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EXHIBITION CATALOGUE

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Oceana was founded in 1998 and is an Italian managed company based in South Africa. The company is operated by the Debenedetti family and the director and driving force of the company is Dr. Giulio Debenedetti, a medical doctor with a life-long passion for aquariology.

In 2005 and 2007, Oceana was sub-contracted to build and install exhibits for two large aquarium projects by ICM/Reynolds (the world leader in acrylic production and aquarium project management).

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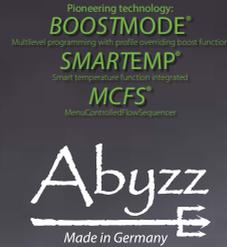
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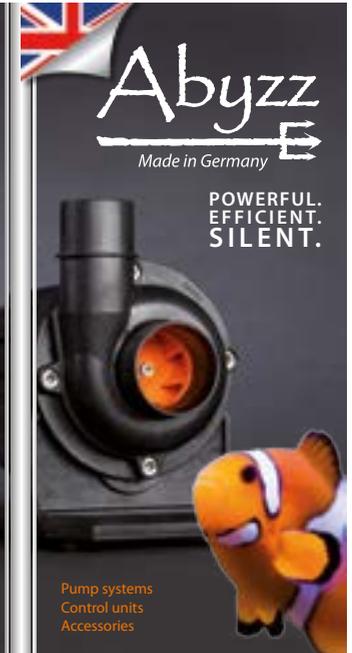


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PROFESSIONAL QUALITY

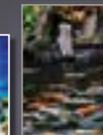
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- ✓ comprehensive protective functions
- ✓ bus connectors for external systems
- ✓ adjustable power and programmable controller



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- ▶ streams and water features
- ▶ filter systems
- ▶ industrial applications



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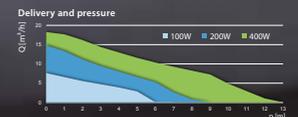


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Established 1995, **Aqua Logo Group** of companies has always been a trendsetter in all segments of Russian Aquatic Market, including Wholesale, distribution of aquarium&terrarium products and livestock, Professional retail shops, Aquarium design and Maintenance and Engineering. We are Members of EuroAsian Regional Zoo and Aquarium Association (Earaza), Ornamental Fish International (OFI).

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SECTION **HYDROBIONTS IN AQUARIA**

TERMS OF REPRODUCTION CAT-SHARKS IN THE AQUARIUM OF “MUSEUM OF THE WORLD OCEAN”

Nasonova N.A.¹, Baltyzhakov I.S.²

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2 - *Museum of the World Ocean, Kaliningrad*

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The museum of World's Ocean is also actively practiced artificial reproduction of some fish species, including cat sharks. We explored some options of eggs and done chemical analysis.

The study was carried out with a ruler, weights “aqua spoon”, oven, Fourier transform infrared spektometra; hydraulic press, spektometra - X-ray energy dispersive, muffle furnace chamber.

The experiment involved two tanks. Sharks in first one took vitamins, in second one not. During the experiment time, the sharks tore down 56 eggs. Shark who took vitamins - shaped eggs faster. During the experiment, the collection of eggs from aquariums are three types of anomalies recorded. Reported eggs with yolk, fill the entire cavity of the eggs, the eggs without the yolk and the egg with two yolks.

Vitamins affected by the number of anomalies. Sharks who took the vitamins gave better eggs than others. With the addition of B vitamins in the feed can be adjusted reproductive cat sharks in aquariums.

CORALS IN PUBLIC EXHIBITIONS. THE EXPERIENCE OF THE CONTENT, THE OPTIMAL SPECIES COMPOSITION

Chikadze S.Z.

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The maintenance of living corals in zoo's and aquariums certainly enhances the attractiveness of the exhibits for visitors. However, the cultivation of living coral requires significant material costs and skilled personnel. Often, public exposure refuse the maintenance of live corals for reasons of economy. The report attempts to summarize experience to minimize costs while creating attractive displays. Long-term monitoring of survival, growth rate, ability to reproduce,

certain types of corals allowed us to formulate the basic principles of successful maintenance of a living reef. In aquarium culture there are nearly 30 fast-growing species of coral that is resistant to adverse conditions, such as excess nitrates and phosphates in water, lack of currents and temperature spikes. These species are easily propagated by slicing, quickly recovering from the injuries inflicted by fish easily grow to a substrate. In public exhibitions, it is advisable to “build” reefs of precisely these kinds. This reef will be cheap in the content, not less beautiful than the reef from the rarest of endangered species, and no less attractive for visit.

**COLLECTION, HUSBANDRY AND TRANSPORT OF
NAUCRATES DUCTOR, SPHYRAENA VIRIDENSIS, SILURUS
GLANIS AND EPINEPHELUS MARGINATUS**

Correia J.P.S., Guedes R.R., Mauricio F.V.F., Campino N., Silva
L., Rodrigues N.V., Morato T.A.G.

Flying Sharks
info@flyingsharks.eu

This presentation focuses on the technical details adopted to collect *Naucrates ductor* using hook & line off the central Azorean archipelago, *Sphyrna barracuda* using barrier nets in Horta island, *Silurus glanis* with barrier nets in the Ebro river and *Epinephelus marginatus* using traps in Horta Island. Details are additionally provided on husbandry techniques adopted for each species, with emphasis on prophylactic and post-traumatic treatments that have proved very successful over the years, such as the use of Betadine baths. Results on both simulated transports and de-facto transports are also presented, including essays conducted with the use of pH buffering and ammonia quenching agents, thus ensuring water quality remained optimal throughout transport. These essays, and subsequent transports, revealed that a formula of 25 / 100 / 100 grams of Amquel / sodium bicarbonate / sodium carbonate (respectively) yield ideal results. Additional techniques adopted for the very particular transport of a large 2,6 meter long teleost (*Silurus glanis*) by both road and air are also given, such as how to balance the need for degassing, while keeping a fully sealed environment, through the use of one-way valves. Further notes on the occurrence of species specific parasites on *Epinephelus marginatus* are also given.

**HUSBANDRY AND TRANSPORTATION OF THE
SCALLOPED HAMMERHEAD SHARK (SPHYRNA LEWINI)**

De Pauw J.

De Jong Marinelife, Spijksesteeg 2a, 4212 KG, Spijk, The Netherlands
Jeffrey@dejongmarinelife.nl

The *Sphyrna lewini* is one of the hardiest species during shark husbandry and do not forget about the transportation. Only 6 institutions throughout Europe are keeping the *Sphyrna lewini* on display (Survey by Reef HQ aquarium, June 2014). This makes getting new information about this species in captivity hard and are mainly behaviourism and observation researches.

First the hammerhead sharks are kept for several months at De Jong Marinelife before they are shipped to the institution. During this acclimatisation period knowledge has been gathered about their behaviour and feeding, but sadly also pathology reports from sharks that died. During the presentation these pathology reports will also be a topic to inform about possible threats which could show up at the *Sphyrna lewini*.

De Jong Marinelife has supplied the *Sphyrna lewini* to institutions throughout Europe and Israel. This results in a lot of expertise and information that has been gathered during the husbandry and transportation of the *Sphyrna lewini*. During this presentation information will be shared about the transportation method used to travel up to 48 hours by truck with the *Sphyrna lewini*. During these transports a variety of water parameters were measured. This will show the toleration these sharks can handle during transportation.

All this information will lead to more insight about this sensitive, but beautiful shark species. This will result in more information being shared with other institutions who are keeping the *Sphyrna lewini* or are going to keep this species in the future.

**SAVING THE GREY NURSE SHARK
(CARCHARIAS TAURUS) ONE AT A TIME**

Dr. Jones R.

The Aquarium Vet, Moorabbin, Victoria 3189, Australia
rob@theaquariumvet.com.au

The grey nurse shark (*Carcharias taurus*) shark is critically endangered on the east coast of Australia. Population estimates are that there are less than 1500 remaining and that they will be extinct within twenty to thirty years. Amongst other things, ongoing losses occur because of the impact of fishing gear (both recreational and commercial) on these sharks.

Acting under a permit issued by NSW Fisheries, the Manly SEALIFE Sanctuary and the Sydney SEALIFE Aquarium, with The Aquarium Vet, have now performed several rescues of grey nurse sharks at Magic Point just south of Sydney. Magic Point is an aggregation site for juvenile grey nurse sharks. The first two rescued sharks have now been monitored for a period of eighteen months following their rescues. Both have thrived and grown, and have also travelled long distances from their rescue site, proving that this method of conservation works.

It is hoped in the future to be able to extend this work to the entire coast of NSW where there are many sharks similarly impacted. Finally, in selected cases, it would be beneficial to transfer some sharks back to the Manly SEALIFE Sanctuary. These would be sharks that required more care or interaction than could be provided in the field e.g. those that require endoscopy, surgery or long term monitoring.

INVADING SPECIES OF THE BALTIC IN THE MUSEUM AQUARIUMS

Makeeva N.V.

*Museum of the World Ocean, Kaliningrad
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Species composition of animals is poor and forms from migrating species. The north and more freshwater areas, located near water-mouths, are marked with freshwater species mostly; the areas of more salty water located close to the Danish Straits are marked with typical sea inhabitants. In certain years, oceanic fish could get into the Baltic Sea because of penetration of oceanic water and rise in salinity: swordfish, garpike and other.

In the recent years, new unusual ichthyofauna has appeared in the Baltic Sea: thinlip mullet (*Liza ramada*), goldsinny wrasse (*Ctenolabrus rupestris*), round goby (*Neogobius melanostomus*), broadnosed pipefish (*Syngnathus tupphe*), greater weever (*Trachinus draco*), mitten crab (*Ericheir sinensis*) and rockpool prawn (*Palemon elegans*).

The reasons of their invasion – rise in temperature and intensive navigation.

A mitten crab and rockpool prawns appeared in the museum aquariums several years ago. After the latest expedition in 2015, broadnosed pipefish were introduced. Keeping methods for these species are of a great interest as well as their transition from light salted Baltic Sea water and adaptation to oceanic saltwater, their keeping and life span in artificial conditions. The exploration resulted in necessary experience for creation of an oncoming exhibition devoted to inhabitants of the Baltic Sea. Aquarium specialists' further plans are

devoted to new species - their catching and adaptation, development of keeping methods for round gobies and greater weevers.

CROSSASTER PAPPUSUS IN MOSCOW ZOO AQUARIUM. EXPERIENCE AND PROSPECTS

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Three sea stars *Crossaster papposus* are kept in the Moscow Zoo Aquarium animal collection since 2009. This species has value as a spectacular cold water species of domestic fauna, although it is widespread in sub littoral zones of Arctic seas.

The aspects of morphology, physiology, ecology and behavior, based on accessible scientific information and observation in captivity will be presented, as well as recommendations on aquarium design, feeding techniques, food preferences of the animals.

The maintenance of cold water species meets some challenges, including requirements of low aquarium water and room air temperature. The current practice on *Crossaster papposus* in the Moscow Zoo Aquarium will be described. The ways to avoid health problems and the description of equipment used in Moscow Zoo Aquarium are also given.

EXPERIENCE OF KEEPING THE COLLECTION OF MADREPORARIAN CORALS IN MOSCOW ZOO

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Keeping madreporarian corals in artificial environment during last couple tens of years is being a popular trend in Oceanarium's exhibitions in many different countries of the world.

Since 2012 in Moscow Zoo the authors have started the work on equipping two aquariums with the required LSS and lighting for keeping the madreporarian corals and forming the madreporarian corals collection based on the theoretical experience of foreign colleagues on keeping the madreporarian corals in closed aquatic systems.

After quarantine the corals were put in two laboratorian aquatic systems. In system 1 with volume of 600 liters we put large polyped corals – 4 pieces of *Trachyphyllia geoffroyi*, 2 pieces of *Symphyllia* sp., 1 piece of *Scolymia* sp., and representatives of small polyped corals – a couple of species of *Montipora* sp. of different colour variations – 6 colonies, *Polyphyllia talpina*.

In system 2 which consisted of three aquariums with the total volume of 610 liters we put *Euphyllia glabrescens*, *Euphyllia parancora*, *Euphyllia ancora*, *Favia* sp., *Pocillopora* sp., *Hydnophora rigida*, *Montipora* sp., *Stylophora pistillata*, *Seriatopora hystrix*, *Caulastrea curvata*, *Acropora* sp. (around 30 exemplars frags).

Corals were reproduced by fragmentation. Over time we have got beautiful coral colonies that are worth exhibiting out of small coral fragments. You can exchange frags with colleagues.

Levels of calcium in coral systems could be supported manually by every day testing the water for calcium and alkalinity. It will allow not to use expensive calcium reactor and to save the money in conditions of limited financing.

Our successful 4 years' experience in keeping the madreporarian corals could be recommended for marine exhibitions with aquatic systems with small volumes.

THE EXPERIENCE OF KEEPING AND BREEDING SEA HORSES IN THE MOSCOW ZOO

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Sea horses have always been public aquariums and Oceanariums favorite brand objects. Unfortunately, at the moment most of the sea horse species are critically endangered. Sea horses reproduction in captivity is one of directions on saving sea horses population.

In Moscow Zoo we have kept 10 sea horses *Hippocampus* sp. (10 artificially reproduced exemplars) in 140 liters aquarium. We fed them live fresh water shrimp, brine shrimp and frozen feed 4 times a day.

After 8 months sea horses have formed 3 couples and started spawning. We have raised 9 series of baby sea horses. We raised them in 1.5 liters plastic containers that were put in water-bath. During first 5 days the baby fish were fed 6 times a day by enriched rotifers of 10 pieces/ml concentration with a small amount of microalgae. Beginning from the 6th day they were fed 4 times a day by enriched rotifers of 30-40 pieces/ml concentration. From 10th day we added to their menu brine shrimp naupliuses concentrated 3-4 pieces/ml. From 14th day we added 24 hours aged enriched brine shrimp. From 20th day the baby fish were put in bigger volume containers and were fed 6 times a day by 4-5 days aged enriched brine shrimp. From 35th day we fed them 4 times a day with enriched brine shrimp and young of freshwater shrimp.

After 50 days the sea horses grew older and we put them in a 25 liters aquarium and added melted high-vitamin frozen opossum shrimps to their feed. After 10 months sea horses achieved pubescent age and started spawning.

EXPERIENCE IN FORMING THE CATALOG OF ORIGINAL PHOTOS AND VIDEOS OF OCEANARIUM INHABITANTS

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There are no two identical oceanariums across hundreds of them all over the world. Although you can find same hydrobionts from different geographical areas in almost every oceanarium and which cause interest of public aquariums visitors. Primarily these hydrobionts are large sharks and rays, big sea turtles and groupers, a variety of bright representatives of coral reefs and the inhabitants of harsh polar waters. Aquatic animal and plant collections in sizeable oceanariums include 500-1000 species.

Just like recognized movie stars they play their roles representing native biotopes in artfully recreated natural exposures in aquarium complexes. One of the main goals when providing oceanariums with information is selection of high-quality and preferably not copyrighted photos of all aquarium's inhabitants.

During the process of building and exploitation of oceanariums and large aquariums created by AL Engineering, the majority of the inhabitants of quarantine and exposition areas was photographed, a lot of photos and videos of hydrobionts delivery, feeding and treatment process were taken and filmed.

One of the parts of the shooting archive is technical frames used for reporting on completed work. However, a fair amount of animal photos was obtained, the quality of which is suitable for the printing process, creating albums, catalogs, providing aquariums with information, advertising, commercials, and other purposes. Shooting aquariums and their inhabitants is associated with a lack of lighting, excessive brightness range, the ban on the use of flash, reflections on glasses, the mobility of animals and other negative factors. All of this places higher equipment requirements, shooting techniques and processing of the resulting material.

As a result of the work, the original base of static and dynamic images of exhibition animals was formed; recommendations on the technical equipment and photos, video shooting techniques in oceanarium were prepared as well as recommendations for adequate coverage of exposition and visitor zones.

ELASMOBRANCH TRANSPORT TECHNIQUES AND EQUIPMENT

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Elasmobranchs are delicate animals and appropriate care should be observed during their transport or permanent damage and even death can result. Key considerations include risk of physical injury, elevated energy expenditure, impaired gas exchange, compromised systemic circulation, hypoglycemia, blood acidosis, hyperkalemia, accumulation of metabolic toxins, and declining water quality. Carefully planned logistics, appropriate staging facilities, minimal handling, suitable equipment, an appropriate transport regime, adequate oxygenation, comprehensive water treatment, and careful monitoring will all greatly increase the chances of a successful transport. In special cases the use of anesthesia and corrective therapy may be merited.

EXHIBITING LENINGRAD REGION HYDROCOLES IN MINI AQUARIUMS

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Main exhibition objects of modern aquariums often are bright tropical animals and large representatives of local fauna. At the same time many small animals of the region where Oceanarium is located could be of huge interest from the exhibition point of view and from the point of view of educating local people. There isn't enough information about organizing and keeping this kind of exhibitions in Oceanarium. In Saint-Petersburg Oceanarium there is a diverse species of invertebrates, Amphibia and small hydrocoles of Leningrad region presented in 9 aquariums with volume of 20-30 liters all over the year. In this work we generalized the experience on gathering hydrocoles, launching and decorating this kind of aquariums. We indicated main issues arising in work with hydrocoles of Leningrad region and possible ways of solving these. Also there are recommendations given on keeping and exhibiting some interesting species.

EXPERIENCE OF LENINGRAD REGION FRESH WATER FISH CONSERVATION

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If we talk about conserving and exhibiting fishes of temperature climate, I can claim that it is a very interesting and promising task. Especially it is true for northern countries like Russia. For example, in Finland there is an Oceanarium completely dedicated to fauna of Northern seas.

Total quantity all fish species of all seas washing Russia and also the fresh water lakes and rivers is so large and diverse that it does represent huge interest from educational and esthetic point of view. Many northern species are often even more interesting than the tropical region species.

So far in this work there is quite a modest goal – which is to generalize all experience on capturing, conserving and exhibiting fresh water fish of Leningrad region.

SECTION LIFE SUPPORT SYSTEMS (LSS)

CLEANING THE WATER IN PISCICULTURAL HUSBANDRIES WITH REVERSING CIRCLE OF WATER USAGE IN BIO REACTORS WITH MOBILE FINE LOADING

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In this article bio reactor constructions with mobile fine loading are being looked at, its work results at cleaning reversed water of piscicultural husbandries are presented, analysis of processes of biological water cleaning on these reactors. It is shown that the efficiency of bio reactors with mobile fine loading is 1.5-2 times higher than the stationary loading.

AN ULTRAVIOLET AND OZONE IN DISINFECTING OF WATER IN AQUARIUMS OF DIFFERENT VOLUME

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Disinfecting of water plays an important role in creation of comfortable and healthy conditions for keeping of inhabitants of an aquarium. There is a large number of ways of disinfecting of water. But for disinfecting of water in aquariums most often use water radiation by light of ultra-violet lamps or water saturation by ozone. Both ways have both advantages, and shortcomings.

Besides, an important role is played by doses, contact time, a percentage ratio of the disinfected water to total amount and many other factors. And different experts and producers of the equipment are based on various indicators and figures that sometimes not really well affects inhabitants of aquariums or purses of their owners.

In what cases to choose an ultraviolet and in what ozone? What the choice depends on?

Whether various ways of disinfecting supplement and influence at each other can. We suggest to systematize the available data from various sources and to come to certain parameters, the most comfortable both for one and for other party.

There is a large number of producers of the equipment. And each of them considers that his equipment the best and the most effective. Whether so it actually?

WORLDWIDE PRACTICES IN PUBLIC AQUARIUMS WITH GEORG FISCHER COMPANY

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1. Introduction. The company Georg Fischer as a worldwide leader producing plastic piping systems and measurement and control products.
2. Main projects and references with Georg Fischer products installed.
3. Production range and technical characteristics of the products (fittings; valves; automation) used in terms of public aquariums.
4. Customizing: designing and producing non-standard items and systems together with a customer.
5. Conclusion. Questions and Answers.

LIFE SUPPORT SYSTEMS NEED TO BE INCLUDED IN THE CONSERVATION MESSAGE OF AQUARIUMS IN THE MODERN WORLD

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It is the goal of all public aquariums to educate their visitors on the wonders of the aquatic world, as well as to instill in them the importance of conserving the natural resources and environments of marine and freshwater animals and plants. This is evident in the very mission statements each institution proudly publishes and posts on their web sites and in their yearly reports. Ironically, the life support machinery and associated equipment that is essential to maintaining the water quality of the marine and freshwater exhibits can only be characterized as poor examples and models of conservation. Life Support Systems are huge consumers of energy and electricity creating equally huge and often embarrassing operational costs. It is time to rethink the mechanical, biological and chemical framework that is at the core of life support system design and create a paradigm shift toward energy efficient filtration systems. The technology to accomplish these goals and designs already exists. This paper will present alternative designs that not only meet animal husbandry water quality goals and targets, but also achieve 30 to 50% savings in energy consumption and cost.

OVERVIEW OF SOME DEVICES FOR SUSPENDED SOLIDS REMOVAL

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Based on our experience, mechanical filtration of water flowing out from the pools with fish is the only efficient method for removal of suspended solids (organic and inorganic waste) that didn't turn into colloidal or dissolved state. Mechanical filtration into layer's depth devices are represented by widely used in exhibition aquariums pressure sand filters of vertical or horizontal application with multilayer quartz sand (or other filler) filling of different fractions. Is it always worth it? What alternatives could be there? Brief overview of alternative devices.

**LIFE SUPPORT SYSTEMS TECHNOLOGICAL EQUIPMENT
EXPLOITATION EXPERIENCE IN TODAY'S CONDITIONS
TAKING THE PLANETA NEPTUN OCEANARIUM
AS AN EXAMPLE**
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Due to different reasons there is almost no domestic production of technological equipment for Life Support Systems (LSS) in the sphere of Decorative Fishery. Because of this we are to use our exploitation experience while selecting the technological equipment in order to create LSS. We must be taking into account the unification principle, assessing the cost, production quality, construction materials, simplicity and comfort of exploitation and maintenance, possibility and speed of repairing.

Apart from this, possibility of applying principles of substitution import products by domestic ones (e.g. the system of monitoring the hydrochemical parameters of aquarium water by TESTRON JSC) and innovative approach (applying a mechanical belt filter in LSS of jellyfish aquarium and an automatically controlled compact monoblock LSS "MAT").

**MODERN TECHNOLOGIES IN THE ARTIFICIAL
ILLUMINATION OF AQUARIUMS WITH RESPECT
TO THE EXIGENT AQUATIC ORGANISMS**

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Effective artificial lightening in public aquariums is an inalienable part of LSS in the case of keeping the organisms with high demands in captivity. The latest achievements in the LED technologies enable one to completely exchange the verified but obsolete sources of light such as MH and luminescent lamps to the more effective modern LEDs. On the basis of our experience in the coral and plant production, we would like to regard the following aspects of the artificial illumination of aquariums by LEDS: real demands of plants and animals in the light intensity and spectrum and the aesthetic perception of aquarium by visitors.

SCHURAN SEAWATER EQUIPMENT

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We are in the business of building first rate, customized aquariums out of thermoplastics.

For the past 30 years, prominent zoos, aqua zoos, scientific institutes, hotels, restaurants, commercial enterprises and home owners with special requirements have profited from our company's plastics expertise all over the world.

Schuran builds customized aquariums in all sizes for all requirements. Working in close cooperation with engineers, marine biologists and zoo keepers we provide quality products that satisfy all needs and standards.

Rectangular and round tanks, raceway tanks, individually designed show equipment of all dimensions or highly sophisticated jellyfish tanks, holding and water treatment equipment – we are the specialists to do the job for you.

**OZONE MANAGEMENT IN AQUATIC LIFE
SUPPORT SYSTEMS**

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Ozone is an effective treatment resource capable of significantly improving water quality and water clarity in aquatic systems. When applied and managed appropriately ozone can ameliorate contaminants that degrade water quality. However, poorly controlled ozone dosing may result in persistent, highly reactive and toxic by-products that can harm aquatic life. Reactive ozone by-products are collectively called residual oxidants. By understanding and using the concept of applied ozone dose (AOD), ozone can safely be applied and controlled to achieve desired benefits, while minimizing the risk of overdosing. Monitoring and recording oxidation-reduction potential (ORP), residual oxidants, water turbidity, animal behavior, and husbandry activities are an essential part of a comprehensive ozone-management strategy.

THE DISCOVERY WORLD AQUARIUM (SOCHI)

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The Discovery World aquarium is a large modern aquarium in Sochi, and is itself a major municipal project. The project uses the best international practices on display of aquatic animals, allowing to provide the optimal environment for life in captivity, and the large experience acquired by visitors, is provided by a combination of education and entertainment.

Optimal environment for animals living in captivity, requires exceptional water quality that can be ensured only using modern filtration technologies. Filtration systems used in the Discovery World Aquarium, is the most advanced to date, and their operation requires trained personnel.

When designing the natural habitat of aquatic animals, the goal is to reproduce the natural environment in the amount of water to be recycled. This is achieved by using well-designed water management Systems. The combination of elements used in each System of life support, takes into account which demonstrates the types, dynamics of flow, dissolved and suspended solids, as well as many other facts. The right combination of filter elements to maximize the contribution of each element, which allows efficient use of filter technologies and equipment of water quality control. The only way the water environment for the animals in captivity can reach a balance and expansion.

To ensure an optimal environment for aquatic animals, this project is equipped with the most modern technologies of water purification. Apply pressure filters, Filters with an ascending motion of the fluid, Ozone generators, Devices, foam fractionation, as well as many other components used in modern methods of water filtration. The water quality is maintained independently in several separate systems to ensure economy and ease of maintenance.

In connection with the performance of complex equipment for water purification, it must be operated correctly, otherwise it will hurt the water quality.

LOW HEAD LIFE SUPPORT SYSTEM (LSS)

FOR OCEANARIUMS AND COMMERCIAL

FISH FARMING RAS

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LSS definition for large-capacity fish farming systems. Water quality requirement.

LSS comparing for main oceanarium tanks, zoo show tanks and commercial fish farming systems.

Farms volume for system with low head technology. Goal attainment for assigned task on examples of operating large-capacity systems.

Samples of equipment for large-scale systems operational cost decreasing: drum microfilters, propeller pumps, airlifts, open flow canal UV-systems, indirect action foam fraction systems, rotary lobe blowers.

Project samples and operated systems with LSS.

Systems performance.

Requirements for recirculation aquaculture systems (RAS) at the LSS design.

SECTION **HYDROCHEMISTRY**

THE COMPLETE PICTURE: WATER QUALITY THAT ENSURES ANIMAL WELFARE VIA COMPREHENSIVE LIFE SUPPORT SYSTEM DESIGN

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Life support system instrumentation indicates equipment *function*, but it is water quality parameters that indicate equipment *efficacy* and resource allocation that indicates equipment *efficiency*. Equipment parameters—pressure, flow, water level, etc.—can be operating within “design specifications”, yet water quality parameters (e.g., nutrients, alkalinity, pH) can be unsuitable for aquatic life and/or excess resources (e.g., water, energy, labor) must be expended to normalize the environment. In the past, available technologies were not able to address the demands of a healthy closed aquarium habitat without eventual recourse to substantial water exchanges to normalize the environment. This situation no longer prevails. Dissolved contaminants can now be physically removed from solution by ozone-

assisted foam fractionation, a widely accepted industry standard in the modern era. Nitrite accumulation can be managed with recently-developed and user-friendly denitrification technologies. Phosphates can be controlled with modern water treatment tools and pH decline can be addressed via well-designed gas exchangers to ameliorate CO₂ accumulation from animal and bacterial respiration, and the degradation of wastes and uneaten food. Given these relatively recent advances, it is clear that water quality challenges in a modern aquarium have their root causes tied to incomplete life support system design and/or inappropriate system operation. By ensuring that life support systems are well designed and operated appropriately, optimal water quality can result and excess resource expenditure can be avoided, consistent with the conservation and fiscal priorities for the modern zoo and aquarium.

**ISOLATION AND IDENTIFICATION
OF REPRESENTATIVES OF GENUS MYCOBACTERIUM
FROM THE AQUARIUM WATER**

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Different types of mycobacteria are pathogens of fish tuberculosis (mycobacteriosis). Mycobacteriosis is widely spread among objects of industrial and decorative Fishery.

Among the fish mycobacteriosis pathogens there are zoonotic pathogens which are able to cause human disease. This survey is dedicated to the methods of isolation and identification of representatives of the genus Mycobacterium from aquarium water.

**DEFINITION OF ORGANIC CARBON AS EFFECTIVE
ADDITION TO HYDROCHEMICAL CONTROL
IN PUBLIC AQUARIUMS**

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For lowering level of organics in aquarium water cleaning process is optimized: skimmers are being changed, filtration enhanced, active carbon applied, but almost no one knows what impact all this has on the actual level of dissolved organic carbon (DOC). For how much, how long it takes to change DOC? How does DOC level change when we use different filtration strategies in our aquariums? DOC level is an important parameter to monitor, but is there a target value for DOC, as there is for all other important chemical parameters?

At present, definition of organic compounds concentration in water, rarely used in the past, becomes more popular in professional Aquariumistics. In particular it is due to the fact that the existing analyzer TOC-5000 manufactured by Shimadzu company, as the “choice instrument” is now not the only device on the market, there are now mobile sensors-analyzers measuring principle of which is based on UV absorption at wave length 254 nm. Immersion sensor is a multibeam absorption photometer with effective turbidity compensation. For such parameters as COD/BOD there is correlation with SAC254 which is similar to correlation between COD and Total Organic Oxygen (TOO). High resolution, informational data measured with specified frequency, affordable start cost, minimal cost for launching and maintenance – these are advantages of optical sensor as the controlling tool of parameters data.

In the report there are DOC rates results measured by SAC254 in different aquariums in comparison to the data from literature, levels and dynamics of carbon in ocean tropical waters are being assessed, it’s meaning for eco systems.

**SECTION
VETERINARY**

**MONOGENOIDOSES IN CONDITIONS OF OCEANARIUM
AND HOW TO FIGHT THEM**

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Monogeneans are being carried by nearly all species of fresh water and marine fish taken from natural environment (90%). In conditions of poor biocenosis and limited volume of water in aquariums monogeneans are able to increase its quantities and cause disease.

Life-time diagnostics of monogeneans presence on hydrocoles coming into Oceanarium, especially while its localization is at gills or gastrointestinal tract, is difficult or impossible. This is why it’s difficult to conduct Medio prophylactic measures.

Work experience in Oceanarium showed that monogeneans that relate to different biological toxons (systematic groups) show different kind of sensibility on different medicines, not same as described in books for monogeneans in general. Discovered on European Sheatfish cleidodiscuses didn’t die after we applied many substances that are considered to be lethal for monogeneans in these concentrations.

Further experimental research of effective influence measures on different fish parasite monogeneans is required.

**PREVENTION, DIAGNOSIS & CURE
OF ORNAMENTAL FISH DISEASES: DO'S AND DON'TS**

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Working during 39 years with fish diseases teaches us daily lessons: We can never be 100% certain and we must remain critical with our findings.

The Water quality and the fish food quality plays a most important role for keeping fish in good condition.

For the hobbyists the most common problems are: overcrowding, overfeeding and too small filters (lack of filtering capacity).

For the exporter and importer there is a need for: good implemented biosecurity, adequate quarantine and practical diagnostic methods.

We will show with photographs and videos several 'cases' of diseased ornamental fish, fresh water, cold water and marine fish.

We will explain our diagnosis, the do's and don'ts with the reasons why the problems occur on our fish (fresh and marine water), the plans that we can install to prevent and, when possible, some suggestions for cure or treatment.

We will present limited scientific details but emphasize the practical applications on our daily work with fish health management.

We will explain following cases:

+ *Mycobacterium* in ornamental fish: becoming a common disease..

+ Head-and-Lateral- Line Syndrome (HLLS) & Hole-in-the-head Disease (HITH): parasite *Spirotrunculus* and other causes & freshwater and marine fish diseases.

+ Angel fish disease & Discus fish disease: so-called pest (or aids) or what?

+ White spot or ICH infections: sometimes unnoticed, new kind of ICH (*Neoichthyophthirius*) and new method for treatment, also for marine reef aquaria with *Cryptocaryon* infections.

**THE USE OF ASSISTED REPRODUCTIVE TECHNOLOGIES
IN BREEDING PROGRAMS FOR ELASMOBRANCHS IN
AQUARIA**

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Despite the common use of reproductive technologies in a range of terrestrial and aquatic species, relatively little work has been done with elasmobranchs. Reproductive technologies such as sperm collection and quality assessment, sperm cryopreservation, artificial insemination, and monitoring female reproductive condition and gestation could potentially be used to complement existing breeding programs for elasmobranchs in aquaria.

As a greater emphasis is placed on self-sustaining elasmobranch populations, reproductive technologies will become an increasingly important component of aquarium breeding programs. Ongoing research at SEALIFE Melbourne Aquarium, Australia, and Dubai Aquarium and Underwater Zoo, United Arab Emirates, aims to create a basis for future use of reproductive technologies in elasmobranchs in aquaria worldwide.

Reproductive technologies have the potential to ensure sustainable captive populations of elasmobranchs, and to assist in the conservation of elasmobranch species in both the wild and captivity. The achievements to date as well as future areas of research will be discussed.

**POORLY STUDIED FISH PARASITES CAUSING DISEASE IN
OCEANARIUM CONDITIONS**

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In Oceanarium conditions where fish is kept in artificial water, diseases are frequently caused by protozoan parasites. Parasitic amoeba, flagellates and myxosporea are all poorly studied pathogens. Out of the parasitic worms the monogeneans-capsalids, larval stages of nematodes and trematodes would have the most epizootic significance. In quarantine conditions it is required to conduct "active" quarantination i.e. preventive measures for all the incoming

fish against the parasites that are able to cause disease, no matter whether the disease symptoms are found or not. There is a need to study parasitofauna of concrete fish species which are more popular in Oceanariums.

SECTION **MODERN APPROACHES TO DESIGNING** **AND BUILDING AQUARIA**

THE VORONEZH AQUARIUM

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The Voronezh aquarium was opened on 27th October, 2011 and became the third (according to the opening date) large public aquarium in Russia and the only one in Central Chernozem region.

This project is technically complicated as it is carried out in the city remote from the sea shore and in particular from the ocean.

Nowadays the aquarium, located on the premises of City-park "GRAD" shopping mall, is one of the main sights of the city and one of the most favourite recreation facilities of the region.

The area of 4400 square meters, inhabited by underwater, land, jungle, forest and steppe dwellers, is open to exploration. There are more than 200 species of fish, about 100 species of mammals, reptiles, invertebrates and birds.

The Voronezh Aquarium has a unique collection of animals including such rare species as sand tiger sharks, Humboldt penguins, Japanese spider-crabs, dragon-moray eels and the others.

The exposition is divided into four theme-based zones: "Forests and Steppes", "Polar Waters", "Jungles" and "Seas and Oceans". More than 50 expository objects are displayed (aquariums, aqua terrariums, enclosures etc.).

The Aquarium mission is much broader than just showing wonderful inhabitants of our planet. It also includes cooperation with Russian and foreign organizations in the sphere of environmental education, conservation of rare species of animals. It also comprises fostering careful attitude to the environment we ourselves are a part of.

INNOVATIVE FIBERGLASS ROCKWORK TECHNOLOGY PRESENTS MANY ADVANTAGES COMPARED WITH CONVENTIONAL SHOTCRETE OR CARVED CONCRETE

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Timesaving

- FRP is lightweight, therefore exhibits can be manufactured ahead of time in any location and shipped to any part of the world

- Construction of the exhibit doesn't depend on the construction/ waterproofing of the actual tank on site

- Client can inspect the exhibit as a finished product many months before installation

- Installation on site comprises of quick re-assembly as opposed to ground up construction from zero

Waterproofing

- FRP rockwork is bonded to the walls of the tank and doesn't require drilling anchors into the waterproofing, and therefore does not violate the waterproofing in any way.

Water Displacement/sequestration

- FRP is lightweight and has very low mass compared to shotcrete, therefore does not eliminate significant amounts of water from the system.

- FRP is easy to ventilate, therefore eliminating water sequestration

Durability/Maintenance

- Unlike polyurethane, FRP is hard and non porous and therefore does not allow for aggressive colonization of algae. Cleaning is easily achieved with brushing

- Unlike shotcrete and polyurethane, FRP does not absorb water and become fragile over time. Therefore it will last decades under water without significant discoloration or structural damage

Coloration

- Unlike polyurethane, FRP is colored with both in-cast as well as post-cast coloration. This achieves much more natural and realistic coloration.

Permanence

- If the theme of the tank needs to change, FRP's lightness means it can be easily uninstalled without damaging the structure of tank

- In certain cases FRP can be installed and uninstalled without removal of fish and water from the tank.

**THE BAIKAL MUSEUM OF THE IRKUTSK SCIENTIFIC
CENTER OF THE SIBERIAN BRANCH OF THE RUSSIAN
ACADEMY OF SCIENCES: PAST, PRESENT, AND FUTURE**

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The Baikal Museum has two missions: Public education; Study of ecosystems in Eastern Siberia. The museum set up exhibitions: “Life development in abiotic changes on Earth”; Live Aquarium of 11 large and 40 research aquaria of about 100 tons which are actually natural extensions of Lake Baikal; “Underwater Baikal Studies”; “Live Baikal world under the microscope”, “The virtual diving to the bottom of Lake Baikal” (the submarine simulation with 20 seats and a genuine triple deep water manned vehicle “Pisces-11”); “Baikal on-line” (live webcams and a remote access to seal rookeries, benthic and terrestrial landscapes); Arboretum with a grid of raised walkways – an example of best practices for preservation of a fragile natural environment. The Environmental Education Center was opened in 2009.

Number of visitors increased from ~30 000 to ~150000 in 1993-2015 years. The museum area is currently insufficient for the development of exhibitions and a growing interest of visitors.

A new reconstruction project for the Baikal National Museum-Aquarium of Natural History consists of two stages: I. Reconstruction of the building and a two-fold expansion of display areas. II. Construction of the Baikal Museum aquarium of ~4500 tons on the area of 30 sq.m and underwater hall of 250 sq.m in the shallow waters adjacent to the Museum. The project implementation will increase the annual number of visitors up to ~1 million people which implies a definite social and economic effect.

**DECORATING AQUARIUMS.
PROBLEMS AND SOLUTIONS**

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Decorating plays an important role in creating a comfortable and healthy environment for the maintenance of the aquarium inhabitants, as well as very important for the aesthetic component of creating a composition. There are many ways to decorate the internal tanks and

aquariums with hydrobionts and they differ in the materials used for this purpose. For decorating aquariums and tanks commonly used fiberglass decorations, polyurethane or concrete.

In some cases it is better to choose concrete, fiberglass and public? What are the advantages and disadvantages of a material for decorating?

When decorating the tank or aquarium is very important to consider the distribution of water flows inside the tank, which would avoid creating dead zones, which have a negative impact on hydro-chemical indicators of water. Just when decorating is important to understand that if for decorations or decorations inside the water will be, it will lead to the same consequences. What are the ways to solve this problem.

**CREATION OF HIGH-QUALITY AND ECONOMICALLY
SUCCESSFUL PUBLIC AQUARIUMS IN RUSSIA –
CHALLENGES AND OPPORTUNITIES**

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During the work on the design and construction of the aquarium exposures we at Aqua Logo Engineering faced a variety of approaches to aquarium as a business and as an architectural phenomenon. Here are our considerations about this and the attempt of classification.

1) Types of exposures classified by the architectural design.

1.1. Detached building. Examples – Moskvarium, Primorsky Oceanarium.

1.2. Component of shopping and entertainment center. Examples: Oceanarium of Voronezh, Saint-Petersburg Neptune Oceanarium.

1.3. Component of cultural and entertainment events such as dolphinariums, water parks, amusement parks, museums. Examples: World Ocean museum Kaliningrad, Oceanarium of Kazan.

2) Principal zoning (area to visitors/fish/technical zones ratio). While writing a business plan of future Oceanarium it is important to properly consider the ratio of the area for visitors, exposures and technical zones. It is not uncommon for investor to overload the exposure being cautious about plenitude of visitors' impressions. In practice, stuffiness and congestion can outweigh any beauty in the memory of visitors.

3) What affects the exposure attendance mostly: exotic species composition, unusual architecture, topology and unusual shapes of aquariums, tactile elements of exposure, navigation and information systems? We will try to identify the signs of quality engineered Oceanarium from visitor's point of view.

4) How can privately held company build a beautiful, unique, functional object, make it a hallmark of the city and not go bankrupt? We will consider the main elements of the Oceanarium budget in connection with the outcome.

**SEVASTOPOL SEA AQUARIUM-MUSEUM:
THE WAY THROUGH THE CENTURIES**

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Sevastopol Sea Aquarium-Museum will celebrate 120 anniversaries on October 30, 2017. At the actual article traces the difficult way of foundation, formation and development of the Aquarium. One of the oldest marine aquariums of planet had to pass through World Wars, Revolutions, wrecks and ruins, the losses of collections, but, it revived and restored, renovated and more modern, advanced and developed each time as a result. A huge role-played had a number of outstanding leaders in its transformation.

The exhibition halls of the area are 1200 m², and a modern aquatic collection includes about 1000 species on today. The world's largest collection of fishes and invertebrates of the Black Sea puff up the particular pride.

All works on the creation of the exhibition were done by employees of the Sevastopol Aquarium.

The reconstruction of the historic hall, where was opened the first Sevastopol Aquarium about 120 years ago, had finished to the actual time. It was spent about 25 million of rubles for its renovation, and the total investment for the anniversary will be about 50 million of rubles.

Sevastopol Aquarium-Museum is a well-known cultural and educational institution on today. More than 100,000 people visit it each year.

**MONITORING AND CONTROL SYSTEMS OF MODERN
AQUARIUMS – NEWS AND TRENDS**

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Today the market offers us a lot of monitoring and control devices for aquariums. They differs in variety of the prices, functions, convenience and complexity of setup and operation. It isn't difficult to find something interesting. It is difficult to define that your right choice, and the selected device meets your needs. We carried out

the comparative analysis of several the most popular devices and we want to share result. We defined the main positive and negative sides of different systems and compared their prices. We hope that provided information will help buyers to define for itself suitable system and to spare the time and money.

EXPANSION OF THE AQUARIUM COLLECTION

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When a seaquarium, an aquarium, or a museum operates successfully, visitors come back to it time and again. Expansion of the exposition at the cost of interesting, rare, and original species of fishes and invertebrates can play an important role in repeated engaging of visitors. Besides, in generating and expanding the exposition, it is necessary to take into account that unusual, sometimes even terrible and misshapen representatives of fish fauna, such as the Vampire Fish, Hydrocynus Goliath, Sunfish, various Sharks are attractive to the majority of visitors.

However, the maintenance of unusual inhabitants requires constant betterment of the life-sustaining systems. So, the water and air in the «Moskvarium» are constantly purified by means of the engineering systems. Temperature conditions, chemical composition, and other parameters of the water are monitored automatically. Besides, laboratory control measurements of hydrochemical parameters of the water are made several times a day. There is own quarantine area for new inhabitants - marine and fresh warm-water quarantines, marine and fresh cold-water quarantines, and cay quarantine. Besides, there is a small-sized laboratory in the technical area of jellyfishes and seahorses for reproduction of this part of the collection. To provide the operation of such a complex, the highly professional staff is necessary, the advanced training of which should be carried out right along.

Also, for successful organization and maintenance of the exposition, interchange of experience is very important between various seaquariums and public aquariums.

AQUATIC SYSTEMS MANAGEMENT RESOURCES

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A review and discussion of reliable, accessible resources useful in the training of staff and/or problem solving when dealing with aquatic system management issues.

Aquatic systems can be defined as follows:

1 - Aquariums

2 - Aquatic exhibits - without fish or invertebrates but with aquatic animals such as polar bears, otters, marine mammals, crocodilians, etc.

3 - Water features - ponds, lakes, waterfalls and streams (natural and man made), which may or may not feature deliberately introduced exhibit animals

4 - Various combinations of the aforementioned systems.

Issues typically arise when new aquatic exhibits are being built, existing aquatic exhibits are being renovated or there is a chronic unresolved issue with an existing exhibit.

Efficient management of aquatic systems is a significant factor in the bottom line for all aquariums, zoos and, increasingly, other institutions. The more efficiently they are operated the greater an institution's ability to operate in a sustainable manner. The various resources currently available to help in this effort will be reviewed and discussed.

PRESENTATION OF THE MINSK ZOO OBJECTS

CONSTRUCTED IN 2015

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We offer our slide show of a large object in Minsk zoo, new exotarium "Orinoco", opened in 2015. Exotarium is a complex of buildings for the exposure of tropical animals from South America, which is built-up area of 4000 sq. m.

The company "Mosbio Engineering" completed narrowly specialized work, namely finishing exposures exotarium decorations made of artificial stone (polymer concrete), artistic painting and creating art objects; installation of an underwater glass aquariums and ponds aquaterrarium and waterproofing; equipment installation

of life support systems, quarantine and biological systems run water bodies; landscaping; the supply of aquatic organisms.

Each enclosure equipped with a summer pond, but the main water exposure exotarium (overall about 200 tons capacity) is located inside the ultra-modern building made of glass with a total area of about 2.5 square metre.

In addition exotarium in 2015 of "Mosbio Engineering" has commissioned the aquarium exhibit - a separate room in which is located 7 saltwater aquariums totaling about 10 tons. Aquariums are inhabited soft and hard coral reef with fish and invertebrates.

THE ALTRUISTIC GENIE: AQUARIA IN THE 21ST CENTURY

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Public aquaria aspire to be cultural centers for education, conservation and research, as well as models for sustainable practice and economic stimulus. In this endeavor public aquaria inspire their visitors through representation of marine and freshwater ecosystems, displaying a wide variety of aquatic organisms. With a global reach of 100s of millions of visitors per annum, public aquaria have been a powerful advocate for the aquatic environment. In the 21st Century this success has been realized in an unexpected way: legitimate questions about animal welfare and sustainable extraction, combined with a variety of societal changes and anthropocentric biases, have resulted in increased pressure to "empty the tanks" and not maintain animals in human care at all. This misguided endeavor would have far-reaching and destructive implications for much of the beneficial work conducted by aquaria and ultimately have a profound negative impact on the ecosystems that aquaria represent. Indeed, a society without aquaria risks an increasingly urban population drifting further along a disquieting trend of biophobia; increasingly disconnected from the environment and caring less about issues of biodiversity loss and conservation. To remain effective and relevant aquaria must respond to this troubling trend through a variety of measures: (1) by setting the highest standards of sustainability; (2) through an increasing commitment to research and conservation, especially projects "outside the box" *in situ*; (3) via increased, well-researched, practical environmental advocacy; (4) by expanding education programs, employing up-to-date information and effective

pedagogical techniques; and (5) continually optimizing industry best practice, incorporating advances in our understanding of animal biology and recent innovations in aquarium technology. Aquaria must work together to more effectively communicate their value to the environment and society, to establish and police industry best practice, and to better connect their visitors to the wild spaces they represent.

TEN YEARS OF EXPERIENCE AT CRETAQUARIUM

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The role and mission of the public aquarium today has evolved from the simple presentation of aquatic organisms to the knowledge producing for nature conservation. CRETAQUARIUM is the first big (1700 m³) marine Greek aquarium, a part of the Hellenic Center for Marine Research (HCMR), belonging in the family of modern aquariums in Europe. Since opening (end of 2005), more than three million visitors from more than 20 countries came face to face with the variety of Mediterranean life (big sharks to tiny seahorses, sensational jellyfish and colorful rainbow wrasse) in the underwater Cretan landscapes ambience similar to the natural behind of the transparent windows of 60 tanks from 0,15 to 600 m³ capacity. In addition to the presentation of the live collections, the education, the sensibilization, the wonder and awareness for the underwater beauty, the research and its dissemination are including while it plays an important role as rescue center for injured sea turtles. Beyond the aquariology's routine related aspects the science at the aquarium is focused mainly on the life cycle, food preference and the behavioral studies of the hosted allochthonus, endangered and protected marine species with ecological and/or economical interest. The Lessepsian migrants *Rachycentron canadum*, *Lagocephalus sceleratus*, *Siganus sp.*, the triton snail *Charonia seguenzae*, the cuttlefish *Sepia officinalis*, the octopus *Octopus vulgaris*, the sea urchin *Paracentrotus lividus*, the macroalgae *Polysiphonia sp.* are some of the species on which research carried out. The aim of this paper is the presentation of the husbandry and research activities overview.

Key words: Cretaquarium, marine aquarium, Mediterranean, scientific activities.

PROBLEMS OF PRESENTING DOMESTIC WATERS IN EXPOSURES OF PUBLIC AQUARIUMS

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Active development of aquaristics in Russia, among other things, raises a problem of presenting domestic waters in exposures of public aquariums. To date this topic remains not completely covered.

According to the author, there is the most interesting representation of marine and freshwaters of temperate and northern latitudes in the USA. For instance, in Monterey Bay Aquarium and Aquarium of the Pacific.

It should be understood that while creating new exhibitions, we should not just show a set of interesting fish (although it is important). It is necessary to provide visitors with the comprehensive aquatic environment and information about the most important water sites in Russia.

An important work would be identifying key local habitats and their certification. Selecting the biotope aquariums which are both: ecologically important and attractive for visitors. Creating an appropriate photo library. Identification of key aquatic species. Elaborating decorative solutions. Not only research institutions can help with this kind of certification. Diving associations might also give a hand.

We must not forget that virtually we are creating artificial ecosystems in our aquariums. When designing the aquarium long-term interaction of living aquatic organisms in it, life support systems and elements of decoration need to be considered. An important problem is the lack of collection and delivery system of domestic aquatic organisms. You can get something from foreign suppliers but this is not enough. Our company has to be engaged in catching for its facilities on its own.

BOUNDARY LINES - USING THE DYNAMIC INTERPLAY BETWEEN LIGHT AND WATER AS A ROUTE TO ENERGY REDUCTION, IMPROVED WELFARE AND A NEW DISPLAY AESTHETIC

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The relationship between light and water is one of the most dynamic and complex interactions in all of nature. The shimmering, shifting, rapidly-changing patterns we see as shafts of light penetrate the deep,

or create kaleidoscopes of colour and shifting shapes on a reef or sandy sea bed are the visual cues of this relationship.

The surface of any body of water is a flexing, bulging, folding boundary which dramatically changes the nature and structure of light rays from the sun or moon. Some light bounces off the surface, reflected back into the air and has no impact on what lies below the surface, while some passes through where it provides the energy to drive the most fundamental and critical biological processes that all life on our planet ultimately depends on.

But water does not yield without a fight! The dense, moving mass of any ocean, lake or river will refract and distort light, stripping away a large chunk of the visible spectrum, leaving an ever increasing percentage, but diminishing amount of blue-to-violet light. Eventually, this too is stripped away, absorbed or reflected back to create the light-less black of the deep ocean abyss...

Today, we know more about the nature of light and the vital role it has to play in the lives and life-cycles of all animals and plants. At the same time, new technologies mean we can be ever more efficient in the way we use light in the aquatic environment. However, it is not only about lower-energy and attractive displays! There is a new frontier, where biology and technology meet, and understanding this is the key to resolving the conflicting priorities of commerce (lower cost, greater efficiency) and environment (improved sustainability and welfare) that are challenging aquarium curators around the world.

SECTION **ECONOMIC ASPECTS IN PUBLIC AQUARIA** **MAINTENANCE**

PUBLIC AQUARIUMS WORLDWIDE - WHAT IS NEEDED?

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Today it is imperative, or better a must, to have a very actual and «Modern» (21st Century) approach in designing, building, and decorating public aquariums. With today's worldwide knowledge of the continuous damming, destructions of natural aquatic habitats and the endless pollution of lakes, rivers, estuaries and the oceans, there is a definite need for visitors to see and understand better the (aquatic) biodiversity of this planet. It is essential to teach them exactly how a community under water dwells in a real (small),

authentic biotope, with precise information and interactive technology of different types. It is a must to show every one (adults and children) what an amazing harmony it is (or was). How they communicate (talk) with each other, the signals they pass on to their mates, or predators, the way they propagate interacting with colours as never seen before – but it can only happen if decorated biotope correct, above and below water, if illumined correctly, day and night, and all fishes and aquatic vertebrates know each other. Heiko Bleher will show how (easy) it is and how incredibly successfully it can be, if done as he shows in his presentation from biotopes around the globe.

SECTION **WORK WITH VISITORS**

WORK WITH VISITORS

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In this presentation Bleher will demonstrate how important it is to guide visitors through worldwide biotopes, how to educate small children (even from Kindergartens), about the endangered (aquatic) biodiversity and coordinate easy programs to attract different categories of visitors from all over the planet, for them to learn about their most unusual behaviour and reproduction, the communication (yes fishes can talk), with video projections and Interactive technology in exposition area and how to create arrangements accordingly. Bleher will show during his presentation these methods and unique, nearly unknown by anyone, of freshwater creatures. – and not only.

DIALOGUE WITH THE VISITOR – A WISH OR A NEED? FEEDBACK EXPERIENCE IN SAINT-PETERSBURG OCEANARIUM

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One definitions of Oceanarium says that it's an “underwater museum”. So just like in any other museum the work here is not possible without feedback. Clear understanding of public's needs and

demands helps to improve exhibition and quality of service which in its turn makes attracting more visitors possible.

One of most accessible and easy ways for an organization to communicate with its visitors is book of reviews. Despite the fact that only small percentage of all public leave feedback (just 1% of total), over ten years of work impressive information database was gathered. All useful feedback could be divided into two groups considering the data type: geographical (>12000 responses) and exhibitional (>15000 responses). The first category of responses gives us an idea about audience's geographical coverage (all over Russia, as well as other countries), which could help keep already covered geographical units interested and attract the new ones. The second category of responses shows us how the visitor sees our exhibition, what he liked, what caused him unhappy, what is still to be done, to his mind. The dynamics in feedback changes is also interesting to monitor from year to year.

Except the practical interest for Oceanarium the book of reviews is important for the visitor himself, as this is how he could feel that he is a significant and active participant in the process, and he can indirectly improve our exhibition and services offered. Only this kind of mutually beneficial collaboration will allow Oceanarium to realize public's wishes quickly and successfully, to widen its audience, and for the visitors – attend exhibition with more satisfaction and use.

ACTIVE LEARNING FOR PRIMARY AND SECONDARY SCHOOLCHILDREN IN OCEANARIUM EDUCATIONAL CENTER

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The report considers two groups of classes offered by Oceanarium Educational Center. The first group includes classes contributed to expansion of general learning and personal enrichment. Topics and even names of these classes promote children's interest. They are: Top Ten (the remarkable sharks), Meet Stepa, the Little Seal, Dive into the Deep, Nemo's Finding Home, Diver Profession, Dangerous Inhabitants of Oceanarium. Classes of this group are usually given by means of heuristic discussion based on previously learned students' concepts on subject matter. Here we use a lot of photographs, videos, specimens and handouts for illustrative purposes.

The second and the most promising group is represented by the scientific classes closely related to national curriculum. Activities used through these classes make the topic more attractive for students and easy to learn; that, in turns, increases the demand among the school teachers. The most popular classes are: What are Fishes, Fish Diversity, Cartilage or Bony, Who Lives in a Pond, Underwater Constructors, A Fish or a Mammal, What is Water, Life in a Pond Drop, Neighbors: the Good and the Bad.

Second group classes offer more scope for learning activation through a number of methods. We use card games and interactive games ("Dangerous or Not", "Whose Children Live in the Water), experiments (water physical properties), project-based learning (microorganisms identification), action games to explain natural processes ("Build a coral tower", Water molecules", "Echolocation").

CULTURAL AND EDUCATIONAL ACTIVITIES OF SAINT-PETERSBURG OCEANARIUM

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Ecological education of the society is one of the main goals of any Oceanarium of the world nowadays. In Saint-Petersburg Oceanarium in 2007 there was an Educational Centre established in order to fulfill this goal. Two main divisions were defined in the work of the Centre – the educational division focused on school groups and the cultural division which is oriented at wider circles of society. Over the 8 years more than 100 000 people took part in Educational Centre's projects. Children from 420 Saint-Petersburg schools and 143 Leningrad region schools attended the educational programs (it's 56.1% and 32.75% respectively out of the total number of schools of city and region). These are significant results in Saint-Petersburg highly competitive educational environment.

Successful collaboration with schools is based on continuous search and applying new forms of work popular in modern schools, yearly updates of themes and methods of the offered programs. We plan on paying more attention to scientific research and projects of our schoolers.

The Oceanarium staff organised a city museum competition called "Big Regatta". This competition became very popular so the cultural

division of the Educational Centre separated from the general work. More than 40000 people took part in the competition during the 8 years and we had 50 museum partners from Saint-Petersburg and other Russian cities.

The competition became so popular due to careful selection and regular changes of museum partners, individual attitude to the competition participants, convenient format and yearly change of theme.

ORGANIZATION OF EDUCATIONAL ACTIVITIES IN THE “MOSKVARIUM”

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The interaction with visitors in “Moskvarium” is carried out in two directions: the first is the arrangement of survey and thematic excursions, the second is the arrangement of informative occupations in a lecture hall.

The variety of inhabitants in “Moskvarium” allows to organize various informative classes for visitors of different age.

Such classes are given for organized groups, for parents with children and individually. Especially there is a wish to note the importance of family occupations where parents can spend time with the children in the creative atmosphere, having gained new knowledge and the general positive emotions.

Much attention is paid to our services being available to physically disabled people. In “Moskvarium” a barrier-free environment is created and allows visitors in wheelchairs to move easily.

There are individual classes developed by us for children with mental violations and postponement of psychomotor development. These occupations have informative and entertaining character and include creative tasks of various level of complexity.

Also the program of occupations is prepared for total blinded and visually impaired visitors. Tactile feelings are extremely important for them. Therefore to acquaint them with sea inhabitants, we use specially executed models from polymeric materials, relief and graphic grants. Further we acquaint them with live animals in contact aquariums where invertebrates - starfishes, ofiura, gastropoda mollusks are presented. Also, for this category of visitors we offer creative occupations with application of relief sheets and plaster preparations for coloring.