**INTERNATIONAL COMMISSION FOR THE CONSERVATION OF ATLANTIC TUNAS**

**COMMISSION INTERNATIONALE POUR LA CONSERVATION DES THONIDES DE L'ATLANTIQUE**

ICCAT  CICTA  CICAA

**COMISION INTERNACIONAL PARA LA CONSERVACION DEL ATUN ATLANTICO**

Madrid, 19 April 2022

# ICCAT GBYP CIRCULAR # G-0434/2022

**SUBJECT:** **CALL FOR TENDERS ICCAT GBYP 05/2022 – AERIAL SURVEY INCORPORATING DIGITAL SYSTEMS FOR THE MONITORING OF BLUEFIN TUNA SPAWNING AGGREGATIONS IN THE MEDITERRANEAN SEA (ICCAT GBYP – PHASE 11)**

I should like to transmit the Call for Tenders ICCAT 05/2022 - Aerial survey incorporating digital systems for the monitoring of bluefin tuna spawning aggregations in the Mediterranean Sea, under the Atlantic-Wide Research Programme for Bluefin Tuna (GBYP).

I would be grateful if you could distribute this Call for Tenders to qualified people and institutions that might be interested.

Please accept the assurances of my highest consideration

*Executive Secretary*

Camille Jean Pierre Manel

**DISTRIBUTION:**

– **Commission Officers:**

| | | | |
|---|---|---|---|
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– **Head Delegates/Head Scientists**

– **Cooperating Parties, Entities or Fishing Entities**

**Attachment:** Call for Tenders 05/2022, including area survey sampling design and budget.

**CALL FOR TENDERS ICCAT GBYP 05/2022**

**PILOT AERIAL SURVEY INCORPORATING DIGITAL SYSTEMS FOR THE MONITORING OF BLUEFIN TUNA SPAWNING AGGREGATIONS IN THE MEDITERRANEAN SEA (ICCAT GBYP – PHASE 11)**

**GBYP aerial surveys objectives and background**

The main objectives of the ICCAT Atlantic-Wide Bluefin Tuna Research Programme (GBYP) are to improve: (a) the understanding of key biological and ecological processes, (b) current assessment methodology, (c) the management procedures, and (d) advice.

Key tasks are to reduce uncertainty in stock assessment and to provide robust management advice. This requires improved knowledge of key biological processes and parameters. Currently almost all the data used in stock assessments are obtained from fisheries-dependent data, which can be affected by changes in exploitation patterns and TACs. It is therefore important to obtain data from alternative sources, such as fishery independent indices, in order to verify the assumptions made when conducting the assessments or to improve the current data sets used in OM or MSE.

Therefore, one of the major research tasks under the ICCAT Atlantic-Wide Research Programme for Bluefin Tuna (GBYP) has been the aerial survey for spawning aggregations (AS), which has already been carried since 2010 (all documents are available here), aiming to provide a fishery-independent index of relative abundance of spawning stock biomass.

The GBYP AS has faced numerous logistical challenges, which have resulted in changes in survey design and data processing to standardize methodologies and improve the accuracy of the index. Consequently, a new in-depth revision of the whole GBYP AS program was carried out in 2020 by two external experts (Vølstad 2020 and Buckland 2020) who detected some inconsistencies in the currently available AS index time series and presented several recommendations for its improvement, which were considered by the SCRS Species Group. One of these recommendations was to start moving to digital observing and counting systems to substitute human observers-based system, and another was to extend, if possible, the surveyed areas. In addition, in 2021 a global reanalysis of the whole time series was carried out to further refine the database and generate an improved index time series based on fully standardized analytical procedures.

In 2021, a pilot aerial survey was carried out in the Balearic Sea area, aiming at evaluating the feasibility of using digital systems for the monitoring of BFT spawning aggregations and its accuracy and precision, as compared to the classic human observers-based system.

Considering the results from this pilot survey and those from the global revision and reanalysis of the time series carried out in 2021, as well logistic constraints and available budget, the GBYP Steering Committee has decided to resume the aerial survey for bluefin tuna spawning aggregations in the core areas of the Western and Central Mediterranean Sea in 2022, incorporating again digital systems for recording and characterizing BFT spawning aggregations, in addition to classic human observers-based system. The three sub-areas to be surveyed are the following: Balearic Sea (Area A), Southern Tyrrhenian Sea (Area C) and Central-southern Mediterranean Sea (Area E).

Funds have been made available under GBYP Phase 11, for covering the related costs.

Consequently, this Call for Tenders is launched, for public or private entities, be they scientific institutions or interested companies, for the submission of proposals to carry out the full project, detailed in the following paragraph.

**Contractor tasks**

The Contractor will work in close consultation with the ICCAT GBYP Coordinator and the GBYP Steering Committee and, if required by GBYP, on the advice of an expert nominated by GBYP, who could participate some days during the survey as an onboard scientific observer, substituting one of the scientific observers hired by the company. The Contractor will conduct aerial surveys in one or more sub-areas covering the

spawning aggregations, identified in the attached maps, according to the sampling design attached (**Attachment 1**). The three sub-areas to be surveyed are the following: Balearic Sea (Area A), Southern Tyrrhenian Sea (Area C) and Central-southern Mediterranean Sea (Area E). The Contractor is responsible for obtaining the flight permits.

The Contractor will develop a paired pilot aerial survey targeting BFT spawning aggregations, combining classic visual observations and recording of digital images. The survey will be conducted following the sampling strategy defined in the attached files, where the coordinates of several series of replicas of transects are defined.

The survey will be conducted in the period from the end of May to the beginning of July 2022. The spotting and digital image recording altitude will be 300 m. The distance covered in a one-hour flight should be about 100 nm, with about 6 on-duty flight hours per day. It is reasonable to take into account adverse weather forecasts for 20% of the days (bad weather conditions mean winds over 3 on the Beaufort scale, or low clouds at less than 300 m altitude, or heavy rain, which prevent reliable observation of tuna schools close to the sea surface). For the visual observations it is mandatory to apply the aerial survey protocol. In parallel to the visual observations carried out by the professional and scientific spotters on board, high quality digital images will be recorded covering 100% of the surveyed transects "on effort" by an imaging system, preferably gyroscopically stabilized, able to geolocate and store all the images generated within the flights. The width of the surveyed strip will be no less than 600 m, and the resolution of the images no less than 5 cm by pixel, in any case enough for taxonomic identification of target individuals at species level. Additional images of all the spotted schools will be taken "off effort" overflying these schools at an altitude of 300 m, once the plane has finished the encircling flights to allow a better characterization of the school by human observers and before re-joining the transect to continue the "on effort" prospection. The digital images taken "on effort" and "off effort" must be properly labelled to allow to distinguish clearly both types, since they must be processed separately. The stored images taken "on effort" will be post processed for detection, identification and quantification of megafauna, focusing on BFT, generating a georeferenced database useful to calculate an aerial survey index following strip-transect methodology with Distance software. The images taken "off effort" of the detected schools will be also postprocessed, aiming at getting estimations of the total abundance and percentages of individuals belonging to different size groups, to be used for comparative analyses between estimations from observers on the field and those based on postprocessing of digital images.

The operational budget for these pilot campaigns is sufficient for several replicates according to the survey design. The objective is to get four replicates in each area, and unless "force majeure" reasons concur, the minimum number of complete replicates by areas will be three.

The offer is to specify the following: (a) type of aircraft (adequate for aerial spotting, possibly with upper wings, two propellers and good forward visibility, mandatorily equipped with bubble windows, one on each side); (b) availability of a pilot and a professional tuna spotter; (c) availability of two scientific spotters, belonging to scientific institutions that are independent from the fishing industries; (d) survey time provided for each replica in areas "in" and "out"; availability of expert(s) for digital images postprocessing. The total number of days envisaged for field operations is 30, plus a maximum of 20% additional days as stand-by time for adverse weather conditions.

The Contractor will provide a full GPS recording of all flights and sighting positions, together with the necessary way points when relevant. In addition to automated recording of images over the transects, all sightings by human observers will be also documented with photos, preferably using a high resolution, geo-stabilised, GPS tagging, electronic camera. All photos will be delivered along with the final report.

The Contractor will provide, after the end of the field operations, a copy of the images recorded by the automated digital image system and the database resulting from the post-processing of such images.

The Contractor will provide the sightings forms from visual observations to ICCAT GBYP, duly filled, at the end of each week (24 hours maximum after the last flight), in order to allow for real-time checks and corrections.

The awarded Contractor will ensure the participation of one official representative, the pilot(s), the professional spotter(s) and the scientific spotters in an online training course (1 day) to be held prior to the starting of field operations, possibly at short notice. Participation in the course is mandatory. The Contractor will provide photos and the personal details of all the staff working on the survey before the training course.

**Contractor minimum qualifications**

➢ Documented multi-year experience in bluefin tuna studies and/or aerial surveys or censuses of marine populations; previous experience in tuna aerial survey is preferred.

➢ Availability of an adequate aircraft for aerial spotting, including a technical description of the aircraft equipped with two bubble windows (one on each side) and a digital high quality image recording system, preferably gyroscopically stabilized, able to provide the georeferenced high-resolution images described in the previous section, piloted by a licensed pilot having documented experience in this field.

➢ Availability of at least one professional tuna spotter, who has documented multiyear experience in this field.

➢ Availability of at least two scientific observers, preferably with previous experience in tuna fisheries or biology, aerial surveys and/or census of marine populations, and who pertain to scientific institutions or entities independent of the fishing industries and who hold a University degree in one of the following: Fisheries Science, or Marine Biology or Natural Sciences or Biological Sciences or Environmental Sciences or closely related fields. At least one of these spotters should have demonstrated experience in the use of the automated digital image recording system.

➢ Availability of at least one expert in digital images postprocessing for identification and characterization of megafauna, especially BFT.

➢ Excellent working knowledge of one of the three official languages of ICCAT (English, French and Spanish). A good command of English is highly desirable.

➢ Bank or Insurance guarantee for the amount of the contract, to be provided before signature of the contract.

**Request for bids**

Interested entities **should submit an offer only** to the ICCAT Executive Secretary (camille.manel@iccat.int), with copy to Ms. Ana Martinez (ana.martinez@iccat.int) by **9 May 2022**, including:

a) A detailed offer, describing in detail the type of spotting aircraft and the automated digital imaging recording system to be used for the survey, the methodology followed for the postprocessing of digital images, the minimum number of flight hours to be guaranteed in total, the maximum number of stand-by days, the date for the interim report and the date for the final report;

b) The curricula of the pilot, the professional spotter and the scientific observers;

c) The curriculum of the institution or company applying for the GBYP Pilot Aerial Survey 2022, with any documented experience in aerial survey or marine population survey, to include recent and relevant contracts for the same or similar items and other references (including contract numbers, points of contact with telephone numbers and other relevant information);

d) A detailed estimated budget for the aerial survey, specifying the cost, including number of working days, to cover four replicates, according to the attached table (**Attachment 2**). It should include also the estimated duration and cost of digital images post-processing tasks;

e) The name, address, VAT/tax number and telephone number of the tendering body, along with the contact number of the person responsible for field activity;

f) The institutional and administrative background of the tendering body (e.g. statutes, type of institution, annual budget, budget control procedures, etc.);

g) If the aircraft proposed for the survey does not belong to the tendering body, then a declaration from its owner should be included, to define the availability of the aircraft for this duty and to ensure that the aircraft is properly insured for all risks by a primary insurance company; a copy of the subcontract or MOU should be also provided;

h) A detailed list of any subcontracting activities;

i) The declaration that the offering institution will strictly follow the aerial survey design and the protocol provided by ICCAT GBYP prior to the beginning of the surveys, along with the forms to be used for the survey, and the administrative rules specified in the contract;

j) A declaration that all the comments eventually made on the draft final report will be incorporated in the final report;

k) A completed copy of the operating license and authorization (if applicable) and any administrative document, released by the competent public authority, demonstrating that the offering institution is authorized to operate the aerial survey;

l) A declaration that the offering institution will provide an insurance guarantee for the full amount of the contract, before its signature;

m) A declaration that the offering institution will be covered by full insurance for the aerial survey to be carried out according to the Call for tenders, excluding ICCAT from all liability concerning the work to be carried out by each offering institution;

n) Acknowledgment of this Call for tenders;

o) A statement specifying the extent of agreement with all terms, conditions, and provisions herein included.

Offers that fail to furnish the required documentation or information or reject the terms and conditions of the Call for tenders may be excluded from consideration.

Contractors can be either research institutions such as government or private laboratories, universities, or private consultancy firms or other entities having the required qualifications.

The Contractor will be available to report to any meeting requested by ICCAT.

The Contractor will take onboard an expert scientific observer appointed by ICCAT GBYP at any time, at short notice.

The ICCAT Secretariat will make a selection of the offers and will decide the contract to be awarded. The awarded entity will be notified shortly afterwards.

**Deliverables**

1. The sighting forms and a report on automated image recording operations concerning the first week of activities to be submitted by e-mail the day after the first week of operations, at the latest, with the GPS tracks (electronic) and brief notes on specific problems.

2. The sighting forms and a report on automated image recording operations concerning the second week of activities to be submitted by e-mail the day after the second week of operations, at the latest, with the GPS tracks (electronic) and brief notes on specific problems.

3. The sighting forms and a report on automated image recording operations concerning the third week of activities to be submitted by e-mail the day after the third week of operations, at the latest, with the GPS tracks (electronic) and brief notes on specific problems.

4. The sighting forms and a report on automated image recording operations concerning the fourth week of activities to be submitted by e-mail the day after the fourth week of operations, at the latest, with the GPS tracks (electronic) and brief notes on specific problems.

5. The sighting forms and a report on automated image recording operations concerning the fifth week of activities to be submitted by e-mail the day after the fifth week of operations, at the latest, with the GPS tracks (electronic) and brief notes on specific problems.

6. The draft final report on field operations to be submitted at the latest by **10 July 2022**, including:

   a) Full description of the work carried out during the aerial survey;

   b) Detailed description of the methodology;

   c) Detailed maps of the areas in which the aerial survey was carried out, according to the aerial survey design;

   d) Maps with the GPS tracks of the survey, by date;

   e) Detailed maps of the sightings, with GPS positions;

   f) Full copy of the official sighting forms, complete with full details;

   g) Complete copy of the photos and videos of visual observations taken during the survey (on appropriate digital storage medium), including their reference;

7. The draft final report on automated digital images recording to be submitted at the latest by **25 July 2022**, including:

   a) Copy of recorded images, separating those taken "on effort" and "off effort";

   b) Database of raw results of image postprocessing tasks, separating those taken "on effort" and "off effort". In both cases the correspondence between the results on a given school generated during the field surveys by human observers and those from the post processing of images, whenever possible in the case of "on effort" images (it is when the spotted school was within the strip covered by the digital system), and in all "off effort" images, must be clearly established.

8. Draft Final global Scientific report, to be submitted at the latest by **28 July 2022** including, besides the two aforementioned draft reports on field activities and post-processing operations,

   a) A global summary of main results, conclusions, problems encountered and recommendations for improvement of future surveys.

   b) A PowerPoint presentation of such Summary for the ICCAT SCRS Bluefin Species Group Session or any other ICCAT SCRS meeting.

9. The definitive final report, to be prepared taking into account the eventual comments provided by ICCAT, and the full administrative report including copies of all administrative documents, to be submitted by **31 July 2022**, at the latest.

**Payment details**

Disbursements will be made according to the following schedule:

1. 40% of the total amount of the contract upon signing of the contract;
2. 40% upon providing Deliverable No. 5;
3. 20% after approval of the final report upon incorporation of comments made by ICCAT and approval of the administrative documents.

**Logistics**

All documents provided by the Contractor must be in MS Word or compatible software, tables must be in Excel format or compatible, figures and pictures must be in JPEG or TIFF format or compatible. All documents submitted must be in English, French or Spanish.

**Copyright**

All of the material produced by the Contractor will remain the property of ICCAT GBYP and must be kept confidential.

**References**

Buckland S.T. 2020. Independent peer review of the revision of GBYP aerial survey design, implementation and statistical analyses (ICCAT GBYP 12/2020) of the Atlantic-wide research programme for bluefin tuna (ICCAT GBYP Phase 10). Collect. Vol. Sci, Paps. ICCAT 77(2): 977-987.

Vølstad J.H. 2020. Review of the revision of GBYP aerial survey design, implementation and statistical analyses (ICCAT GBYP 12/2020) of the Atlantic-wide research programme for bluefin tuna (ICCAT GBYP Phase 10). Collect. Vol. Sci, Paps. ICCAT 77(2): 988-1005.

# Area A – Balearic Sea

**Replica 1**
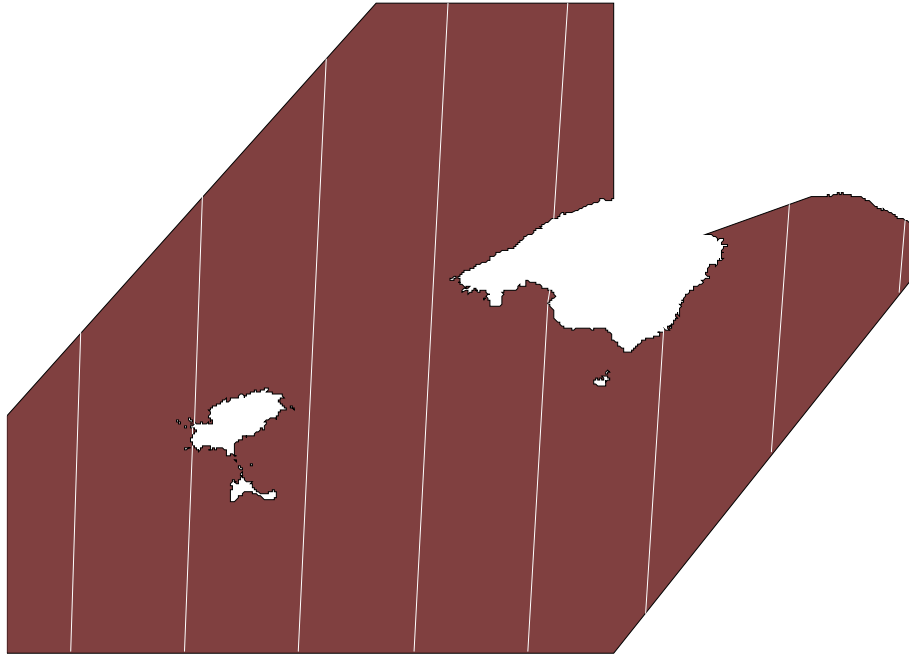


Sample layer name:  Replica 1
Type of sampler:    Line
Number of samplers: 8

List of samplers:
  x-coord  y-coord

 Sampler 1
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  0.7510964 39.35616
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 Sampler 2
  1.18965 38.00578
  1.223444 38.8756
  --
  1.225183 38.9196
  1.226264 38.94691
  --
  1.226866 38.96213
  1.266103 39.93437
  --
 Sampler 3
  1.672063 38.00697
  1.789901 40.51007
  --
 Sampler 4

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  2.302854 40.73841
  --
Sampler 5
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  2.724313 39.47151
  --
  2.724796 39.47936
  2.727942 39.53037
  --
  2.746509 39.82922
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  --
Sampler 6
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  3.208869 39.35724
  --
  3.209051 39.35991
  3.209705 39.36948
  --
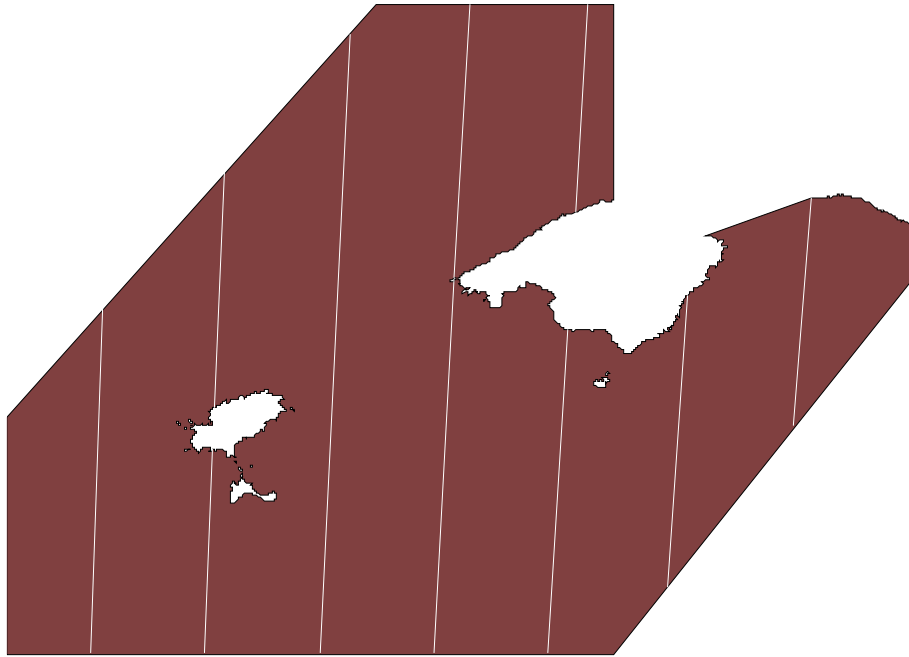Sampler 7
  3.662232 38.84454
  3.741367 39.89382
  --
Sampler 8
  4.20538 39.5188
  4.230945 39.82466
  --

## Replica 2



```
Sample layer name:  Replica 2
Type of sampler:    Line
Number of samplers: 7

List of samplers:
    x-coord  y-coord

  Sampler 1
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    0.8412835 39.45829
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  Sampler 2
    1.274717 38.00613
    1.309005 38.8628
    --
    1.316279 39.04103
    1.357818 40.03607
    --
  Sampler 3
    1.757122 38.00697
    1.883199 40.61131
    --
  Sampler 4
    2.239446 38.00583
    2.324733 39.57843
    --
    2.325262 39.58787
    2.391311 40.73853
    --
  Sampler 5
    2.721644 38.0027
    2.804898 39.37204
    --
    2.835907 39.86251
    2.892899 40.73792
    --
```
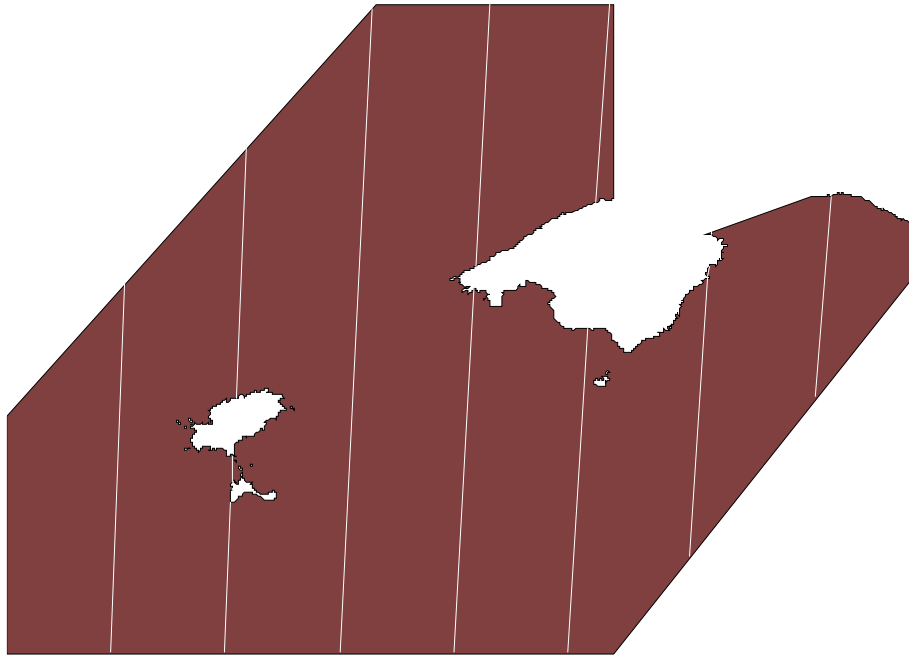
```
Sampler 6
  3.222773 38.28687
  3.306228 39.51025
  --
Sampler 7
  3.757229 38.96366
  3.831179 39.92511
  --
```
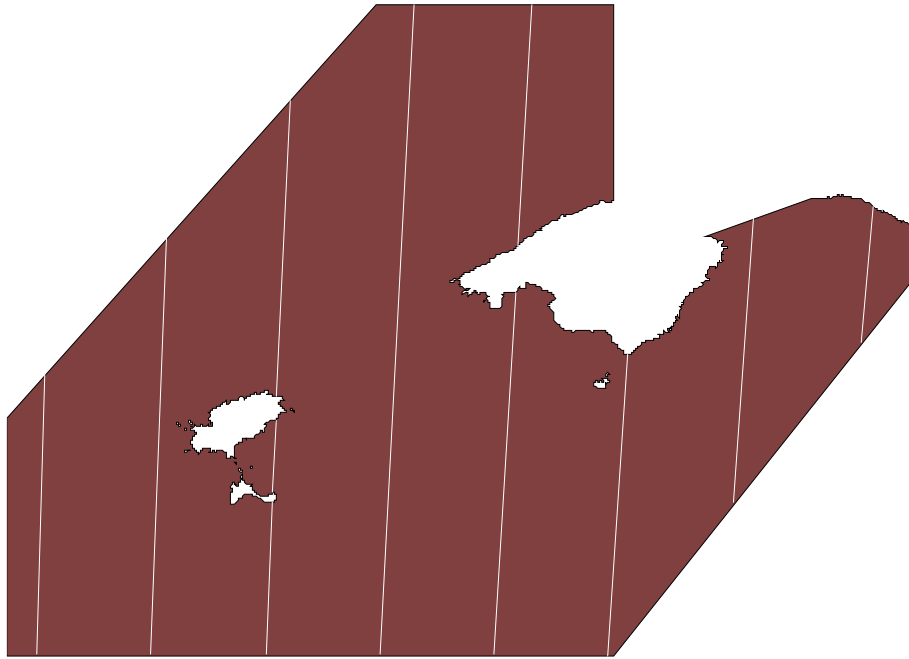
**Replica 3**



```
Sample layer name:  Replica 3
Type of sampler:    Line
Number of samplers: 7

List of samplers:
    x-coord  y-coord

  Sampler 1
    0.8773497 38.00396
    0.9317359 39.56035
    --
  Sampler 2
    1.359784 38.00642
    1.385616 38.63603
    --
    1.387722 38.68669
    1.388023 38.69394
    --
    1.389094 38.71967
    1.393867 38.83401
    --
    1.403894 39.07259
    1.449807 40.13769
    --
  Sampler 3
    1.842178 38.00691
    1.976782 40.71246
    --
  Sampler 4
    2.324483 38.00542
    2.409145 39.53399
    --
    2.414587 39.62902
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    --
  Sampler 5
```

```
  2.806654 38.00195
  2.89149 39.37038
  --
  2.925738 39.9011
  2.98133 40.73758
  --
Sampler 6
  3.316265 38.40643
  3.397959 39.57832
  --
  3.398578 39.58698
  3.401831 39.63242
  --
  3.411213 39.76297
  3.412319 39.77832
  --
Sampler 7
  3.852556 39.08268
  3.918839 39.92843
  --
```

## Replica 4



```
Sample layer name:  Replica 4
Type of sampler:    Line
Number of samplers: 8

List of samplers:
   x-coord  y-coord

  Sampler 1
    0.5650522 38.0013
    0.6009678 39.18531
    --
  Sampler 2
    1.047488 38.00505
    1.113444 39.76424
    --
  Sampler 3
    1.529913 38.00682
    1.557605 38.64508
    --
    1.559325 38.6842
    1.57278 38.98827
    --
    1.577543 39.09503
    1.634618 40.34069
    --
  Sampler 4
    2.012281 38.00661
    2.155023 40.73807
    --
  Sampler 5
    2.494545 38.00442
    2.582864 39.53265
    --
    2.594508 39.72706
    2.656663 40.73848
    --
```

```
Sampler 6
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  3.058035 39.26683
  --
Sampler 7
  3.504205 38.64526
  3.59145 39.84137
  --
Sampler 8
  4.044209 39.32044
  4.090824 39.89424
  --
```

# Area C – Southern Tyrrhenian Sea

**Replica 1**



Sample layer name:  4 Replicas - Replica 1
Type of sampler:    Line
Number of samplers: 6

List of samplers:
  x-coord  y-coord

 Sampler 1
  15.56295 38.29397
  15.74683 39.92273
  --
 Sampler 2
  15.07043 38.13248
  15.26668 39.99473
  --
 Sampler 3
  14.58809 38.06188
  14.77776 39.9972
  --
 Sampler 4
  14.1092 38.02568
  14.28837 39.99945
  --
 Sampler 5
  13.63199 38.01052
  13.79836 39.99956
  --
 Sampler 6
  13.16872 38.19486
  13.30776 39.99752

**Replica 2**



```
Sample layer name:  4 Replicas - Replica 2
Type of sampler:    Line
Number of samplers: 6

List of samplers:
    x-coord  y-coord

  Sampler 1
    15.47723 38.27763
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    --
  Sampler 2
    14.98852 38.15279
    14.98889 38.15665
    --
    14.98918 38.15954
    15.18048 39.99495
    --
  Sampler 3
    14.50242 38.04186
    14.55019 38.56379
    --
    14.55236 38.58696
    14.69151 39.99775
    --
  Sampler 4
    14.02666 38.04222
    14.20201 39.99963
    --
  Sampler 5
    13.55124 38.05276
    13.71189 39.99936
    --
  Sampler 6
    13.08227 38.16378
    13.08255 38.16779
    --
    13.08311 38.17577
    13.2212 39.99694
    --
```

**Replica 3**



```
Sample layer name:  4 Replicas - Replica 3
Type of sampler:    Line
Number of samplers: 6

List of samplers:
    x-coord  y-coord

  Sampler 1
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    15.83609 39.62925
    --
  Sampler 2
    15.19578 38.17209
    15.39097 39.99034
    --
  Sampler 3
    14.7167 38.1396
    14.90256 39.99628
    --
  Sampler 4
    14.22991 38.01733
    14.41334 39.99908
    --
  Sampler 5
    13.75268 38.00006
    13.92348 39.99974
    --
  Sampler 6
    13.29241 38.21873
    13.43303 39.99825
    --
```

## Replica 4



```
Sample layer name:  4 Replicas - Replica 4
Type of sampler:    Line
Number of samplers: 7

List of samplers:
    x-coord  y-coord

  Sampler 1
    15.88871 38.43923
    15.90247 38.56153
    --
    15.917 38.68944
    15.99869 39.38795
    --
  Sampler 2
    15.39097 38.24304
    15.58439 39.99395
    --
  Sampler 3
    14.90957 38.19077
    14.93554 38.45758
    --
    14.94182 38.52125
    15.0956 39.99511
    --
  Sampler 4
    14.41964 38.03928
    14.6066 39.99823
    --
  Sampler 5
    13.94294 38.02884
    14.11699 39.99973
    --
  Sampler 6
    13.47206 38.0997
    13.62676 39.99909
    --
  Sampler 7
    13.01553 38.39584
    13.13598 39.9963
    --
```

# Area E - Central-Southern Mediterranean Sea

**Replica 1**



Sample layer name:  4 Replicas - Replica 1
Type of sampler:   Line
Number of samplers: 10

List of samplers:
  x-coord  y-coord

 Sampler 1
  15.60554 34.33436
  15.57477 36.00107
  --
 Sampler 2
  15.16814 34.33393
  15.12789 36.00049
  --
 Sampler 3
  14.73004 34.33499
  14.68035 36.00095
  --
 Sampler 4
  14.29125 34.3369
  14.23219 36.00078
  --
 Sampler 5
  13.85187 34.33716
  13.74642 37.00193
  --
 Sampler 6

```
  13.41195 34.33578
  13.29086 37.00399
  --
Sampler 7
  12.93558 35.0004
  12.83476 37.00424
  --
Sampler 8
  12.49058 35.00215
  12.37814 37.00267
  --
Sampler 9
  12.04506 35.00221
  11.93318 36.79797
  --
  11.93143 36.82695
  11.921 37.00014
  --
Sampler 10
  11.59906 35.00059
  11.49863 36.46776
  --
```

**Replica 2**



Sample layer name:  4 Replicas - Replica 2
Type of sampler:    Line
Number of samplers: 10

List of samplers:
  x-coord  y-coord

 Sampler 1
  15.88271 34.33377
  15.85795 36.00054
  --
 Sampler 2
  15.4457 34.33439
  15.41146 36.00106
  --
 Sampler 3
  15.00808 34.33337
  14.96436 36.00015
  --
 Sampler 4
  14.56969 34.33588
  14.52223 35.80754
  --
  14.51996 35.88467
  14.51989 35.88689
  --
  14.51972 35.89294
  14.51956 35.89835
  --

14.51956 35.89837
14.51949 35.90063
--
14.51939 35.90412
14.51657 36.00109
--
Sampler 5
 14.13068 34.33718
 14.0682 36.00028
 --
Sampler 6
 13.6911 34.33685
 13.57994 37.0029
 --
Sampler 7
 13.25098 34.33487
 13.12418 37.00429
 --
Sampler 8
 12.77295 35.00123
 12.66788 37.00388
 --
Sampler 9
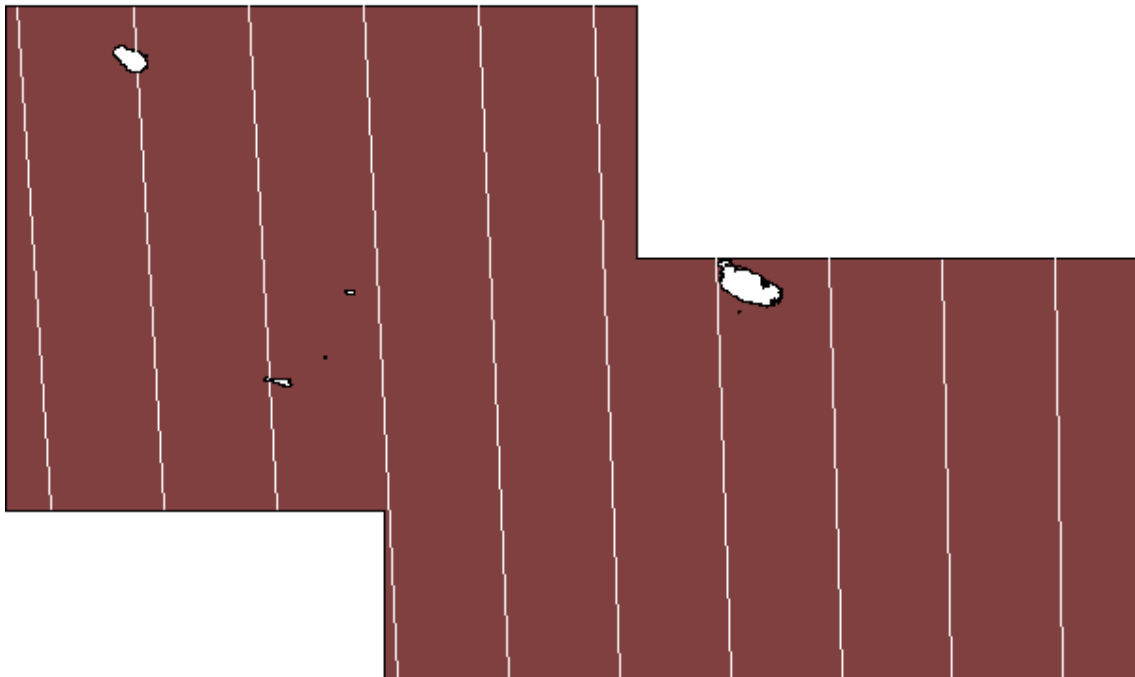 12.32776 35.00237
 12.21108 37.00164
 --
Sampler 10
 11.88206 35.00182
 11.75366 37.00027
 --

**Replica 3**



Sample layer name:  4 Replicas - Replica 3
Type of sampler:    Line
Number of samplers: 10

List of samplers:
  x-coord  y-coord

 Sampler 1
   15.68524 34.33426
   15.6562 36.00099
   --
 Sampler 2
   15.24795 34.33413
   15.20943 36.00073
   --
 Sampler 3
   14.81 34.33447
   14.76202 36.00079
   --
 Sampler 4
   14.37132 34.33667
   14.31396 36.00094
   --
 Sampler 5
   13.93205 34.33724
   13.82943 37.00136
   --
 Sampler 6
   13.49222 34.33616

```
  13.37398 37.00375
  --
Sampler 7
  13.05186 34.33343
  12.91798 37.00433
  --
Sampler 8
  12.57177 35.00195
  12.54275 35.51202
  --
  12.54199 35.52551
  12.46145 37.00309
  --
Sampler 9
  12.12635 35.00233
  12.02017 36.73443
  --
  12.01481 36.82475
  12.00444 37.00004
  --
Sampler 10
  11.68043 35.00101
  11.54667 37.0001
  --
```
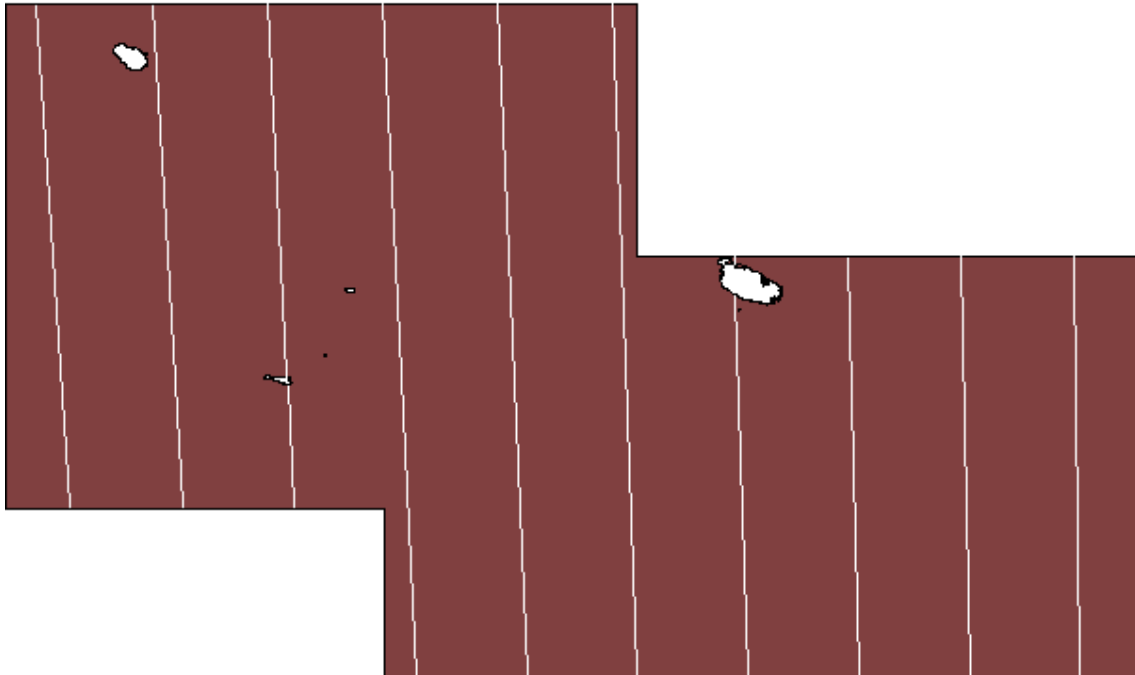
**Replica 4**



Sample layer name:  4 Replicas - Replica 4
Type of sampler:    Line
Number of samplers: 10

List of samplers:
  x-coord  y-coord

 Sampler 1
  15.75626 34.33412
  15.72875 36.00087
  --
 Sampler 2
  15.31907 34.33426
  15.28209 36.00089
  --
 Sampler 3
  14.88124 34.33395
  14.83479 36.0006
  --
 Sampler 4
  14.44266 34.33643
  14.39164 35.84527
  --
  14.38848 35.94706
  14.38836 35.95109
  --
  14.3878 35.96936
  14.38683 36.00103
  --

Sampler 5
  14.00348 34.33726
  13.9034 37.0008
  --
Sampler 6
  13.56374 34.33644
  13.44805 37.00348
  --
Sampler 7
  13.12347 34.33399
  12.99213 37.00436
  --
Sampler 8
  12.64412 35.00173
  12.6168 35.48963
  --
  12.61528 35.51701
  12.53569 37.00342
  --
Sampler 9
  12.19878 35.00238
  12.07875 37.00066
  --
Sampler 10
  11.75294 35.00134
  11.62111 37.0002
  --