exceeded. Even though this is a positive initiative, from the porpoise's point of view, it is highly recommended that the actual effect of it is measured. On another positive note there is also a raising awareness within the wind power industry of the negative impact on marine life of their operations that may prompt the development of new construction methods for the foundations, so pile driving can be avoided. The same is true for seismic surveys; other sound types are being tested which allows the source level of the sound generators and the noise leakage to the surroundings to be reduced.

Financial outlook

Assuming that our recommendation of a "mini-SAMBAH" in 2018 (based on 25 positions) and a new, full scale SAMBAH survey in 2025-26 is taken, a rough cost assessment for these two specified actions can be done. The one for the "mini-SAMBAH" should be considered as guideline for estimating smaller-scale surveys in other countries. SAMBAH II would probably require similar funding as SAMBAH I, i.e. in the order of magnitude of 5 million Euros. The marking buoys for Sweden need to be supplemented, corresponding to a cost of ca. 15,000€. Some C-POD and buoys losses will have to be expected, so some provisions to cover these must be included in the budget. A proportion of the stations should be provided with a "ranging SAM" setup, which requires six C-PODs instead of just one, thus adding to the costs. Assuming the 10% of the stations would suffice, 180 extra C-PODs would be added to the total 300 units. This would add ca. 200,000€ to the total budget.

A "mini-SAMBAH" may be limited to one-year data collection on the offshore banks in central Baltic Sea, and maybe some of the potential wintering grounds in Sweden and Poland. The high densities found in the south-western part of the Baltic Sea may make it worthwhile to combine such a "mini-SAMBAH" with several towed-array surveys, covering the four seasons and/or aerial or ship-based visual SCANS-type surveys, to validate the SAMBAH methodology.

Using a "mini-SAMBAH" survey on the offshore banks in central Baltic Proper in Swedish EEZ as an example and assuming that existing C-PODs will cover the needs, a cost assessment has been done; it is presented in Tables 1 and 2. The ship costs are based on two scenarios: 1) hiring a commercial fishing vessel (the SAMBAH costs for such a ship for Sweden have been used) and 2) engaging the Swedish research vessel Skagerak II, in which case costs for the Skagerak I during SAMBAH have been used, since the ratings for the new ship are not yet known. On top of these data collection

costs, the costs for project management, analysis and reporting need to be added. The total costs sum up to 148,000-225,000€, depending on what ship is used for the field work.

Table 1. Cost assessment for the field work of a "mini SAMBAH", lasting one year, limited to 25 positions on the offshore banks area in central Baltic Sea and only within the Swedish EEZ. Days at sea in the R/V case include the ship's return travel from its Gothenburg base to the study area; research personnel are picked up in Karlskrona, Sweden. The F/V ship is assumed to be based in Karlskrona, Sweden.

	Ship F/V	Ship R/V
No positions	25	25
No cruises	5	5
Days at sea	17	32
Ship cost	€ 153,988	€ 92,041
Buoy equipment	€ 2,509	€ 2,509
Travel and transport	€ 1,000	€ 1,000
Personnel	€ 43,199	€ 46,013
Total cost	**€ 200,696**	**€ 141,563**

Table 2. *Cost assessment for project management, analysis and reporting of data from a "mini SAMBAH", limited to 25 positions on the offshore banks area in central Baltic Sea.*

No of positions	25	
No of deployments	4	
Resulting raw data files	100	
Cleaning metadata	100	hours
Raw processing	100	hours
Exports	60	hours
Research assistant	**7,638**	**€**
Project management	**38,400**	**€**
Density analysis	320	hours
Distribution analyses	320	hours
Reporting	320	hours
Senior researcher	**38,400**	**€**
Total costs	**84,438**	**€**