



RTD Synopsis: Thematic Area 7 – Aquatic Animal Health & Welfare

To help in assessing past (FP6) and ongoing (FP7) RTD projects, the working groups of this thematic area are used as sub divisions of this synopsis. However, two actions addressed animal health issues in general:

- **EADGENE (FP6)**, a Network of Excellence focused on the genomics of animal-pathogen interactions, brought together various strands of European research on livestock diseases, to help Europe retain its position as a world leader in animal health. Genomic research addressed host-pathogen interactions in farm animals and in fish, the focus was on farmed salmonids - Atlantic salmon and Rainbow trout - and on Infectious Salmon Anaemia Virus (ISAV) and Infectious Pancreatic Necrosis Virus (IPNV). Genomic standards were developed and related to comparability (international, across species) of research methodologies, tools etc. for industries operating internationally. They integrated the scientific results and turned outcomes into practical tools, such as strategies for improved diagnostics or breeding, and inventions (e.g. targeted vaccines).
- **EMIDA (FP7)** is an ERA-NET set up to coordinate European research on emerging and major infectious diseases of livestock. Its key objectives are to map and analyse existing research and current needs and information on the commissioning and management of joint programmes; to develop, test, evaluate and refine instruments (Pilots) and to develop a strategic trans-national animal health research agenda. A specific disease database www.discontools.eu is being constructed.
- Specifically on aquaculture, **PANDA (FP6)** established an expert database, containing 293 members from over 50 countries worldwide covering a broad range of primary specialisations including fin fish and shellfish diseases. A permanent web site for network www.europanda.eu was created for public and network communication on risk analysis, epidemiology, diagnostic methods, environmentally safe control strategies and training opportunities and requirements.

Immunology including development of diagnostic tests, vaccines and immune modulators.

Improving understanding of host pathogen interaction together with the application of novel tools such as diagnostic tools, vaccines and immunomodulators.



- The species-specific **EUROCARP (FP6)** project developed new special strains of carp with improved disease and stress resistance. New generation Carp-specific genetic markers and map were also developed, as well as a set of guidelines on carp breeding for commercial production based on reduced reliance on drug treatments.
- **IMAQUANIM (FP6)** brought expertise together to develop technology to improve the disease immunity of Europe's major aquaculture species, investigating immunity in Atlantic salmon, rainbow trout, sea bass, sea bream, carp, mussel and oyster. Tools (gene arrays and antibodies) and assays to monitor molecules and cell populations that are key components of the immunological systems were developed for each species. Research on molluscs and oysters focused on their innate immune system.
- **PROMICROBE (FP7)** is developing fundamental information on microbial communities associated with aquaculture species (both herbivorous and carnivorous) with specific regard to evolution of the microbial community (MC) as the host develops from hatchling into juvenile and on the stability of the MC composition after a major disturbance. It will also develop ways to 'profit' from host microbial interactions by steering the MC composition, with the possibility to use the system-MC to minimize environmental impacts from aquaculture, while benefiting the cultured organisms.

Epidemiology, health monitoring and surveillance, emerging and exotic diseases

Minimizing the spreading of existing, emerging and exotic diseases through epidemiology, health monitoring and surveillance.

- **DIPNET (FP6)** created a European network to integrate and strengthen the current scientific knowledge on the potential transfer of pathogens and diseases between wild and cultured aquatic animal populations, and thereby to support to the development of European policies protecting the health of wild aquatic animal populations while allowing responsible use of the aquatic environment for aquaculture purposes. Its main outputs were a literature review of disease interactions and pathogen exchange between farmed and wild aquatic animals; a scientific review of risk assessments and modelling in aquatic animal health and a review of current activities and methods for fish disease epidemiology. See the documents section at <http://www.revistaaquatic.com/DIPNET/>
- **PARAQUAM (FP6)** looked at gill parasites and blood flukes causing mass mortality in greater amberjacks *Seriola dumerili* – a 'new species' of interest for Mediterranean aquaculture. Although important basic knowledge on the parasites was gained, the planned



immunological study of fish infected with monogeneans had to be postponed and hence requires further investigation.

- **RANA (FP6)** specifically addressed infectious diseases are caused by the Iridoviridae, and more specifically the Ranavirus genus. It looked at wild fish, farmed fish and ornamentals and whether international standards, such as those of OIE and the EU, should be adapted to include tropical ornamental fish. RANA also added to scientific evidence to show which of the viruses are capable of infecting both fish and amphibians, either living separately or as sympatric hosts, and whether if either host type can act as a vector for a serious disease in the other.

Pharmaceuticals, pro-biotics and biosecurity measures

The key goals of this working group of the TA are to minimise treatment and ensure effective application avoiding resistance build up and the improve management measures with alternative control measures (biological, pre- pro-biotics...). Although several FP6 and 7 projects encompassed these goals, they have been summarised under the other WGs, where their main impacts lie.

Animal welfare, management and biological capacity and interaction with its environment

Greater access to information and technology was considered a main issue to be addressed in the future be it in the form of more dissemination of the use of TTIs and an investigation of industry and consumer acceptance of TTIs would help to understand the limiting factors affecting their widespread implementation. ERMES established that the needs of SMEs in the aquaculture sector are oriented towards technology transfer and innovation rather than RTD. Knowledge transfer was the core need of the sector and must be addressed in the future. SMEs must be able to access new developments and be given adequate support in application of new technologies.

- **BENEFISH (FP6)** looked to develop a science based decision analysis model for comparing the biological effects and the economic considerations associated with the adoption/adherence to a welfare standard for fish farming. The consortium identified important and widely accepted welfare indicators which are applicable across species and culture systems. It also looked at the added value of implementation of higher welfare standards throughout the value chain. One key output suggests that elevated levels of CO₂ within a fish tank are a robust risk factor for both growth and feed efficiency in Atlantic salmon smolts. The bio-economic model suggests Norwegian smolt producers can enhance the welfare of Atlantic salmon juveniles, in addition to improving profits, by using CO₂ stripping technology to reduce CO₂ levels in tank water.



- **WEALTH (FP6)** provided baseline data from commercial farms on environment and fish health (e.g. temperature, oxygen, carbon dioxide, behaviour, fish densities, damages/histopathological changes, status of immune parameters) and identified limiting factors and key hazards in various production systems (e.g. low or very high O₂, high CO₂ or stocking density). The project also provided new research tools and approaches (e.g. methods to measure expression of immune or hypoxia related genes, micro arrays, in vivo and in vitro immune stimulation, intestine permeability, cortisol in water) and established links between environmental factors, stress physiology, immune responses and disease resistance. These outputs provide a basis for the validation of **operational welfare indicators** – notably growth performance, feed intake, fin and skin damage, cortisol in water, intestine permeability, assays to profile genes related to chronic stress, hypoxia and immune function, new techniques for in vitro and in vivo immune challenges, and various disease tests.
- **FASTFISH (FP6)** was very much linked to the above two projects and developed an internet based database and expert system for monitoring behaviour and environment in salmon cage farms - **FAST TOOL – which registers fish behaviour, rearing environment and production parameters**. FASTFISH tailored the FAST-TOOL to commercial production by testing it on selected hatcheries and farms in periods with potentially high and low stress levels. With a focus on sea bass, FASTFISH described the **behavioural ontogeny from hatching to juvenile stage**, demonstrating marked differences in growth rate, swimming performance, swimming speed, and feeding behaviour, between fish reared with different methods. Intensively reared fish had a delayed behavioural ontogeny and growth compared to mesocosm reared fish. This information can increase larval quality and survival rates and improve the profitability of the fish farm. Finally, a publication on ‘Cortisol release in water from seabass - a reliable indicator of stress in sea bass’ provides strong evidence that **cortisol release rate into the water can be used as a non-invasive method for the assessment of the stress response** and that although sea bass presents a high blood stress response after exposure to acute husbandry stressors; sea bass release less cortisol into the water compared to other species previously examined. The identified indicators were cross-validated as “proxy” measures for stress, using immunological and physiological (plasma cortisol and cortisol released in water) methods.
- **WELLFISH (FP6)** www.fishwelfare.com brought all European expertise in the field of fish welfare together providing a forum for interaction with stakeholders, so ensuring involvement and participation from interested parties with respect to the development of fish welfare knowledge and tools, as well as their implementation in European Aquaculture. The platform provides fundamental and comparative knowledge on the importance of different biological factors; operational welfare indicators and OWI-matrices including production experience, environmental factors and key management procedures and more



general recommendations, control systems and support tools for decision makers in government and industry.

A full list of the projects undertaken in Thematic Area 7 – Health and Welfare can be found in the Annex. More detailed information is provided in the Technical Leaflet (TL) describing the main outputs and deliverables of each project.



Thematic Area 7: Health and Welfare

F.P.	Acronym	Project Title
6	BENEFISH	Evaluating the economic impact of maintaining the welfare of farmed fish
6	DIPNET	Disease interactions and Pathogen exchange between farmed and wild aquatic animal populations – A European Network
6	EADGENE	European animal disease genomics network of excellence for animal health and food safety
7	EMIDA	Coordination of European research on emerging and major infectious diseases of livestock (ERA-NET)
6	EUROCARP	Disease and Stress Resistant Common Carp: Combining Quantitative, Genomic and Proteomic and Immunological marker technologies to identify high performance strains, families and individuals.
6	FASTFISH	On farm assessment of stress level in fish
6	IMAQUANIM	Improved immunity of aquacultured animals
6	PANDA	Permanent network to strengthen expertise on infectious diseases of aquaculture species and scientific advice to EU policy
6	PARAQUAM	Parasite pathogens in new species of Mediterranean aquaculture: an experimental approach
7	PROMICROBE	Microbes as positive actors for more sustainable aquaculture
6	RANA	Risk assessment of new and emerging systemic iridoviral diseases for European fish and aquatic ecosystems
6	WEALTH	Health and welfare of farmed fish
6	WELLFISH	Welfare of fish in European aquaculture