September 2019 vs. 2.3



ABT Innovia *Capability Statement*



Excellence through Innovation and Quality





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AquaBioTech Group is an international aquaculture, fisheries and marine consultancy and engineering company. Our headquarters are strategically located in the centre of the Mediterranean, on the island of Malta, and operates globally with clients in over fifty-five countries. Staff are recruited from across the globe, enabling communication with clients in nineteen languages.

AquaBioTech Group undertakes a variety of aquaculture, fisheries and other aquatic environmental projects through its regional offices and selected partners throughout the world. The vast majority of the company's work is related to the marine or aquatic environment, encompassing aquaculture developments, market research/intelligence, through project feasibility assessments, finance acquisition, project management, technology sourcing and technical support and training. Within **AquaBioTech Group** there are various divisions that focus on different business areas:

ABT Aquaculture is the consulting division of the company for all aquaculture related projects. We have become well established as a provider of due-diligence assessments and risk assessments for all forms of aquaculture operations, as well as consulting on operational issues and improvements in hatcheries, fish farms, research facilities and processing facilities.



OFFSHORE AQUACULTURE

We are able to provide a complete service from project design all the way through to installation and commissioning. Projects of all sizes are undertaken, including assistance in procurement of equipment, technologies and staff for new projects. Experienced in designing offshore aquaculture projects for some of the most exposed sites, our engineers work with cage manufacturers and mooring experts to safely move fish farms further offshore.

LAND BASED AQUACULTURE

With extensive global experience in the design and construction of Recirculation Aquaculture Systems (RAS) for new projects and retro-fits, we offer a wealth of knowledge, assisting in management and monitoring of land-based production facilities. Our company undertakes a variety of different RAS projects including full project engineering, through to specific biological aspects of production systems for mainstream and emerging species. All projects include an online monitoring system that allows our staff to continuously monitor the system's performance from our head office.

AquaCirc[™] has developed a number of highly efficient and cost-effective RAS. The system developed by AquaBioTech Group is a unique recirculation system which combines numerous state of the art recirculation apparatus, such as specifically designed tanks, Glass Reinforced Plastic (GRP) fibreglass products, specialist products and saturation cones.



ABT Aquatics is an independent aquatic consulting division that forms part of **AquaBioTech Group**. It has widerange of in-house expertise specializing in all engineering, husbandry and technical aspects. We are aware of the importance of the dialogue between client and provider and are dedicated to providing excellent consultation. **ABT Aquatics** focuses on aquariums and the ornamental industry with the main areas of work including:

- Architectural, engineering and structural design
- Outline planning with concept development
- Management support and turnkey operations
- Life Support System (LSS) development
- Filtration systems development
- Initial feasibility studies
- Livestock supply

ABT Marine provides a range of services including marine surveying, remote operated vehicle (ROV) search and rescue missions, habitat mapping, and GIS analysis. The skills and techniques employed include subsea sediment and water quality assessments, bathymetric and side scan sonar surveys, ROV investigations, and site inspections using both remote sensing, underwater video techniques and SCUBA diving.

ABT Innovia offers research services to support the development of vaccines, functional feeds, alternative protein sources, culture technologies and production techniques with a wide range of commercially important species under any combination of culture conditions in our fully licensed and bio-secure R&D facilities. Our wet and dry labs are GMP certified for the life cycle and safety testing of vaccines as well as GLP certified for toxicology research and other services.

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AquaBioTech Group has been continually upgrading and expanding its research and development facilities, which currently includes a total of thirty (30) trial rooms or "Bays" with fourty-three (43) individual trial systems, all utilising **AquaBioTech Group**'s RAS technology.

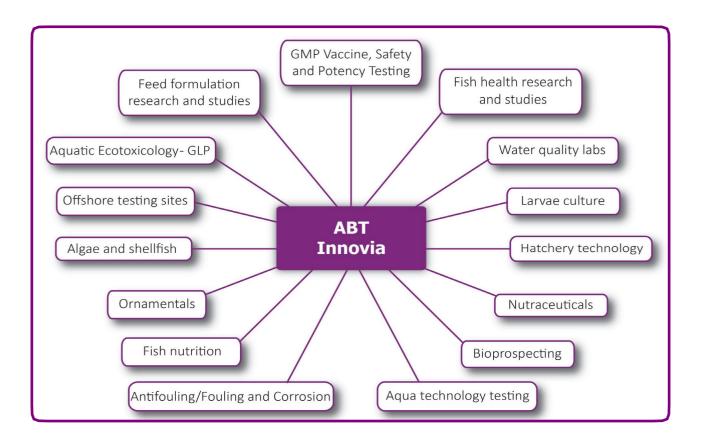
The latest expansion and upgrading phase is now complete and the new bays are operational, all with their own dedicated drain lines, more energy efficient pumps and the very latest heat-exchange units with increased efficiencies. All systems are lit using photo-control LED lighting and each bay has its own specific ventilation unit and computerised water quality monitoring and equipment control system.

The overall design and finishing enhances sanitation; with epoxy resin floors and walls for ease of cleaning.

Having our own GRP fiberglass production facility means that we can produce tanks of any shape and size and can put an entire system together to have it operational in less than two weeks, if required.

As part of our expansion we have established a new, dedicated aquatic ecotoxicology laboratory and testing systems for fish, algae and shellfish species.

The main areas of contractual industrial research undertaken for our clients and expertise areas of the company are described in the following illustration:



VETERINARIAN RESEARCH

The veterinarian unit is geared towards undertaking research and trials investigating and assessing health related applications, such as vaccine and functional ingredient development, safety and potency involving viral, bacterial and parasitic diseases in aquatic animals.

AQUATIC NUTRITION RESEARCH / STUDIES

The fish nutrition facility is available to international companies to benchmark commercially available products and carry out investigative research on new products. This includes testing of new formulations with specialised or novel ingredients and providing new approaches to improving fish growth, reducing environmental impacts or improving fish health. In-depth detailed research, such as digestive physiology, metabolic biochemistry and quality issues can also be undertaken at the facility in a wide variety of species.

HATCHERY TECHNOLOGY AND PRODUCTION TECHNIQUES

The research facility hosts a fully operational live feed and larval rearing bays where the latest technology and production strategies can be tested for improving hatchery production/efficiency and knowledge of new species production in both commercial and ornamental aquaculture.



TESTING FACILITIES AND CORE SERVICES

The wet labs at the facilities are divided into separate areas so as to ensure maximum biosecurity and client confidentiality. Each of the bays contains a set of holding tanks with self-contained recirculation systems providing high-level mechanical, chemical and biological filtration. All incoming water is filtered down to 1µm and the RAS units have the option of continuous UV, ozone or combined treatment. Systems can use freshwater or seawater with operational temperatures ranging from 8°C to 35°C. Multiple RAS units can be operated within one Bay. Our facilities currently include trial rooms with full recirculation aquaculture systems allowing for complete customization. All bays can be adjusted for fresh water or marine species, for a variety of temperatures and uses as per client requirements.

Bav 1



Twelve (12) tanks in the system (1,500 L each).



S1: Six (6) tanks in the system (300 L each).S2: Nine (9) tanks in the system (300 L each).S3, S4 and S5: Four (4) tanks in each system (250 L).



S1: Six (6) tanks in the system (1100 L each). S2: Twelve (12) tanks in the system (1100 L each). An interconnection is possible if reguired.



Eighteen (18) tanks in the system (500 L each).



S1,S2: six (6) tanks in each system (500 L each). The room is divided by a wall with separate equipment on each side that can be interconnected if required.



S1: Nine (9) tanks in the system (500 L each). System can be operated at two (2) levels (350 L or 500 L each)



Twelve (12) tanks in the system (300 L each).



Eighteen (18) tanks (1,000 L each). Freshwater - assigned to Tilapia, Pangasius or other similar species with an additional three (3) tanks (90 L each) and six (6) tanks (50 L each) for fry on-growing.



Bay 8

S1: Twelve (12) tanks in the system (500 L each) with full RAS.





S1: Eighteen (18) tanks in the system (10 L). S2: Three(3) tanks in the system (800 L). A GLP laboratory for preparation and performance of ecotoxicological and anti-fouling trials and dissection and study of fish.



Fifteen (15) tanks in the system (670 L each).



S1, S2: Eight (8) tanks in end system (100 L each).All tanks have acrylic viewing windows for greater ease of fish behaviour observation.



Sixteen (16) tanks in the system (40 L each). Polycarbonate tanks with sliding lids.



S1: Ten (10) tanks in the system (6*10 L, 2*20 L, 2*40 L). S2: Twelve (12) tanks in the system (40 L each).



S1, S2: Four (4) tanks in end systems (400 L each).



Twelve (12) tanks in the system (500 L each).



LO Biosecurity



Four (4) tanks in the system (500 L each).



Twelve (12) tanks in the system (500 L each).





Four (4) tanks in the system (500 L each).



Six (6) tanks in the system (400 L each).



Three (3) tanks in the system (400 L each).



S1: Three (3) tanks in the systems (400 L each).S2: Three (3) tanks in the systems (400 L each).

Biosecurity is one of the most important aspects in animal production since it prevents the introduction, spread and transmission of disease into, within and between animal production facilities. Although basic in principle, biosecurity is one of the most challenging aspects of food production, as it encompasses the design, implementation and monitoring of specific measures at a variety of stages when working with animals.

Our facilities operate with a high degree of biosecurity so as to reduce the risk of pathogen transmission. Our staff is trained in industry-leading biosecurity procedures and the work-flows around the facilities are designed to keep biosecurity risks to a minimum. Some of our biosecurity policy features include:

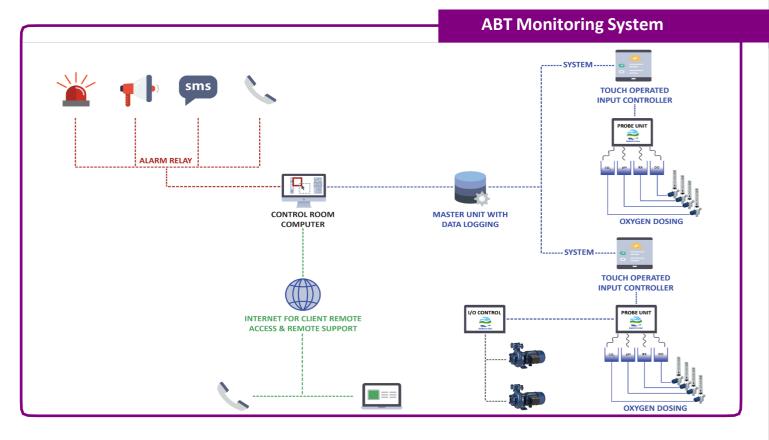
- Disinfection of footwear, gear and hands at the entrance of every lab
- Strict access control to experimental bays
- Individual sets of footwear, equipment and water quality sensors in each bay
- Constant disease surveillance performed on water and stock
- Quarantine procedures in place for each batch of incoming fish, even when sanitary certificates have been provided by the supplier



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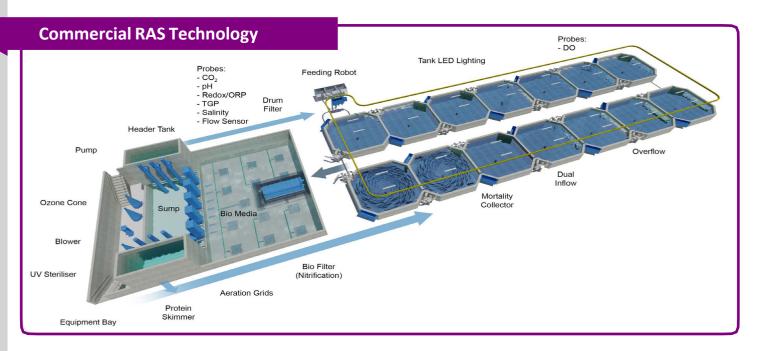
AquaBioTech Group operates an advanced system for continuous measurement, monitoring and control of important water parameters, as well as key operational technology, just as it does in any of its commercial hatcheries or fish farms.







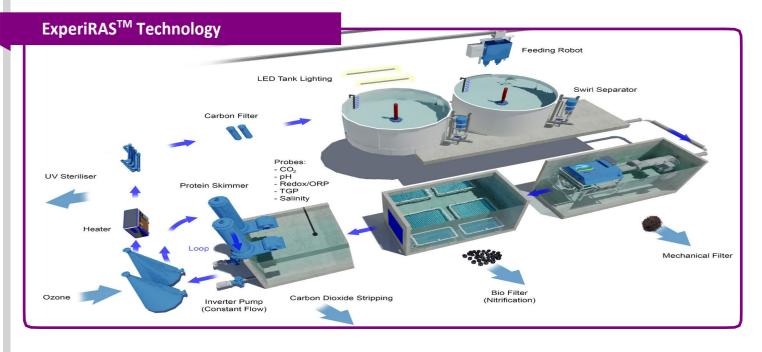
Based on our expertise, we design facilities that run a wide range of daily water exchange rates – from flow-through to zero exchange. We also offer independent filtration solutions for solids removal, biofiltration, gas exchange, water polishing and disinfection.



INTERNAL DESIGN AND MANUFACTURING

ABT Innovia and **AquaBioTech Group**, also apply their expertise to the design and manufacturing of Glass Reinforced Plastic (GRP) equipment for aquaculture facilities, offering:

- Skid-mounted RAS units
- Tanks for every application: fish tanks, biofilter tanks, sumps, lids
- Speece cones: oxygen and ozone cones
- Packed columns: oxygenation and degassing
- Protein skimmers



ABT Innovia research facility can run cost effective trials with cold water species like Rainbow Trout, and tropical species like Pangasius, Asian Sea bass and Tilapia . Furthermore, with existing partnerships with hatcheries worldwide have allowed us to develop secure reliable supplies of a number of additional species.

The following list represents species we are able to secure from known sources, but we are also open to requests from clients to work on other species if required.

FISH SPECIES

MARINE

- Atlantic Salmon / Salmo salar
- Yellowtail / Seriola lalandi
- Groupers / Epinephelus sp.
- Sea bream / Saparus auratus
- Meagre / Argyrosomus regius
- Cobia / Rachycentron. canadum
- Sole / Solea solea / Senegalensis sp.
- Turbot / Scophthalmus maximus
- Coho salmon / Oncorhynchus kisutch
- Pomfret / Paralichthys sp
- European Sea bass / Dicentrarchus labrax
- Japanese flounder / Paralichthys olivaceus

WARM - FRESHWATER

- Clarias Catfish / Clarias gariepinus
- Pangasius / Pangasius hypophthalmus
- Tilapia / Oreochromis niloticus (and other species)
- Nile Perch / Lates niloticus
- Asian Seabass / Lates calcarifer
- Tambaqui / Colossoma macropomum
- Snakeheads / Channa striata and C. micropeltes

COLD - FRESHWATER

- Tench / Tinca tinca
- Perch / Perca fluviatilis
- Pike Perch / Sander lucioperca
- Brown / Sea trout / Salmo trutta
- European Catfish / Silurus glanis

ORNAMENTALS

- Clownfish
- Zebra Danio / Danio rerio





- European eel / Anguilla anguilla
- Sturgeon / Sterlet / Acipenser sp.
- Rainbow Trout / Oncorhynchus mykiss
- Carp / Koi Carp / Cyprinus carpio (and other species)
- Angelfish / *Pterophyllum scalare*
- Medaka / Oryzias latipes

SHELLFISH

- Oysters
- Abalone
- Manila clams
- Limpets / Patella sp.

PHYTOPLANKTON

- Pavlova
- Isochrysis
- Skelotonema
- Nanochloropsis

LIFE FEEDS

- Copepods
- Artemia / Artemia sp.

OTHER INTERVERTEBRATES

Corals

• Sponges

AQUATIC ECOTOXICOLOGY

ACUTE AND CHRONIC TRIALS

- Macroinvertebrates / Daphnia magna, Americamysis bahia
- Fish / Danio rerio, Cyprinus carpio, Oncorhynchus mykiss, Cyprinodon variegatus, Dicentrarchus labrax, Pagrus major, Lepomis macrochirus, Oryzias latipes, Pimephales promelas
- Phytoplankton / Pseudokirchneriella subcapitata, Tetraselmis chui, Skeletonema sp., Phaeodactylum tricornutum, Desmodesmus subspicatus, Navicula pelliculosa

ANTIFOULING EFFICACY TRIALS

- Barnacles / Amphibalanus amphitrite
- Mussels / Mytilus galloprovincialis, Brachidontes pharaonis
- Bryozoan / Bugula neritina
- Diatoms / Phaeodactylum tricornutum



- Razor clams / Ensis sp.
- Sea urchins / Paracentrotus lividus
- Mussels / Mytilus edulis and M. galioprovincialis
- Chlorella, Phormidium
- Chaetoceros, Tetraselmis
- Thalassiosira, Phaeodactylum

Rotifers / Brachionus sp.

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After several years working in the field of product efficacy, we have developed models for many disease pathogens that threaten aquatic animal production. Our facilities have an extensive background working with some of the most relevant diseases affecting fish in aquaculture, such as *Streptococcus agalactiae* but also other pathogens which are more difficult to work with such as *Flavobacterium psychrophilum*.

We have been working on expanding our list of challenge models. Work has been completed on our cohabitation challenge models for streptococcosis on Nile tilapia (*O. niloticus*) in challenges with orally infected fish. New microbiological technologies have been studied for its application in the production of highly concentrated pathogenic bacteria vials that are also available to our clients, ready to use in our own bacterial strains but also ready to apply to any other organism requested.

OUR CHALLENGE MODELS INCLUDE

- Challenge by pathogen inoculation through a bath/dip or an oral/parenteral administration.
 Mortalities can be studied in the fish directly inoculated with the pathogen or in cohabitation groups according to the trial design
- Application of vaccine / therapeutic products by bath, oral or parenteral routes
- Application of environmental stressors when required by the experimental protocol

PARASITE CHALLENGE MODELS (UNDER DEVELOPMENT)

• Monogeneans (Sparicotyle chrysophrii)

Challenge Model List

BACTERIA

- Flavobacterium psychrophilum Trout; Bacterial
 Cold-Water Disease
- Streptococcus agalactiae Tilapia; Streptococcosis
- Streptococcus iniae Tilapia; Streptococcosis
- Photobacterium damselae subsp. piscicida Sea bass; Pasteurellosis
- Vibrio anguillarum Serotype 01 Sea bass; Vibriosis
- Vibrio harveyi Sea bream; Vibriosis
- Aeromonas hydrophila Tilapia and Pangasius;
 Motile Aeromonas Septicemia

 Aeromonas salmonicida subsp. salmonicida -Trout; Furunculosis

VIRUS

- Cyprinid herpesvirus 3 Common carp; Koi
 Herpesvirus Disease
- Betanodavirus (RG NNV: Red Grouper Nervous Necrosis Virus) - Sea bass; Viral Nervous Necrosis
 PARASITES
- Sparicotyle chrysophrii Sea bream; Sparicotylosis



Different types of nutrition trials can be performed in our facilities:

- Benchmarking performance trials using different commercially available feeds where fish are grown for a period of time, and biometric parameters are recorded
- Feed formulation trials, where desired raw materials or additives are included at different inclusion levels in experimental diets. Feeds can be formulated by the client or with the help of **ABT Innovia**



- Functional feed trials: where feeds containing special ingredients are fed prior to a particular challenge such as thermal stress, low oxygen or an immunological challenge
- Digestibility trials

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In our laboratories, and in collaboration with various research centres, we can perform several tests which are useful in the diagnosis and treatment of a disease outbreak.

- Microbiological isolation of bacteria
- Identification by biochemical tests
- Optical microscope classification
- Histology
- RT PCR
- ELISA

INTERNAL ANALYSIS AND PRACTICES

- Tagging
- Histology
- Microbiology
- Spielberg test
- Digital Imaging
- Vaccine residue
- General biometry
- Optical microscopy
- Elastomer and PITs
- Examination via gross necropsy
- Physiological / Biochemical parameters



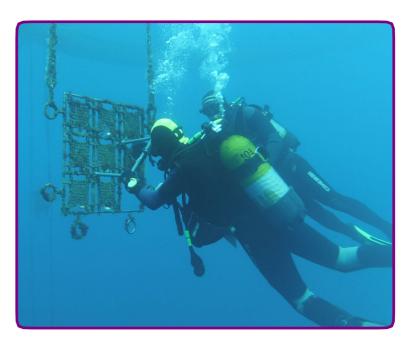
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WITH PARTNER LABORATORIES AND RESEARCH CENTRES

- ELISA
- HPLC
- RT PCR
- Respiratory burst
- Sediment analysis
- Heat Shock Proteins
- Off flavouring geosmin / MIB
- Viral isolation and cell culture
- Enzymatic activity at tissue level
- mRNA expression in specific tissue
- Protein expression in specific tissue
- Proximate composition of whole body or target organs

Marine fouling causes enormous problems in the maintenance of vessels, aquaculture cages, ropes and moorings as well as intake pipelines, Reverse Osmosis (RO) plants and other structures. Our licensed facilities provide laboratories, testing tanks and field studies to assess the antifouling efficacy of active substances and antifouling products. In field studies, we provide an in-depth assessment of the antifouling performance using image analysis, attachment strength tests and identification of the fouling community.



LABORATORY SCREENING TESTS

Single species bioassays provide a fast and reliable screening method to identify effective active substances and formulations. Bioassays can be done in vitro to test active substances or follow the latest standardized screening test methods (ISO) for efficacy of anti-fouling paints. Micro and macro-fouling model species currently in-house:

- microalgae, macroalgae
- bryozoan, hydrozoan, polychaeta
- barnacles and mussels

FIELD TESTS – HARBOUR AND OFFSHORE

- Static field tests in harbour (Panels ASTM D3623-78a, D6990-05)
- Offshore field tests (Nets / Metallic Demonstrators / Corrosion testing



Many regulations require ecotoxicological studies in order to fulfil applications for registration such as the European REACH regulations on chemicals and the Certification of Bioplastics. The ecotoxicology research laboratory is GLP certified and uses universally recognised techniques to measure and screen hazardous substances which are released or may be released into the environment.

AREAS OF APPLICATION

EXPERTISE AND SPECIAL SKILLS

- Industrial chemicals
- Veterinary drugs
- Feed additives
- Cosmetic products
- Biocides

- Environmental toxicity studies on aquatic organisms
- Residue studies
- Studies on behaviour in water
- Biochemical parameters
- Endocrine disruption



MODEL SPECIES AVAILABLE

• Algae

Toxicity tests on algae are assessed in accordance with the latest OECD guidelines. We have several species cultured in-house (green microalgae and diatoms) and have been working with marine microalgae for several years. Tests with different species, freshwater or marine, can be established on request.

• Aquatic invertebrates

Toxicity tests with aquatic invertebrates are available with freshwater and marine species, notably with mysids, brine shrimps and rotifers.

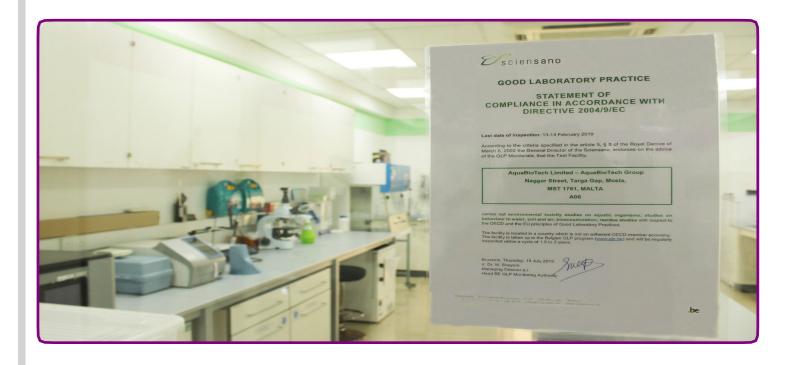
• Fish

We have extensive experience working with a wide array of freshwater and marine fish species and can perform acute or chronic studies according to standard guidelines (OECD 203, 210, etc.). Our wet labs are specifically designed to run large-scale short and long- term trials, with a wide range of tank sizes, from 10-1500 L.

ABT Innovia is a GMP (Good Manufacturing Practice) certified facility by VMD, UK, (Certificate No: VMDGMP/ T039/2018) and VDR Malta (Certificate No: VPRDGMP/01/2018. **ABT Innovia** has also been inspected and certified by VSU, Turkey (Certificate No: GMP/TR/V/YD/S0106/2018). **ABT Innovia** is listed at EudraGMP as a site of QC testing as it complies with the principles and guidelines of Good Manufacturing Practice laid down in Directive 91/412/EEC.



Also, **ABT Innovia** is a GLP (Good Laboratory Practice) certified facility by GLP Monitoring Authority, Belgium. **ABT Innovia** is able to offer toxicity studies on aquatic organisms: studies on behavior in water, soil and air; bioaccumulation; residue studies with respects the OECD and the EU principles of Good laboratory Practices.



Aquatic organisms are faced with many threats to their health through natural exposure to stresses and challenges. At **AquaBioTech Group** we are constantly striving to advance scientific understanding of how technology, nutrition and health management can help fish, shrimp and other aquatic species resist and

recover from illness, stress and disease. Optimising the health status is essential for maintaining fish welfare and for achieving optimum growth of aquaculture species - research plays a key role in accomplishing these goals. The ethical and humane treatment of all animals in our care is of the highest priority, therefore we implement the three "R's" principle, where possible and when animal testing is required, namely;



REPLACEMENT

It refers to methods that avoid the use of animals, or at least replacing those animals that are used in research. When discussing research needs with clients, **AquaBioTech Group** will encourage clients to identify alternatives to animal testing such as in vitro methodologies.

REDUCTION

It refers to methods which minimise animal use and enable researchers to obtain comparable levels of information from fewer animals or to obtain more information from the same number of animals. When designing experiments, **AquaBioTech Group** will attempt where possible to reduce the number of animals used. This can include:

- Reusing experimental animals when no increased risk of pain, suffering or lasting harm is foreseen
- Carrying out appropriate research (e.g. literature research) to avoid unnecessary testing
- Improving experimental design and statistical analysis

REFINEMENT

It refers to improvements in scientific procedures and husbandry practises which minimise actual or potential pain, suffering, distress or lasting harm and / or improve animal welfare in situations where the use of animals is unavoidable.

When conducting experiments, **AquaBioTech Group** will provide the highest standards of care and husbandry to the experimental animals, including:

- Ensuring where possible that the use of non-invasive techniques are employed
- Maintaining appropriate and optimal husbandry conditions
- Ensuring that suitable humane endpoints are identified

AquaBioTech Group is actively involved in research and academic activities at both National and European level, either in collaboration with local universities and public bodies or as part of larger consortia which take part in Europe's main research schemes.

In Malta, **AquaBioTech Group** has ongoing collaborations with local entities including University of Malta.

The company is also actively involved in European and international collaborative research projects such as H2O2O framework programme and other initiatives. AquaBioTech Group has completed numerous collaborative research projects in the various areas of expertise.

Furthermore we participate in a number of international and bilateral cooperation schemes such as the ERANETs, Interreg, Eureka, PRIMA Initiative and others to establish a long-lasting business and research collaboration with counterparts from Africa, Middle East, Asia, Latin America, USA and Canada.











AquaBioTech Group provides opportunities for students and post-graduates to undertake traineeships and gain valuable practical experience and develop new skills in the various fields of activity in which we operate.

We have been receiving an increasing number of trainees over the years, coming from all over the world and contributing to enrich our international dimension. Undertaking an internship with **AquaBioTech Group** means that you get to work in an internationally orientated and award-winning company. With state-of-the-art research facilities, an innovative mindset and a young and multicultural team.

AquaBioTech Group is the perfect place for young trainees to learn more about the industry and cultivate their professional skills.



We offer internships within:

- Graphic design
- Web development
- Administration
- Market research
- Video producing and editing
- Business development
- Communications and Marketing
- Research and development
- Occupational Health & Safety

- Laboratory QA/QC
- Aquatic Ecotoxicology
- Aquaculture Technician Internship
- Aquaculture Engineering and Maintenance
- Fisheries
- Marine Research
- Fish Health and Microbiology
- Water Quality

We believe that our first responsibility is to our clients who utilise our products and unique professional services. Meeting their needs and demands is our primary goal, pushing us carry out every task at the highest standard.

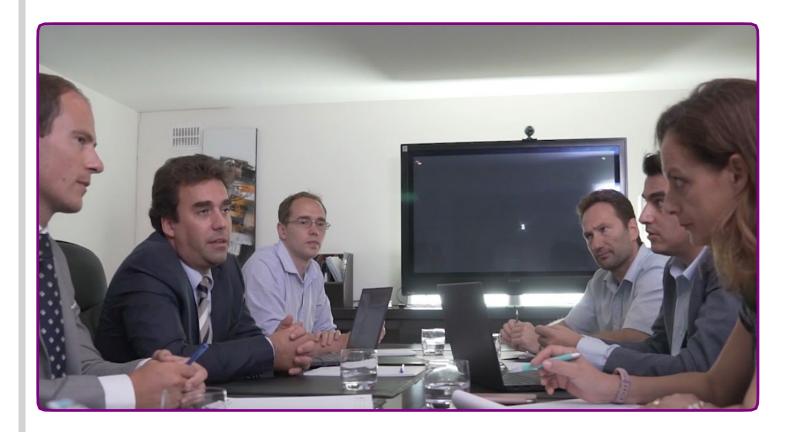
We constantly strive to reduce our costs in order to maintain reasonable prices, as this will enable our clients to obtain the best value for their money using our services. Our customer's demands and problems are of the highest importance to us and are serviced promptly and accurately.

Experimenting with new ideas, developments, concepts and research is an ongoing process at **AquaBioTech Group**, and innovative programs are constantly developed to offer new services and technologies.

In accordance with our mission statement, we continue our expansion. We expect to keep growing our facilities and wet labs in order to satisfy the growing sectoral demand. These facilities will include additional quarantine and stock fish rooms and RAS facilities for fish nutrition and challenge trials.

The company also offers a licensed offshore marine experimental site area which is used for applied research and testing for a wide range of activities including the anti-fouling materials tests, water quality monitoring equipment and other oceanographic instrumentation / research activities.

"Quality is the customer coming back – not just the service"







AquaBioTech Group

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