
Curriculum Vitae

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Fernando Canovas, PhD

The signatory declares that all data and informations provided in this curriculum vitae are true, and otherwise assumes the responsibilities which should derive from the inaccuracies listed.

During the evaluation process, the applicant is fully available to expand and justify the information here contained.

Personal data

Family name: **Cánovas**
Forename: **Fernando García**
ID/Passport n°: 34797843-Q / BA162342
Date of birth: June 12th, 1972
Gender: M
Nationality: Spanish
E-mail: fcgarcia@ualg.pt



Academic background

- **University of Murcia** Murcia, Spain
Ph.D. Experimental Sciences 2006
 - Advisors: José Serrano, José Galián and Pilar De la Rúa
 - Thesis: Spatial genetic variability and molecular ecology of *Apis mellifera iberiensis* Engel, 1999
 - Grade: magna cum laude
- **University of Murcia** Murcia, Spain
M.Sc. Biological Sciences 2003
 - Advisors: José Galián and Pilar De la Rúa
 - Thesis: Genetic characterization of *Apis mellifera iberica* (Hymenoptera, Apidae) populations from Galicia
 - Grade: magna cum laude
- **National Distance Education University** Spain
B.A.H. Mathematical Sciences *In progress*
- **University of Murcia** . Murcia, Spain
B.A.H. Veterinary Sciences 1998

Languages and computer languages

Language	Speaking	Reading	Writing
<i>English</i>	G	P	G
<i>Portuguese</i>	G	P	G
<i>Spanish</i>	P	P	P

(N=normal; G=good; P=perfectly)

Computer languages and databases:

- *Bash Linux shell*
- *R*
- *Python*
- *MySQL*
- *HTML*
- *Spatial databases:*
GRASS, Mapserver
- *High level text editing:*
- \LaTeX , \BibTeX
- *Arduino*
- *Parametric 3D design:*
OpenSCAD

Other qualifications

2007	Lifeguard from Red Cross
2003	Prevention and Treatment of Diving Accidents (Spanish Navy)
2002	Recreational Skipper (motor and sailing; up to 49 feet and 12 miles from the coast)
2002	Advanced scuba diver (National Association of Underwater Instructors, NAUI)
1997	Scuba Diver B1* (CMAS)
1991	Driving License

Researcher IDs

ORCID:	0000-0002-8837-1927	http://orcid.org/0000-0002-8837-1927
ResearcherID:	M-3457-2013	http://www.researcherid.com/rid/M-3457-2013
Scopus Author ID:	23395891600	

Academic positions, and past scientific and teaching experience

- **Invited Scientist fellowship** Centro de Ciências do Mar (CCMAR)
Ecological and evolutionary genomics in marine algae Sep. 2014 - Feb. 2015
- **Postdoctoral fellowship FCT** Centro de Ciências do Mar (CCMAR)
Ecological and evolutionary genomics in marine algae Sep. 2008 -
- **Postdoctoral fellowship MEC-Fulbright** University of Balearic Islands
Underground adaptation in freshwater crustaceans Sep. 2007 - Aug. 2008
- **Research contract** Regional Institute of Agrarian Investigations (IMIDA)
Population genetics of crop plagues Nov. 2005 - Dec. 2005
- **Research contract** Regional Institute of Agrarian Investigations (IMIDA)
Crop colonization by insect plagues Jun. 2005 - Dec. 2005
- **Research contract** University of Murcia
Population genetics of managed honeybees Oct. 2004 - Feb. 2005
- **Research contract** Regional Institute of Agrarian Investigations (IMIDA)
Crop colonization by insect plagues May 2004 - Dec. 2005
- **Research contract** University of Murcia
Molecular ecology of Iberian honeybees May 2001 - Dec. 2003
- **Assistant student** University of Murcia
Department of Animal Biology Oct. 1995 - Jun. 1996
- **Assistant student** University of Murcia
Department of Genetic Oct. 1994 - Oct. 1995
- **Assistant student** University of Murcia
Department of Biochemistry and Molecular Biology Oct. 1992 - Nov. 1993
- **Assistant student** University of Murcia
Department of Applied Mathematics and Statistics Oct. 1991 - Jul. 1992

Positive assessment for activity at **PhD Assistant Lecturer**¹ level, by the *National Agency for Quality Assessment and Accreditation*, Spain (PAD n. 2009-82). February 18th, 2009.

<i>2014</i>	GIS in biological sciences. In: Geomatics
<i>Degree / year</i>	M. Sc. in Geomatics / postgraduate
<i>Number of hours</i>	20
<i>Institution</i>	University of Algarve
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<i>2010 - 2013</i>	Training courses for postgraduate and PhD students (see <i>Organisation of scientific dissemination activities</i> section)
<i>Degree / year</i>	postgraduate / PhD
<i>Number of hours</i>	112
<i>Institution</i>	University of Algarve
<hr/>	
<i>2011</i>	GIS in biological sciences. In: Geomatics
<i>Degree / year</i>	M. Sc. in Geomatics / postgraduate
<i>Number of hours</i>	10
<i>Institution</i>	University of Algarve
<hr/>	
<i>2008</i>	Genetics techniques. In: Evolution
<i>Degree / year</i>	B. A. H. Biological Sciences / 3 rd year
<i>Number of hours</i>	80
<i>Institution</i>	University of Balearic Islands
<hr/>	
<i>2005</i>	Data analysis for mitochondrial DNA. In: Molecular ecology techniques
<i>Degree / year</i>	B. A. H. Biological Sciences / 3 rd year
<i>Number of hours</i>	20
<i>Institution</i>	University of Murcia
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¹To join the Spanish University Teaching Bodies, prior national assessment is required which, by assessing the merits and competences of the candidates, ensures quality when selecting university academic staff. The Academic Staff Recruitment Assessment Programme (PEP) set up by ANECA, assess academics teaching and researching performance.

Advisor experience

Student name: Buga Berkôvic
Title: Metapopulation landscape genetics of seagrass and associated pipefish in a tidal mudflat lagoon
Degree: PhD Thesis
Grant reference: SFRH/BD/68570/2010 (Fundação para Ciência e Tecnologia)
Year: in progress

Student name: Tara Van Belleghem
Title: Mapping the *Holothuria* populations information and update WebGIS access to data
Degree: Credits on "lab methods" in EMBC²
Year: January - March, 2015

Student name: Chiara Magliozzi
Title: Old concept and new tools: habitat suitability maps to analyse the ecological niche
Degree: EMBC² Master Thesis / grade 17 (over 20)
Year: July, 2014

Student name: Julian Olaya
Title: Mapping the *Holothuria arguinensis* populations from Ria Formosa (Portugal)
Degree: EMBC² Master Thesis / grade 17 (over 20)
Year: September, 2014

Student name: Andjin Siegenthaler
Title: Spatial distribution patterns and population structure of *Holothuria mammata* and *H. arguinensis* in the Ria Formosa (Portugal)
Degree: EMBC² Master Thesis
Year: July, 2013

Student name: Alberto Mauro
Title: Aplicação WebGIS para análise do comportamento de substâncias prioritárias da DQA na bacia hidrográfica do Algarve
Degree: Geomatic Master Thesis / grade 17 (over 20)
Year: July, 2012

²EMBC: International Master of Science in Marine Biodiversity and Conservation

Publications

International refereed journals (listed in SCI)

1. **Cánovas, F.**, Magliozzi, C., Mestre, F., Palazón-Ferrando, J.A. and González-Wangüemert, M. (accepted). ENiRG: R-GRASS interface for efficiently characterizing the ecological niche of species and predicting habitat suitability. *Ecography*.
JCR area: Biodiversity Conservation
Impact factor: 4.207
Third: 1 (6 of 42)
2. Pearson, G.A, **Cánovas, F.**, Cox, C., Verret, F., Lago-Lestón, A., Lasternas, S., Duarte, C.M., Agusti, S. and Serrão, E.A. (accepted). Cool Genes: metatranscriptomes reveal functional variation in diatom communities from the Antarctic Peninsula. *ISME Journal*.
JCR area: Ecology
Impact factor: 9.267
Third: 1 (4 of 140)
3. Siegenthaler, A., **Cánovas, F.** and González-Wangüemert, M. (accepted). Spatial distribution patterns of *Holothuria Arguinensis* in the Ria Formosa (Portugal). *Journal of Sea Research*.
JCR area: Marine Freshwater Biology
Impact factor: 1.855
Third: 1 (34 of 103)
4. **Cánovas, F.**, De la Rúa, P. Serrano, J. and Galián, J. (2014). Analysing and describing a contact area of two distinct evolutionary units. An ecological perspective. *Journal of Insect Conservation*, 18 (5): 927-937.
JCR area: Entomology
Impact factor: 1.945
Third: 1 (19 of 90)
5. Sánchez, J.A., La Spina, M., Guirao, P. and **Cánovas, F.** (2013). Inferences of the population structure of *Myzus persicae* in diverse agroecosystems using microsatellite markers. *Bulletin of Entomological Research*, 103: 473-484.
JCR area: Entomology
Impact factor: 1.882
Third: 1 (15 of 85)
6. **Cánovas, F.**, Mota, C., Pearson, G.A. and Serrão, E.A. (2011). Driving south: a multi-gene phylogeny of the Atlantic brown algal family Fucaceae resolves the relationships within the recently-diverged genus *Fucus*. *BMC Evolutionary Biology*, 11: 371.
JCR area: Genetics and Heredity
Impact factor: 4.294
Third: 1 (49 of 156)

7. **Cánovas, F.**, Mota, C.F., Ferreira-Costa, J., Serrão, E.A., Coyer, J.A., Olsen, J.L. and Pearson, G.A. (2011). Development and characterization of 35 single nucleotide polymorphism markers for the brown alga *Fucus vesiculosus* L. *European Journal of Phycology*, 46(4): 342-351.
 JCR area: Marine and Freshwater biology
 Impact factor: 1.901
 Third: 1 (29 of 92)
8. Zardi, G., Nicastro, K., **Cánovas, F.**, Pearson, G., Ferreira-Costa, J. and Serrão, E. (2011). Adaptive traits are maintained on steep selective gradients despite gene flow and hybridization in the intertidal zone. *PLoS ONE*, 6(6): e19402.
 JCR area: Biology
 Impact factor: 4.411
 Third: 1 (12 of 85)
9. **Cánovas, F.**, De la Rúa, P. Serrano, J. and Galián, J. (2011). Microsatellite variability reveals beekeeping influence on Iberian honeybee populations. *Apidologie*, 42(3): 235-251.
 JCR area: Entomology
 Impact factor: 2.266
 Third: 1 (19 of 74)
10. González-Wangüemert, M., **Cánovas, F.**, Pérez-Ruzafa, A., Marcos, C. and Alexandrino, P. (2010). Connectivity patterns inferred from the genetic structure of white seabream (*Diplodus sargus* L.). *Journal of Experimental Marine Biology and Ecology*, 383: 23-31.
 JCR area: Marine and Freshwater biology
 Impact factor: 2.074
 Third: 1 (18 of 87)
11. Villacorta, C., **Cánovas, F.**, Jaume, D. and Juan, C. (2009). Isolation and characterization of microsatellite loci for the cavehopper *Palmorchestia hypogaea* (Amphipoda: Talitridae). *Conservation Genetics Resources*, 1(1): 401-404.
 Impact factor: 1.136
12. González-Wangüemert, M., **Cánovas, F.**, Pérez-Ruzafa, A. and Marcos, C. (2009). Phosphoglucose isomerase variability of *Cerastoderma glaucum* as a model for testing the influence of environmental conditions and dispersal patterns through quantitative ecology approaches. *Biochemical Systematics and Ecology*, 37(4): 325-333.
 JCR area: Ecology
 Impact factor: 1.136
 Third: 2 (78 of 116)
13. **Cánovas, F.**, De la Rúa, P. Serrano, J. and Galián, J. (2008). Geographical patterns of mitochondrial DNA variation in *Apis mellifera iberiensis* (Hymenoptera: Apidae). *Journal of Zoological Systematics and Evolutionary Research*, 46(1): 23-30.
 JCR area: Evolutionary Biology
 Impact factor: 1.633
 Third: 1 (25 of 124)
14. Sánchez, J.A., **Cánovas, F.** and Lacasa, A. (2007). Thresholds and management strategies for *Aulacorthum solani* (Hemiptera: Aphididae) in greenhouse pepper. *Journal of Economic*

Entomology, 100(1): 123-130.

JCR area: Entomology

Impact factor: 1.205

Third: 1 (21 of 66)

15. González-Wangüemert, M., Pérez-Ruzafa, A., **Cánovas, F.**, García-Charton, J.A. and Marcos, C. (2007). Temporal genetic variation in populations of *Diplodus sargus* from the SW Mediterranean. *Marine Ecology-Progress Series*, 334: 237-244.
JCR area: Oceanography
Impact factor: 2.315
Third: 1 (6 of 46)
16. **Cánovas, F.**, Lacasa, A. and Sánchez, J.A. (2006). Implementing a Geographical Information System (GIS) for pepper greenhouse natural enemy and pest management in Southeast Spain. *IOBC WPRS Bulletin*, 29(4): 25-30.
17. Gallego, D., **Cánovas, F.**, Esteve, M.A. and Galián, J. (2004). Descriptive biogeography of *Tomicus* (Coleoptera: Scolytidae) species: A study of limits of distribution by predictive models in Spain. *Journal of Biogeography*, 31: 2011-2024.
JCR area: Ecology
Impact factor: 2.804
Third: 1 (26 of 112)
18. **Cánovas, F.**, De la Rúa, P. Serrano, J. and Galián, J. (2002). Mitochondrial DNA variability in *Apis mellifera iberica* populations from Galicia. *Archivos de Zootecnia*, 51: 441-448.

Non-refereed journals

1. De la Rúa, P., **Cánovas, F.**, Galián, J. and Serrano, J. (2006). Situación actual del estado de conservación de *Apis mellifera iberiensis*. *Vida Apícola*, 139: 40-53.
2. Sánchez, J.A., **Cánovas, F.** and Lacasa, A. (2005). Un sistema de información geográfica (SIG) para el manejo de enemigos naturales, plagas y enfermedades en los cultivo de pimiento del Campo de Cartagena (Murcia). *Agroinformación*.
URL: <http://www.agroinformacion.com>
3. **Cánovas, F.** (2005). Más que abejas, ... compañeras. *Eubacteria*, 15: 9-12.
4. **Cánovas, F.** and Galián, J. (2002). Análisis de paternidad en la raza Caprina Murciano-Granadina mediante microsatélites. *Federación de Asociaciones de Ganado Selecto (FEA-GAS)*, 21: 112-115.
5. Galián, J., Abramovich, A., **Cánovas, F.** and Atela, O. (2001). Caracterización molecular en poblaciones de abejas (*Apis mellifera* L.) de Argentina. *Ciencia y Abejas*, 38: 9-12.

Books and book chapters

1. Authors (in order of authorship): Serrano, J., **Cánovas, F.**, Hernández-García, R., Galián, J. and De la Rúa, P.
Chapter title: De África a Europa pasando por Iberia: historia evolutiva de la abeja ibérica
Book title: *Actas del VI Congreso Nacional de Apicultura*
Pages, start: 7; end: 22
Date: 2011
Editor: Padilla-Álvarez, F.
Publisher: Don Folio
Publisher place: Córdoba, Spain
ISBN: 84-1510-529-0
2. Authors (in order of authorship): De la Rúa, P., Muñoz, I., Piñero, A., Hernández-García, R., **Cánovas F.**, Galián, J., Serrano, J.
Chapter title: Historia evolutiva de la abeja ibérica
Book title: *Evolución y Adaptación. 150 años después del Origen de las Especies*
Pages, start: 162; end: 169
Date: 2009
Editors: Dopazo, H., Navarro, A.
Publisher: Obrapropia
Publisher place: Valencia, Spain
ISBN: 84-92910-06-9.
3. Authors (in order of authorship): **Cánovas, F.**, García, R., Jiménez, E., Navarrete, E., Pedraza, E.
Book title: *Seminarios sobre el Toro de Lidia*
Pages: 64
Date: 1998
Publisher: Servicio de Publicaciones de la Universidad de Murcia
Publisher place: Murcia, Spain.
ISBN: 84-7684-869-2

Software

- **ENiRG** R package
Ecological Niche in R-GRASS 2014
 - Cánovas, F., Magliozzi, C., Mestre, F., Palazón-Ferrando, J.A. and González-Wangüemert, M. (accepted). ENiRG: R-GRASS interface for efficiently characterizing the ecological niche of species and predicting habitat suitability. *Ecography*.
 - Hosted at [R cran](#)

 - **MetaLandSim** R package
Tools to simulate species occupations in dynamic landscapes and range expansion 2014
 - Mestre, F., Cánovas, F. and Beja, P. (submitted). MetaLandSim: Tools for simulating metapopulation persistence and range expansion under environmental change. *Ecography*.
 - Hosted at [R cran](#)

 - **Workflow** scripting
Analysis of transcriptomic and metagenomic data 2014
 - Pearson, G.A, Cánovas, F., Cox, C., Verret, F., Lago-Lestón, A., Lasternas, S., Duarte, C.M., Agusti, S. and Serrão, E.A. (accepted). Cool Genes: metatranscriptomes reveal functional variation in diatom communities from the Antarctic Peninsula. *The ISME Journal*.
 - Upon request

 - **GRASS plugin** gedit
Syntax recognition for GRASS language 2010
 - Upon request

 - **Spatial database** Under Windows CE plus GPS
Mobile spatial database for biological control 2005
 - Upon request
-

Hardware

- **MOBE** Robotics
Underwater remotely operated vehicle (ROV) 2015
 - Cánovas, F., Conduto, J. and González-Wangüemert, M. (submitted). Micro Open Benthic Explorer (MOBE): open ROV developed with educational purposes in marine biology and technology. *American Journal of Science Education and Technology*.
 - Hosted at: [thingiverse](#)

• Mini 3D desktop printer . . .	Robotics
• <i>Mini Rep-Rap 3D desktop printer</i>	2015
• Prusa air 2	Robotics
• <i>Rep-Rap 3D printer for Science Communication Centre (Portugal)</i>	2014
• Prusa i3	Robotics
• <i>Rep-Rap 3D printer for CCMAR (Portugal)</i>	2013

Scientific WEB sites

- **Mapping seahorse populations** Web site and WebGIS
May/2014 to June/2014
 -
 - Main results: GIS with information about *Hippocampus hippocampus* and *H. guttulatus* were implemented into a WebGIS application. Placed at the web page (also fully implemented together with the WebGIS), it contains all the information about distribution, sampling design and general complementary cartographic information collected in the project.
 - The application is hosted at <http://ccmar.ualg.pt/seahorses>
 - Number of hits: NA.

 - **Mapping sea-cucumber populations** Web site and WebGIS
December/2012 to January/2013
 -
 - Main results: GIS with information about *Holothuria* spp. were implemented into a WebGIS application. Placed at the web page (also fully implemented together with the WebGIS), it contains all the information about distribution (World wide), sampling design and general complementary cartographic information collected in the project CUMFISH (PTDC/MAR/119363/2010).
 - The application is hosted at <http://ccmar.ualg.pt/cumfish>
 - Number of hits: 3493 (January 20,2013 - January 20, 2015).

 - **Biological control management** WebGIS
June/2005
 -
 - Main results: GIS with information about insect-plague (*Aulacorthum solani* and *Myzus persicae*) and natural enemies (*Frankliniella occidentalis*, *Orius* spp. and *Amblyseius cucumeris*) were implemented into a WebGIS application. Placed at the web page of the IMIDA center, it contained all the information about temporal and spatial distribution, which were collected during Official Inspections of Plague's Control Department (Ministry of Agriculture in Regional Government of Murcia - 04PCCCI). This system was based on digital collection (using pocket PC plus GPS technologies) of plague and natural enemies data in sweet pepper crops.
 - The application was hosted at <http://www.imida.es>
 - Number of hits: NA.
-

Participation in research projects

As principal investigator

Project Title: Sex-biased evolution in multicellular brown algae (*evosexual*)
Financial entity: Fundação para a Ciência e a Tecnologia (FCT)
Reference: EXPL/BIA-EVF/2263/2013
Participants: CCMAR
Funds: 49,103.00 €
Length: 2014 to 2015
Topic: This proposal extends the study of sex-biased genes (SBG), to an unexplored and independent multicellular lineage, the brown algae. Moreover, the range of sexual (oogamy, anisogamy, isogamy) and reproductive systems (dioecy, hermaphroditism), within a single lineage offer unparalleled opportunities for evolutionary studies of SBG. The major deliverables are to: 1) functionally characterize reproductive tissue transcriptomes in the brown algal family Fucaceae; 2) generate orthologous gene clusters between taxa and combine functional annotation of transcriptome data with expression patterns to explore phylogenomic variation, including replicated instances of dioecy-hermaphroditism switches in mating system; 3) conduct phylogenomic analyses of SBG to test evolutionary hypotheses of rapid divergence and adaptive evolution across different reproductive/mating systems, and divergence times/evolutionary distances. These represent a major advance in the understanding of sex-biased gene expression and the evolution of sexual reproduction.

As a member of the team

Project Title: Extant or extinct tipping points - climate changes drive genetic diversity and dynamics of range edge populations as evolutionary hotspots
Financial entity: Fundação para a Ciência e a Tecnologia (FCT)
Participants: CCMAR
Length: 2013 to 2016
PI: Ester Serrão

Project Title: Adaptive potential at range edges: testing relationships between fitness-related traits and population structure near ecophysiological limits
Financial entity: Fundação para a Ciência e a Tecnologia (FCT)
Participants: CCMAR
Length: 2010 to 2014
PI: Katy Nicaastro

Project Title: Molecular ecology and climate change: adaptative differentiation of *Cymodocea nodosa* and *Caulerpa prolifera* populations through environmental clines
Financial entity: Fundación Seneca
Participants: UMU, CCMAR
Length: 2010 to 2013
PI: Mercedes González-Wangüemert

Project Title: Landscape genetics of a coastal lagoon; an empirical and modeling approach using the seagrass *Zostera noltii* in Ria Formosa

Financial entity: Fundação para a Ciência e a Tecnologia (FCT)
Participants: CCMAR
Length: 2010 to 2013
PI: Filipe Alberto

Project Title: Making edges meet: genetic signatures of climate-driven range shifts
Financial entity: Fundação para a Ciência e a Tecnologia (FCT)
Participants: CCMAR
Length: 2010 to 2013
PI: Ester Serrão

Project Title: Patterns and processes of (neutral and adaptive) variation in the honey bee (*Apis mellifera iberiensis*) hybrid zone of the Iberian Peninsula: a population genetics approach integrating population genomics and landscape genetics
Financial entity: Fundação para a Ciência e a Tecnologia (FCT)
Participants: Instituto Politécnico de Bragança
Length: 2010 to 2013
PI: Maria Alice da Silva Pinto

Project Title: Evolutionary and biogeographical factors in the adaptation to subterranean life: invertebrate case studies from the Balearic and Canarian archipelagoes
Financial entity: Spanish Ministry (MEC)
Participants: UIB, IMEDEA
Length: 2007 to 2009
PI: Carlos Juan Clar

Project Title: Aphid control in peeper greenhouses under an integrated management system
Financial entity: National Institute for Agrarian Investigations (INIA)
Participants: IMIDA, IRTA, IVIA
Length: 2004 to 2007
PI: Juan Antonio Sánchez Sánchez

Project Title: Introgression and genic flow in the honeybee *Apis mellifera iberica* come from transhumance and queen trade. Molecular analysis (microsatellites and mitochondrial haplotypes)
Financial entity: Spanish Ministry (MEC)
Participants: University of Murcia
Length: 2004 to 2006
PI: José Serrano Marino

Project Title: Molecular markers for analyzing gene diversity of insular and peninsular populations in *Apis mellifera iberica*

Financial entity: National Institute of Agrarian Investigations (INIA)
Participants: University of Murcia
Length: 2001 to 2003
PI: José Galián Albaladejo

Project Title: Molecular characterization of honeybee from Murcia: protection and improvement of local populations
Financial entity: Fundación Seneca
Participants: University of Murcia
Length: 2000 to 2002
PI: José Serrano Marino

Research contracts with companies and/or private or public funding bodies

<i>Contract title:</i>	Genetic variability of <i>Myzus persicae</i> in Murcia
<i>Financial entities:</i>	IMIDA
<i>Length:</i>	November/2005 to December/2005
<i>Principal investigator:</i>	Fernando Cánovas García
<i>Contract title:</i>	Implementation of a GIS for integrated and biological control of peppers crops
<i>Financial entities:</i>	IMIDA
<i>Length:</i>	June/2005 to December/2005
<i>Principal investigator:</i>	Fernando Cánovas García
<i>Contract title:</i>	Introduction of technologies in integrated production of greenhouse pepper. Improve program of efficiency of agrarian systems
<i>Financial entities:</i>	Ministry of Agriculture in Regional Government of Murcia (04PCCCI)
<i>Length:</i>	May/2004 to May/2005
<i>Principal investigator:</i>	Fernando Cánovas García
<i>Contract title:</i>	Paternity test in the Murciano-Granadina breed goat
<i>Financial entities:</i>	University of Murcia and Farmer Association of Murciano-Granadina Breed Goat (ACRIMUR)
<i>Length:</i>	June/2003 to June/2004
<i>Principal investigator:</i>	José Galián Albaladejo

Adaptation of facilities

<i>Facilities:</i>	Makerspace
<i>Participating entities:</i>	Centre of Marine Sciences (CCMAR)
<i>Length:</i>	September/2013 to December/2013
<i>Main results:</i>	Adaptation of a laboratory for developing open source-based technologies. Constructed tools: 3D printer and CNC, server, ROV, oceanographical resources (sensors).
<i>Facilities:</i>	Genetic laboratory
<i>Participating entities:</i>	Agrarian and Food Research Center (IMIDA)
<i>Length:</i>	March/2005
<i>Main results:</i>	Adaptation of a laboratory for developing genetic studies.

Invited lectures

- *R-GRASS: an interface for biological research*
 - *Place (date)*: University of Algarve, Faro, Portugal (2011)
 - *Topic*: Master on Geomatic
- *Using Generalized Additive Models (GAM) in biology*
 - *Place (date)*: University of Murcia, Murcia, Spain (2010)
 - *Topic*: CALDUM workshops
- *R for R users*
 - *Place (date)*: University of Murcia, Murcia, Spain (2009)
 - *Topic*: I Conferencia Hispana R-Project
- *Changing environmental conditions shape the genetic structure of coastal lagoon populations*
 - *Place (date)*: Centro de Ciências do Mar, Faro, Portugal (2009)
 - *Topic*: IV Ciclo de seminários do CCMAR
- *An introduction to R*
 - *Place (date)*: University of Murcia, Murcia, Spain (2008)
 - *Topic*: Master on Environmental Sciences
- *Molecular Ecology Techniques: Mitochondrial DNA analysis*
 - *Place (date)*: University of Murcia, Murcia, Spain (2005)
 - *Topic*: 3th year in Environmental Sciences Degree
- *R: a free tool for statistical processing agrarian information*
 - *Place (date)*: IMIDA, Murcia, Spain (2005)
 - *Topic*: Presenting R statistical software

- *R: una herramienta libre para el análisis estadístico de la información (R: a free tool for statistical processing information)*
 - *Place (date):* University of Murcia, Murcia, Spain (2005)
 - *Topic:* Meeting on free software
- *Taller de R (Workshop on R)*
 - *Place (date):* University of Murcia, Murcia, Spain (2004)
 - *Topic:* Meeting on Free Software: CALDUM Project
- *Interpretação ecológica da variabilidade genética das populações de Apis mellifera L.*
 - *Place (date):* São Miguel, Açores, Portugal (2003)
 - *Topic:* IV Congresso Nacional de Apicultura
- *Caracterização molecular das populações de abelhas Ibéricas: técnicas, resultados e futuro (Molecular characterization of the Iberian honeybee populations: techniques, results and future)*
 - *Place (date):* Instituto Politécnico de Bragança; Escola Superior Agrária, Bragança, Portugal (2003)
 - *Topic:* V National Forum of Bee-keeping

Presentations in congresses

Authors: E.A. Serrão, F. Alberto, J. Assis, F. Cánovas, N. Coelho, J. Costa, J. Neiva, K. Nicastro, G.A. Pearson, P. Raimondi
Title: Extant or extinct tipping points – range edge populations as evolutionary hotspots
Type of presentation: Oral
Congress: 10th International Phycological Congress
Publication: Proceedings of the congress (DOI: 10.2216/0031-8884-52.sp4.1)
Meeting place (date): Orlando, Florida USA (2013)

Authors: A.M. Mahoque, F. Cánovas, M. Moreira, N. Atanasova, A. Rebelo
Title: Aplicação WebGIS para análise do comportamento de substâncias prioritárias da dqa na Bacia Hidrográfica do Algarve
Type of presentation: Oral
Congress: VIII Congresso Ibérico sobre Gestão e Planeamento da Água
Publication: Proceedings of the congress
Meeting place (date): Lisbon, Portugal (2013)

Authors: M. González-Wangüemert, F. Cánovas, J. Martínez-Garrido, E.A. Serrão
Title: Molecular ecology and climate change: adaptive differentiation of *Cymodocea nodosa* populations through environmental clines
Type of presentation: Poster
Congress: XVII Simposio Ibérico de Estudios de Biología Marina (SIEBM)
Publication: Proceedings of the congress
Meeting place (date): Donostia - San Sebastián, Spain (2012)

Authors: J. Martínez-Garrido, M. González-Wangüemert, F. Cánovas, E.A. Serrão
Title: Jardines olvidados bajo el mar: evaluación del estado de conservación de las fanerógamas *Ruppia cirrhosa* Petagna (Grande) y *Zostera noltii* (Hornemann) mediante su estudio genético
Type of presentation: Oral
Congress: III Congreso Nacional de Biodiversidad
Publication: Proceedings of the congress
Meeting place (date): Granada, Spain (2011)

Authors: F. Cánovas, C.F. Mota, E.A. Serrão, G.A. Pearson
Title: Southward bound: phylogenomics of the Atlantic brown algal family Fucaceae

<i>Type of presentation:</i>	Oral
<i>Congress:</i>	World Conference on Marine Biodiversity
<i>Publication:</i>	Proceedings of the congress
<i>Meeting place (date):</i>	Aberdeen, Scotland (2011)
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<i>Authors:</i>	M. González-Wangüemert, J. Martínez-Garrido, F. Cánovas, C. Vergara-Chen, E.A. Serrao
<i>Title:</i>	In two waters: Contemporary evolution of lagoonal and marine populations
<i>Type of presentation:</i>	Oral
<i>Congress:</i>	World Conference on Marine Biodiversity
<i>Publication:</i>	Proceedings of the congress
<i>Meeting place (date):</i>	Aberdeen, Scotland (2011)
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<i>Authors:</i>	A. Ramos, E.A. Serrão, F. Cánovas, C. Cox, A. Lago-Leston, C. Duarte, S. Augusti, K. Valentin, G. Pearson
<i>Title:</i>	Environmental genomics of polar phytoplankton communities
<i>Type of presentation:</i>	Oral
<i>Congress:</i>	International Workshop - Molecular Ecology of Sea Ice Communities in a changing world - the Genomic Perspective
<i>Publication:</i>	Proceedings of the congress
<i>Meeting place (date):</i>	Bremerhaven, Germany (2011)
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<i>Authors:</i>	G. Pearson, A. Ramos, F. Cánovas, C. Cox, A. Lago-Leston, S. Augusti, C. Duarte, E.A. Serrão
<i>Title:</i>	Responses of key components of polar food-webs to environmental changes: an environmental genomics approach
<i>Type of presentation:</i>	Oral
<i>Congress:</i>	Conferência Portuguesa das Ciências Polares
<i>Publication:</i>	Proceedings of the congress
<i>Meeting place (date):</i>	Coimbra, Portugal (2011)
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<i>Authors:</i>	G.A. Pearson, F. Cánovas, C.J. Cox, A. Lago-Leston, S. Agusti, C. Duarte, E.A. Serrão
<i>Title:</i>	Metatranscriptomics of diatom-dominated Antarctic communities: Establishing links between diversity and function
<i>Type of presentation:</i>	Oral
<i>Congress:</i>	ASLO 2011 Aquatic Sciences Meeting
<i>Publication:</i>	Proceedings of the congress
<i>Meeting place (date):</i>	SanJuan, Puerto Rico (2011)
<hr/>	
<i>Authors:</i>	A. Ramos, E.A. Serrão, F. Cánovas, C. Cox, A. Lago-Leston, G. Pearson

<i>Title:</i>	Metatranscriptomic analysis of phytoplankton communities in distinct Barents Sea water masses
<i>Type of presentation:</i>	Oral
<i>Congress:</i>	ASLO 2011 Aquatic Sciences Meeting
<i>Publication:</i>	Proceedings of the congress
<i>Meeting place (date):</i>	SanJuan, Puerto Rico (2011)
<hr/>	
<i>Authors:</i>	G.A. Pearson, A. Ramos, F. Cánovas, C. Cox, A. Lago-Leston, E.A. Serrão
<i>Title:</i>	Metatranscriptomic analysis of phytoplankton communities in distinct Barents Sea water masses
<i>Type of presentation:</i>	Oral
<i>Congress:</i>	Arctic Frontiers 2011)
<i>Publication:</i>	Proceedings of the congress
<i>Meeting place (date):</i>	Tromso, Norway (2011)
<hr/>	
<i>Authors:</i>	G.A. Pearson, A. Ramos, A. Lago-Leston, F. Cánovas, C. Cox, S. Agusti, C. Duarte, E.A. Serrão
<i>Title:</i>	Genómica Ambiental de Comunidades Polares de Fitoplâncton
<i>Type of presentation:</i>	Oral
<i>Congress:</i>	2ª Reunião Portuguesa de Ciências Polares: O Estado da Investigação Polar em Portugal no Final do IV Ano Polar Internacional
<i>Publication:</i>	Proceedings of the congress
<i>Meeting place (date):</i>	Lisboa, Portugal (2010)
<hr/>	
<i>Authors:</i>	G.A. Pearson, A. Lago-Leston, F. Cánovas, S. Agusti, C. Duarte, E.A. Serrão
<i>Title:</i>	Exploring phytoplankton communities in the Southern Ocean using metatranscriptomics
<i>Type of presentation:</i>	Oral
<i>Congress:</i>	ESF-COST High-Level Research Conference Marine Biotechnology: Future Challenges
<i>Publication:</i>	Proceedings of the congress
<i>Meeting place (date):</i>	Acquafredda di Maratea, Italy (2010)
<hr/>	
<i>Authors:</i>	Bauzá-Ribot, M., Cánovas, F., Pons, J., Jaume, D., Oromí, P. y Juan, C.
<i>Title:</i>	Origin and phylogeography of the subterranean amphipod crustacean <i>Metacrangonyx</i> in islands
<i>Type of presentation:</i>	poster
<i>Congress:</i>	Annual Meeting of the Society for Molecular Biology and Evolution
<i>Publication:</i>	Proceedings of the congress
<i>Meeting place (date):</i>	Barcelona, Spain (2008)

Authors: González-Wangüemert, M., Cánovas, F., Pérez-Ruzafa, A. y Marcos, C.
Title: Aplicación de los GAM para establecer relaciones entre la composición genética de *Cerastoderma glaucum* y la variabilidad ambiental de la laguna costera del Mar Menor (SE de España)
Type of presentation: poster
Congress: II Congreso Ibérico en Ecología
Publication: Proceedings of the congress
Meeting place (date): Lisboa, Portugal (2006)

Authors: Cánovas, F. and Sánchez, J.A.
Title: Implementing a Geographical Information System (GIS) for pepper greenhouse natural enemy and pest management in Southeast Spain
Type of presentation: oral presentation
Congress: Meeting of the IOBC/WPRS WORKING GROUP on Integrated Pest Control in Protected Crops, Mediterranean Climate
Publication: -
Meeting place (date): Murcia, Spain (2006)

Authors: González-Wangüemert, M., Cánovas, F. Pérez-Ruzafa, A. and Marcos, C.
Title: Aplicación de los GAM para establecer relaciones entre la composición genética de *Cerastoderma glaucum* y la variabilidad ambiental de la laguna costera del Mar Menor (SE de Spain)
Type of presentation: poster
Congress: II Congreso Ibérico en Ecología
Publication: Proceedings of the Congress
Meeting place (date): Lisboa, Portugal (2006)

Authors: Sánchez, J.A., Cánovas, F. and Lacasa, A.
Title: Un Sistema de Información Geográfica (SIG) interactivo para el manejo de enemigos naturales y plagas en cultivos de pimiento
Type of presentation: oral presentation
Congress: IV Congreso Nacional de Entomología Aplicada, X Jornadas Científicas de la S.E.E.A. y I Jornadas Portuguesas en Entomología Aplicada
Publication: Proceedings of the Congress
Meeting place (date): Bragança, Portugal (2005)

Authors: Cánovas, F., Sánchez, J.A. and Hermoso de Mendoza, A.
Title: Diversidad genética de poblaciones de *Myzus persicae* (Sulzer) (Hemiptera: Aphididae) de la Región de Murcia

- Type of presentation:* oral presentation
Congress: IV Congreso Nacional de Entomología Aplicada, X Jornadas Científicas de la S.E.E.A. y I Jornadas Portuguesas en Entomología Aplicada
Publication: Proceedings of the Congress
Meeting place (date): Bragança, Portugal (2005)
-
- Authors:* Sánchez, J.A., Cánovas, F. and Lacasa, A.
Title: Estrategias de manejo y umbrales de intervención para *Aulacorthum solani* (Hemiptera: Aphididae) en cultivos de pimiento en invernadero
Type of presentation: oral presentation
Congress: IV Congreso Nacional de Entomología Aplicada, X Jornadas Científicas de la S.E.E.A. y I Jornadas Portuguesas en Entomología Aplicada
Publication: Proceedings of the Congress
Meeting place (date): Bragança, Portugal (2005)
-
- Authors:* Cánovas, F., Sánchez, J.A. and Hermoso de Mendoza, A.
Title: Temporal and spatial variability of the genetic diversity of *Myzus persicae* (Sulzer) (Hemiptera: Aphididae) from Southeastern Spain
Type of presentation: poster
Congress: 7th International Symposium on Aphids
Publication: Proceedings of the Congress
Meeting place (date): Fremantle, WA, Australia (2005)
-
- Authors:* Cánovas, F., De la Rúa, P., Serrano, J. and Galián, J.
Title: An example of GIS analysis of the biogeography of *Apis mellifera iberiensis* (Engel, 1999)
Type of presentation: poster
Congress: Molecular Ecology and Evolutionary Genetics. Special Symposium in honour of Professor Godfrey Hewitt
Publication: -
Meeting place (date): Norwich, United Kingdom (2005)
-
- Authors:* Cánovas, F., De la Rúa, P., Serrano, J. and Galián, J.
Title: Relationship between genotype and environmental gradients: an example of GIS analysis of the biogeography of *Apis mellifera iberiensis* (Ruttner, 1988; Engel, 1999) from North-Western Spain
Type of presentation: poster
Congress: First European Conference of Apiculture (EurBee)
Publication: Proceedings of the Congress
Meeting place (date): Udine, Italy (2004)
-
- Authors:* Cánovas, F. and De la Rúa, P.
Title: Interpretación ecológica de la variabilidad genética de las poblaciones de *Apis mellifera* (L.)

<i>Type of presentation:</i>	conferencia invitada
<i>Congress:</i>	IV Congreso Nacional de Apicultura
<i>Publication:</i>	Proceedings of the Congress
<i>Meeting place (date):</i>	São Miguel, Açores, Portugal (2004)
<i>Authors:</i>	Cánovas, F. and De la Rúa, P.
<i>Title:</i>	Caracterización molecular de las poblaciones de abejas ibéricas: técnicas, resultados y perspectivas
<i>Type of presentation:</i>	conferencia invitada
<i>Congress:</i>	V Forum Nacional de Apicultura
<i>Publication:</i>	Proceedings of the Congress
<i>Meeting place (date):</i>	Bragança, Portugal (2003)
<i>Authors:</i>	Cánovas, F., De la Rúa, P., Gallego, D., Serrano, J. and Galián, J.
<i>Title:</i>	Interpretación ecológica de la variabilidad genética de poblaciones de <i>Apis mellifera</i> iberica (Ruttner, 1988) del noroeste de la Península Ibérica
<i>Type of presentation:</i>	oral presentation
<i>Congress:</i>	III Congreso Nacional de Entomología Aplicada y IX Jornadas Científicas de la S.E.E.A.
<i>Publication:</i>	Proceedings of the Congress
<i>Meeting place (date):</i>	Ávila, Spain (2003)
<i>Authors:</i>	Gallego, D., Cánovas, F. and Galián, J.
<i>Title:</i>	Distribución de las especies de <i>Tomicus</i> (Scolytidae) en Spain. Un modelo predictivo basado en variables climáticas
<i>Type of presentation:</i>	oral presentation
<i>Congress:</i>	III Congreso Nacional de Entomología Aplicada y IX Jornadas Científicas de la S.E.E.A.
<i>Publication:</i>	Proceedings of the Congress
<i>Meeting place (date):</i>	Ávila, Spain (2003)
<i>Authors:</i>	Salamanca, G.G., Galián, J. and Cánovas, F.
<i>Title:</i>	Validación de un método analítico para la evaluación del ADN mitocondrial de <i>Apis mellifera</i> de diferentes zonas biogeográficas colombianas
<i>Type of presentation:</i>	
<i>Congress:</i>	XXXVII Congreso Colombiano de Ciencias Biológicas
<i>Publication:</i>	Proceedings of the Congress
<i>Meeting place (date):</i>	Colombia (2002)

Organisation of scientific dissemination activities

Organizing meetings, congresses, workshops, training courses, symposiums, conferences, seminars, . . .

- *Revolution V*
 - *Place (date)*: Centro de Ciências do Mar, Faro, Portugal
 - *Date*: November 27th - Decembre 7th, 2014
 - *Activities*: Organization and speaker
 - *Topic*: Revolution V: quantitative ecology and spatial prediction of species distribution
 - *Dedication*: 40 h
- *I CUMFISH Workshop*
 - *Place (date)*: Centro de Ciências do Mar, Faro, Portugal
 - *Date*: May 14th - 15th, 2014
 - *Activities*: Organization committee
 - *Topic*: CUMFISH Workshop: a new resource for a hungry fishery
 - *Dedication*: -
- *Revolution IV*
 - *Place (date)*: Centro de Ciências do Mar, Faro, Portugal
 - *Date*: April 8th - 19th, 2013
 - *Activities*: Organization and speaker
 - *Topic*: Revolution IV: quantitative ecology and spatial prediction of species distribution
 - *Dedication*: 40 h
- *[OpenWorkshops]*
 - *Place (date)*: Centro de Ciências do Mar, Faro, Portugal
 - *Date*: February to June, 2013
 - *Activities*: Organization and speaker
 - *Topic*:
 - * Non statistic with R (February 6th - 7th)
 - * Open source GIS (March 1st)
 - * Introduction to web publishing: Drupal (April 5th)
 - * Statistical models in R (April 24th)
 - * Scientific writing using L^AT_EX: introduction (May 10th)
 - * Scientific writing using L^AT_EX advanced formatting of tables and figures, and bibliography management using B_IB_TE_X (June 7th)
 - *Dedication*: 28 h

- *[OpenWorkshops]*
 - *Place (date)*: Centro de Ciências do Mar, Faro, Portugal
 - *Date*: March to May, 2012
 - *Activities*: Organization and speaker
 - *Topic/s*:
 - * Introduction to R (March 22nd)
 - * Scientific writing using L^AT_EX and B_IB_TE_X (May 17th - 18th)
 - *Dedication*: 12 h
- *Revolution III*
 - *Place (date)*: Centro de Ciências do Mar, Faro, Portugal
 - *Date*: May, 2011
 - *Activities*: Organization and speaker
 - *Topic/s*: Non linear modelling using R
 - *Dedication*: 4 h
- *Revolution II*
 - *Place (date)*: Centro de Ciências do Mar, Faro, Portugal
 - *Date*: February 22nd - 26th, 2010
 - *Activities*: Organization and speaker
 - *Topic*: Management of R statistical software
 - *Dedication*: 20 h
- *Revolution I*
 - *Place (date)*: Centro de Ciências do Mar, Faro, Portugal
 - *Date*: April 19th - 21st, 2010
 - *Activities*: Organization and speaker
 - *Topic*: Management of R statistical software
 - *Dedication*: 12 h
- *I Conferencia R-Project Hispana*
 - *Place (date)*: University of Murcia, Murcia, Spain
 - *Date*: November 26th - 27th, 2010
 - *Activities*: Organization committee
 - *Topic*: R statistical software meeting
 - *Dedication*: -
- *Jornadas de Cría y Salud del Ganado Porcino*
(*Workshop on Breeding and Health of Pig*)

- *Place (date)*: University of Murcia, Murcia, Spain
- *Date*: April 9th - May 4th, 2003
- *Activities*: Organization committee
- *Topic*: Specialize in veterinary medicine of pigs
- *Dedication*: -

Academic service and contributions

- Review and referee activities for the following journals:
 - Apidologie;
 - European Journal of Entomology;
 - Marine Ecology Progress Series;
 - Molecular Biology Reports;
 - PLoS one.
- Evaluation of projects for:
 - National Assessment Committee (ANEP, Spanish Ministry of Science and Education)
- Member of:
 - Centro de Investigação de Montanha (CIMO). 2006-2009
 - Spanish Society of Applied Entomology (SEEA). 2005-2009
 - University Club of Underwater Activities (CUAS). 1997-Now
- Representative of the **University Club of Underwater Activities (CUAS)**:
 - Vice-president. 2007-2010
 - Secretary. 2003-2007

Other achievements

Attendance at workshops and seminars

- 2009 Evolutionary islands 150 years after Darwin
Naturalis. Netherlands
- 2005 I Seminar of proteomic
University of Alicante. Spain
- 2004 Workshop in spatial data infrastructure
Service of Information and Environmental Integration (SIGA). Spain
- 2004 XV Seminar of population genetics and evolution
Spanish Society of Genetic. Spain
- 2002 Laboratory safety
University of Murcia. Spain
- 2000 Workshop in applied statistics
University of Murcia. Spain
- 1994 Workshop in Reptiles and Amphibians
University of Murcia. Spain

Attendance at other training courses

2008. Education of the voice. University of Balearic Islands. Spain.
2006. Phylogenetic Analysis. CIBIO - University of Porto. Portugal.
2003. Prevention and Treatment of Diving Accidents. Spanish Navy. Spain.
2003. Introduction to R. University of Murcia, Spain.
2003. Diving Course. Advanced Scuba Diver. NAUI.
2002. Recreational Skipper. Motor and sailing boat.
2001. Speciation, Phylogeny and Phylogeography. University of Murcia, Spain.
2001. Restoration of Aquatic Ecosystems. University of Murcia, Spain.
2001. Management of coastal ecosystems. University of Murcia, Spain.
2001. Population genetics. University of Murcia, Spain.
2001. Molecular techniques in ecology and systematic. University of Murcia, Spain.
2001. Landscape ecology and biodiversity. University of Murcia, Spain.
1997. Diving B*. CMAS.
1997. Cetaceans. University of Murcia, Spain.
1996. Academic English I. University of Murcia, Spain.
1995. Advances in Molecular Genetic. University of Murcia, Spain.
1994. *In vitro* Embryos Management. Spanish Society of Anatomy. Spain.
1994. Study of Fishes. University of Murcia. Spain.

Awards & Honors

- Best oral presentation

III Congreso Nacional de Entomología Aplicada; IX Jornadas Científicas de la S.E.E.A. Ávila, Spain, 2003.

Professional experience

Date	Position	Company
1999 - 2001	Veterinary	Sanitary Defence Association of Cattle
1998 - 1999	Veterinary	Fort Dodge Veterinaria, S.A.

Professional experience with Educational purposes

Date	Position	Entity	Description
2007	Instructor	Gesturmediterranea, S.A.	<i>Nautical sports</i>
2002-2004	Instructor	Universitary Club of Subacuatic Activities	<i>Marine mammals</i>
2000	Instructor	Regional Government of Murcia	<i>Coastal ecology</i>
1999	Instructor	Regional Government of Murcia	<i>Coastal ecology</i>
1999	Instructor	Regional Government of Murcia	<i>Coastal ecology</i>
1998	Instructor	Regional Government of Murcia	<i>Coastal ecology</i>
1997	Instructor	Universitary Club of Subacuatic Activities	<i>Apnea diving</i>

Methodologies and equipment

Technical Skills:

- Sampling design (wild/managed);
- Mammal blood cell cultures;
- Fluorescence in situ hybridization;
- Primer design;
- PCR techniques;
- RFLP techniques;
- DNA sequencing;
- Microsatellite genotyping;
- Electrophoresis (acrylamide and agarose);
- Ethidium bromide and silver stains;
- Analysis of phylogenetics and evolution;
- Next generation sequencing data analysis;
- Transcriptomics data analysis;
- Geographic Information Systems (GIS);
- Geostatistics;
- Multivariate analysis;
- Linear and non-linear modelling;
- Land/sea-scape genetics;

- phylogenetic analyses;
- metatranscriptomic analyses;
- 3D parametric design;
- basic electronics.

Main equipment:

- Microscopes (optical and fluorescence);
- Stereo microscopes;
- Thermocyclers;
- Centrifuges;
- Autoclave;
- Vertical and horizontal electrophoresis;
- Micropipetting;
- Gel photodocumentation;
- GPS;
- Scuba diving equipment;
- Sailing and motor boats;
- 3D desktop printers;
- Open source microcontrollers.