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## **Oceans: The Odyssey of a Film Shoot**

**By Dominique de Saint Pern**

Five years in production; a 50 million Euro budget; 14 French, Japanese, and Swedish cameramen dispersed across all the seas of the world; teams clad in yellow slickers on board rubber dinghies defying waves, rain, and tempests; several hundred biologists on hand across practically every time zone; crazy inventors; genius tinkerers; the European Space Agency and the scientists of the international project The Census of Marine Life working overtime. The result: millions of images that will end up in a single, immense opera – *Oceans*, the latest creation of Jacques Perrin, with a release date projected for the fall of 2009. It took God seven days to create the world. Jacques Perrin has been slaving, with 115 weeks of shoots, a screenplay in constant development, cutting-edge technological inventions made at the last minute, inventions such as an underwater microscope manipulated by a robotic arm with the sole aim of filming larvae as they've never before been filmed! And that's not counting the dreams to be fulfilled before next winter, when the filming will end: to shoot the birth of a humpback whale in Polynesia, a spectacle so secret that no human eye has ever before witnessed it. To bring back images of sea lions and small Cape penguins diving into a compact ball of sardines as though rushing into a larder. Or get an unedited underwater shot of 30-meter-long blue whales swallowing a cloud of krill in the Sea of Cortez.

*Oceans* isn't a documentary. It is cinema – pure, true cinema; not an external view, not the underwater world observed by a scientist or a filmmaker. With no commentary, the image must speak for itself. A single rule is repeated over and over to the cameramen at every shoot: the world of the sea must be seen through the eyes of its creatures. Be a fish among fish. Pass unobserved, go in front of them, graze them, but do so without altering their behavior. It was necessary, therefore, to create tools that didn't yet exist.

What is amazing about Jacques Perrin as he talks about his film is his childlike jubilation over the incredible mobilization of scientists and the accumulation of technical prowess that *Oceans* has generated. Perrin seems inspired by Jules Verne and his Captain Nemo. Since *The Roaring 40s* (1982), for which he invented cameras with revolving clear view screens in order to avoid raindrops on the lens, then *Microcosmos* (1996), filmed on two square meters of lawn, the laboratory-films produced or co-produced by him have continued to advance cinematographic technique. In 2002, on first thinking about *Oceans* with Jacques Cluzaud, the film's co-director, he reached out to the biologists who collaborated with him on *Winged Migration*: Yvon Le Maho, research director of the National Center for Scientific Research (CNRS) in Strasbourg, polar science expert, and a member of the French Academy of Science. This world expert on sea birds, penguins, and seagulls will be the guarantor that ethical parameters are met to the satisfaction of the scientific world. And Stéphane Durand, 37, biologist and ornithologist, soon

promoted to “whale expert.” It is up to them to decide which species to film, to learn everything about their behavior and their biotope.

This is not an easy task: there are as many whale experts as there are species in the oceans. Blue whale from the Atlantic? From the Pacific? Stéphane Durand feels his way around. Yvon Le Maho introduces him to the Sloan Foundation. In 2000, this private American foundation launched The Census of Marine Life, a program that has united thousands of scientists, from specialists in the bacteria of hydrothermal springs in depths up to 4,000 meters, to eminent experts of albatross or whales.

Thus the production benefits from the precious information of an entire network of experts spread out over the planet. Thanks to The Census of Marine Life, the teams at Galatée Films, Jacques Perrin’s production house, will be able to film in certain territorial waters where marine mammals are protected by extremely strict legislation. In exchange, the scientists gain from Galatée’s sophisticated technology and logistics whereby they are finally able to go up close to animals they’ve thus far only observed from a distance. A bargain for researchers used to working on shoestrings. The images sometimes give them information that was heretofore beyond their reach. Stéphane Durand recalls: “For *Winged Migration*, we worked with ornithologists who, of course, had never flown with birds. When the pelican experts saw the rushes of their adored animals in the air and had the impression of flying right beside them, thanks to our cameras that were mounted on ULM (ultra light motorized vehicles), they watched with their mouths open!”

Once the choice is made of which species to film, two questions arise: what tools should be used to film them? What should the format of the film be? 70 mm? 35 mm in cinemascope, with camera magazines that afford only four or five minutes of useful footage, highly impractical in an underwater shoot? High definition with its 48-minute digital tapes? The idea makes 35 mm film manufacturers and laboratories shudder, it’s such a threat to their industry.

## **A DIVER WITHOUT BUBBLES**

Starting in 2003, a small team gathered around “the two Jacques,” Perrin and Cluzaud, to think about these issues. It consisted of: Olli Barbé, production director, the pivotal person in a shoot; Didier Noirot, diver and cameraman, a former Cousteau collaborator on the Calypso and the Alcione. He’s the diver who uses a closed-circuit rebreather, a dangerous undertaking that requires a superoxygenated mix of nitrogen and carbon dioxide. The doses are controlled by the diver-cameraman himself at the same time that he’s manipulating the camera, taking bearings, choosing the film speed... The slightest lapse of attention, and he’s in danger of passing out – in the depths of the ocean. Diving with a rebreather, however, offers two critical advantages: it allows the cameraman to stay underwater two hours and forty minutes; and it offers limited decompression stages. Most important, it doesn’t make bubbles, an indispensable requirement for not frightening the fish and being able to film them calmly. Didier Noirot will be the person in charge of underwater shoots. Philippe Ros, director of photography and technical supervisor, has become well versed in the transition from analog to digital modes since the 1990s. He will be the point man for hypergamma curves, pixels, and the ergonomics of the cameras.

Six months of feverish meetings later, the decision is made: the images above water will be filmed in 35 mm, and the underwater sequences with high-definition cameras. It's up to Philippe Ros to accomplish what has never yet been done: marry the two formats in such a way that the viewer can't tell the difference in the image. Unlike high definition, 35 mm is very rich in nuance; but high definition offers remarkable resolution. It takes Ros three months to improve the quality of the digital cameras and six more months to achieve perfection. At which point Jacques Perrin tosses out another challenge: "Can we go further?" His sharp eye has spotted reflective halos, a solarization effect... Philippe Ros collaborates with Sony engineers who have been working ceaselessly on the development of contrast curves (hypergamma, the digital equivalent of "ASA") in order to get rid of the "video effect" inherent in the digital. Ros struggles to get better performance from the Panavision cameras, thanks to a veritable lab of software inside the camera. At the same time, he fine-tunes the "digital workflow," a process that controls the ensemble of digital processes in order to stabilize the quality of the image from the first shoot and retain the quality throughout years of filming.

## **THE FAIRY HOOD DIVING SUIT**

In order to achieve what Jacques Perrin wants, what's needed is a matter of dynamics. Didier Noirot suggests they improve the system that he and the Swiss engineer Jean-Claude Protta pieced together: the camera housing, a waterproof underwater caisson with a viewer, is made of 120-kilo hollowed out aluminum bars. Protta will do better: lighter, more stable, hydrodynamic. And so they set about working on the camera's ergonomics, reviewing ways to cut down its size. Philippe Ros, a specialist of the shoulder-mounted camera, is a wizard for simplicity. He imagines two buttons on the camera housing that will allow the cameraman, while in the midst of action, to adjust his camera quickly and simply in response to the diving depth, the color of the water, and the light. It will no longer be necessary to resurface in order to reset the camera while the fish continue on their way through the ocean.

The moment for testing in the water arrives, and the Fairy Hood makes its appearance. This diving suit imitates fish. Hand-sewn scales reflect light; floating veils give the delicate transparency of jellyfish; monochromatic tints – camaïeux – in reds and blues, whose range goes to the palest of colors, test the HD camera's ability to translate these hues; and a blonde wig reproduces the fine strands of algae. Pure tinkering comes to the rescue of high tech, but the work on contrast curves is complex. Perrin is pleased. "We're going to shoot calvalcades of dolphins in choppy waters," he announces. A calm, flat sea isn't his cup of tea. They've got to move at the speed of dolphins, 25 knots, and film at 24 frames/second in 35 mm. Enough to make whole auditoriums of spectators pitch and roll. It's out of the question to resort to 100 frames/second because such slow-motion would look fake.

The two Jacques and Olli Barbé turn to the other Jacques Perrin, the one the team calls Fernand for reasons of convenience. Jacques-Fernand Perrin will be the algorithm and cybernetics man, the one to harness movement. This retired engineer specializes in high-altitude flight: he first worked in the nuclear domain then in defense armament at Thomson-Thalès (the Crotale program, with its short-range air defense missiles, and Chahine were his). He came to the rescue

of the production team during the film shoot of *Winged Migration* when a ULM that was transformed at great expense could only shoot directly ahead. So, flying in the midst of grey geese, all the camera could catch was a bunch of rumps. So that other mistakes of this type wouldn't be made on the next film, Jacques-Fernand begged the production team to call him well in advance.

## **A CAMERA SWALLOWED BY AN ORCA**

This time around, the idea was to create a stabilized head that would house the 35 mm camera, attached to the arm of a jointed crane. The filming would take place on a rubber dinghy moving at full speed, with the camera 30 centimeters from the dolphins' backs. The goal: as always, to be a fish among fish. A few days later, Jacques-Fernand returns with simulations using synthesized images. "With our cinema friends, it doesn't work to say, 'I'm going to do two tenths of a degree in frequencies greater than...'" That means nothing to them. So I transformed the numbers into images." The horizon on the images is nearly stable. Jacques Perrin is enthusiastic, like a kid. They tell him the equipment doesn't exist. Who cares! It takes two years to create Thetys, two years of close collaboration between Jacques-Fernand and Alexandre Bugel, director and key grip, the welding torch guy. In his studio in the Haute-Garonne, this creative tinkerer makes the motor for a gyrostatic camera head – a machine weighing 75 kilos capable of supporting a 35-kilo camera, as well as a crane that carries Thetys beyond the boat and puts it at the surface of the sea. In Paris, Jacques-Fernand studies the technical components, the motors, the gyroscopes. After many simulations, he succeeds in stabilizing the horizon line. They can film great white sharks chasing sea lions without lurching, or the vertical twirls of long-nosed spinner dolphins off the shores of Costa Rica.

But the key invention is the underwater torpedo towed by the boat via a 100-meter-long fiber optic cable. It films in reverse so that the animals can be seen frontally. A meter and a half in length, 30 centimeters in diameter, maximum acceleration of 40 km/hour. Its conception required nineteen participants in eight different countries on two continents. The cost: 1 million Euros. On this point also there were feverish discussions. Part of the team thought they could "take a pipe, put a thing on the end, and film." Jacques-Fernand stepped in: "Gentlemen, my experience with flying or navigating objects tells me that it's not so simple. Because any object thrust into a fluid and going faster than ten knots is going to oscillate and do God knows what." There were two machines of this sort, equipped with semi-professional cameras. The first was put together by a South African; the other, by a German who witnessed his marvel swallowed by an orca. But Jacques Perrin wanted to introduce a small-size digital camera into the equation, a camera that would give an incomparable quality to the images. Philippe Ros worked one year on a fiber optics system.

As for Jacques-Fernand, hydrodynamics aren't his forte, so he turns to experts. Those who he knew conceive submersibles or torpedos that sink ships: the General Delegation for Ordnance (the Direction Générale de l'Armement, DGA, is an agency of the French government in charge of developing and evaluating weapons systems for the French military). He goes to the DGA and they take on the challenge. The agency places its research offices at the Perrin team's disposal, along with its towing basins and its huge hydrodynamic tunnel at Val-de-Reuil, near Rouen,

where they test the submarine scale models. The result is a technological jewel that will remain in the annals of history. Alexandre Bugel has the task of coming up with maintenance tools to put the torpedo into and out of the water rapidly, as well as a system for unwinding the 100 meters of fiber optic cable connecting the torpedo to the boat. A silver-sheened hull, made of composite of fiberglass, steel, and plastic, is entrusted to a small manufacturer in Toulon that already works for the DGA and Ifremer (l'Institut Français de Recherche pour l'Exploitation de la Mer), the French national institute devoted to ocean sciences. In the first test, the machine bellies up. The engineers made a mistake in their calculations of the center of gravity. Back they go to the research labs to rectify the shape and the ballasting. The machine that everyone fears will be swallowed by a whale is baptized Jonas. It contains half a digital camera, the fiber optic cable transmitting information to the other half of the camera, which remains on board. The film will end up using only 1% or 2% of the images taken by Jonas in Costa Rica, San Diego, Alaska. But they are indispensable images.

## **IN THE BREATH OF THE WHALE**

Innovations follow at the rate at which the needs arise, a rate that keeps accelerating. Two mini-helicopters, 12 kilos each, equipped with a 35 mm camera – sheer model-building – are created for aerial shots at sea level. There, too, a system for stabilizing the horizon has to be found. Once worked out, a collision with a bird puts one of the two machines out of service. But the results are there: “We are in the breath of the blue whale,” François Sarano marvels upon his return from the Sea of Cortez. Sarano, a biologist and diver, is co-screenwriter of the film. The “half-in-the-air, half-in-the-water” contraption is put together in two weeks with the help of a caisson, two polystyrene floats, three bolts, and two pieces of self-adhesive tape. Thanks to this machine, they film in and above water at the same time, a technique ideal for filming seals, sea lions, or sea otters, which swim with their heads above water. It’s an underwater scooter, at zero gravity, with propeller and handlebars. The cameraman, lying stomach-down, moves at 8 knots among dolphins and takes the shots, perfecting the angles. Two prototypes have already exploded in testing. The “polecam,” a caisson attached to a shaft, takes the camera beneath the hull of the ship and allows filming in bad weather with no danger to the cameraman.

“What if we illuminated the water without it seeming to be illuminated?” Jacques Perrin dreams out loud. The film shoots have been well underway. Isn’t it the business of cinema to make us believe? So: what if we could recreate moonlight? What if we could give the underwater night its actual mysterious aspect? The only images we have of it is in close-ups, glaring beneath the kilowatts of a projector. The nocturnal life of a reef has never been filmed in a wide shot. Jacques Cluzaud and Philippe Ros imagine an underwater studio at a depth of six meters. Shots filmed in a natural setting of an underwater “cemetery,” off the coast of Edithburg, near Adelaide in Australia, where the lighting effects would make turned over shellfish evoke graves – that would be convincing; a guaranteed Sleepy Hollow effect. Shooting in a coral area in Polynesia 100 meters long by 40 meters wide, with an installation of lights that recreates the effect of a swell, the team films an attack of mollusks on giant starfish.

What’s left to be shot is a blooming, the birth of coral in the Gulf of Mexico, at the moment when the gametes rise from the polyps in the form of little white bubbles and set off on their

voyage to fertilize other atolls – a veritable storm of underwater snow... magical. But the most highly developed technology serves no purpose if the animals don't show up at the rendezvous. How many hundreds of kilometers bumping up and down in a rubber dinghy would it take to cross, empty-handed, the seas that for great pelagic mammals are as big as a garden? In a Polynesian atoll they search for humpback whales that sing and dance. Alas! The annual Sabbath took place in another corner of paradise. They set out for the Antarctic to film the sea leopards' hunt for penguins. But that particular year, they are on a diet of shrimp.

Thanks to these images taken so close to the animals, scientists discover behaviors they knew nothing about. The ornithologist always wondered what happens to the Cape gannet beneath the water when it nosedives at 100 km/hr. Does it chase fish? Does it continue on the same trajectory? At such high speed, what movements does its body make? Now he knows. In the Antarctic, thanks to the manageability of the underwater camera housing, Didier Noirot is able to film a mother Weddell seal as, entirely submerged in the water beneath the ice, she "talks" to her son who remains on the ice floe. Her mouth opens and shuts, and she articulates in the water. Stéphane Durand knows that such a moment has never before been seen; but do scientists even know about this phenomenon?

In the end, on screen, all this technological prowess disappears. It gives us access to the life of the sea such as no human can see it, as it has existed for all eternity. We forget the inventive processes and designs that have allowed for these images to be taken when we are faced with the spectacle of a sleeping humpback whale in the vacant enormity of an austral sea. Or when we are faced with the dance between Didier Noirot the diver and another gargantuan creature that pulls back its fin so as not to crush the little being in flippers. In a dramatic moment, the baby seal in the Antarctic confidently scrutinizes its reflection in the water through a hole in the ice floe. A few centimeters beneath the surface, Didier Noirot, outfitted with the closed-circuit rebreather and the camera housing, captures its gaze, which dives into ours and speaks to us...

## **PRIMITIVE ORGY**

The most spectacular sequence would not have existed without the combined efforts of all the machines. It is the sardine run, off the Transkeian coast of South Africa. The dolphins have an appointment to hunt sardines. Frightened, the latter fuse into a ball, a ball of bait. This is the kill. Whales, sea lions, seagulls, Cape gannets rush out of nowhere and begin to gorge themselves. Clouds of birds plunge into the water in a nosedive, fly among the divers' flippers... On the surface, the mini-helicopter and Thetys; beneath the water, Jonas, the digital cameras, and the underwater caissons place the viewer in the heart of this incredibly violent, primitive orgy.

Two hundred days before the end of the filming schedule, Jacques Perrin says he's given up on trying to film the deep-sea universe beyond a depth of 50 meters. In other words, he would have to use extremely precious submersibles that would still have to be created. His team only half believes him.

