New Perspectives in Ecological Documentaries Under Technological Innovation: A Case Study of BBC' s Blue Planet II (Postprint)

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Abstract

Underwater photography is distinguished from terrestrial photography; its inherent difficulty resides precisely in the fact that marine organisms are in constant motion, perpetually changing, necessitating the capture of their most vivid instants. However, beyond mere snapshot acquisition, it further requires lighting —employing the artistry of light and shadow to articulate the visual composition —as well as the selection of appropriate equipment and the study and tracking of biodiversity, thereby enabling better capture of the most beautiful moments of underwater organisms. Technological innovations in underwater photography equipment bring forth not merely technological reform, but rather a qualitative leap in imaging perspective.

Full Text

A Brief Analysis of New Perspectives in Ecological Documentaries Under Technological Innovation: The Case of BBC' s "Blue Planet II"

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Abstract: Underwater photography differs fundamentally from terrestrial photography in that marine life is constantly in motion, requiring photographers to capture fleeting moments of vitality. Beyond timing the perfect shot, underwater cinematography demands mastery of lighting to sculpt images through the interplay of light and shadow, careful selection of appropriate equipment, and thorough research and tracking of biodiversity to better capture the most stunning moments of submarine life. Technological innovations in diving photography equipment do not merely represent incremental technical improvements, but rather effect a qualitative leap in visual perspective.

Keywords: technology; diving; photography; ecological documentary; visual perspective

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In the realm of oceanic exploration and documentation, the most renowned work is undoubtedly the BBC' s 2001 natural history series— "Blue Planet" —the first comprehensive exploration of the world' s oceans. By the technical standards of its time, this documentary represented a paragon of classical filmmaking. As times have changed, technological progress has not only propelled steady social development but also catalyzed artistic innovation and renewal. Sixteen years later, "Blue Planet II" premiered in 2017, its return alone demonstrating that art and technology advance in tandem with the times. Moreover, thanks to innovations in specialized technology, audiences can now observe marine life from multiple perspectives, as if seeing through the eyes of fish themselves, while revolutionary cinematic techniques reveal previously unknown aspects of the ocean world, presenting "completely authentic nature."

Reflecting on numerous documentaries both domestic and international, what factors have contributed to the creation of these universally acclaimed, controversy-free masterpieces? This question warrants repeated consideration and discussion, as well as deeper analysis and understanding—whether the driving force is the uncertainty of digital technology or the multiplicity of artistic expression. As an author deeply passionate about this field, I hope this article can contribute to the discourse by drawing upon personal filming experience and informed perspectives.

1. New Perspectives in the Context of Technological Innovation

Among technological transformations, the invention and application of aerial photography has undoubtedly become one of the most popular innovations. From the era of cumbersome machinery to today' s lightweight, portable miniaturized equipment, the creative evolution of technology underscores the intimate connection between art and technology. In terms of cinematographic approaches, aerial photography offers audiences a unique sensory experience through its top-down perspective, while underwater photography immerses viewers in a tranquil world—a world where one can hear only their own heartbeat beneath the surface. The submarine realm displays the grandeur and wonder of creation. Humanity has long been fascinated by the ocean, the cradle of life, continuously pushing the limits of diving depth in attempts to fully comprehend the

sea' s mysteries. Thanks to innovations in digital cameras and high-sensitivity sensors, we can now truly witness the diversity of marine species.

The "Blue Planet II" production team employed numerous advanced devices, selecting different underwater diving equipment and specialized cinematography apparatus according to environmental requirements. Many marine creatures—those sprites of the sea—were captured on film for the first time. These technological applications enabled feats previously considered impossible. Standard scuba diving equipment allows descents to approximately 40 meters, while the professional scuba diving world record stands at 332 meters. Documentary teams utilized military-grade submersibles and research vessels to film organisms at depths of 8,000 meters, with photographers able to remain in submersibles at abyssal depths of 1,000 meters for up to 1,000 hours, or use rebreathers to explore coral reefs.

Closed-circuit rebreathers (CCR) have revolutionized underwater photography. Since they produce no bubbles during respiration, photographers can capture required footage at close range without disturbing marine life. Consequently, "Blue Planet II" features extraordinarily powerful, extremely close-up shots that render the film breathtakingly beautiful, making audiences feel as though they are immersed in the blue ocean without disrupting the creatures'natural rhythms and routines. Photographers can remain underwater longer and dive deeper, thereby providing more possibilities for underwater cinematography. These innovative technologies offer creators broader creative space and ample time to capture the ocean' s wonders.

1.1 The Transformation of Diving Equipment Expands Photographic Possibilities

Humanity has never ceased its curiosity about and exploration of the ocean since the beginning. In 1943, the great French ocean explorer and inventor Jacques-Yves Cousteau invented the scuba diving apparatus (in 1943, Cousteau and Émile Gagnan jointly invented the Aqua-Lung). They adjusted this valve and tested it with a tank of compressed air in the Marne River outside Paris, giving birth to the underwater breathing apparatus. Though weighing 22.7 kilograms, this device was not burdensome underwater, allowing divers to move freely beneath the surface. Cousteau was also a filmmaker, and his first underwater film, *Eighteen Meters Down*, won recognition at the 1943 Cannes Film Festival.

This great invention significantly advanced human understanding and exploration of the underwater world. Using BBC' s "Blue Planet" as an example, the production team returned to film the sequel sixteen years after the original series. In 2001, due to limitations of underwater equipment at the time, filming sessions could last only 45 minutes. By 2017, when filming "Blue Planet II," technological innovations in scuba diving and diving equipment allowed the underwater filming team substantially longer submersion times than traditional scuba gear permitted. Rebreather diving enables crew members to observe qui-

etly on the seabed without producing bubbles or causing disturbances. This American former military diving technology can capture footage previously impossible to obtain and allows continuous filming for over three hours underwater. Due to the complex underwater environment, where pressure increases by one atmosphere every ten meters of descent, capturing the most authentic ocean scenes demands higher standards for both divers and equipment.

1.2 Camera Technology Innovations Enable Diverse Storytelling

In 2001, "Blue Planet"was filmed using 16mm film cameras, whereas "Blue Planet II"employed RED DRAGON 6K cameras, Sony A7S2, Phantom 4K Flex, GoPro, Micro Studio Camera 4K, infrared cameras, and other specialized equipment, enabling photographers to capture clear images even in extremely low visibility conditions. The choice of 4K resolution renders every frame breathtakingly beautiful.

The protagonist of "Blue Planet II" is the RED DRAGON 6K digital camera. Its ultra-high resolution and 16.5+ stops of dynamic range have made it a favorite among cinematographers for major documentaries and feature films. This camera can achieve 100fps at 6K resolution, presenting astonishing detail, and its modular design, when equipped with underwater photography kits, enhances work efficiency through its lightweight, portable body. Additionally, its 配套的低通滤镜 (PLPF) [accompanying low-pass filter (PLPF)] can be used to overcome insufficient lighting in the ocean and capture excellent color effects.

Another transformative technology is the underwater infrared camera. In the pitch-dark deep sea without sunlight or sound, only infrared cameras can capture unseen deep-sea creatures, and since marine life cannot detect the camera' s presence, it allows for maximum authenticity in presenting marine organisms. It is precisely such advanced technology that enables us to witness the behaviors and lives of deep-sea creatures.

"Blue Planet II" also extensively utilized macro wide-angle lenses and low-light cameras. For instance, one episode depicts squid collectively spawning in algae. Capturing these tiny marine organisms within the complex algae environment required macro lenses and underwater probe cameras. The actual subjects were so small as to be invisible to the naked eye, but after employing macro wide-angle lenses, audiences could perceive a one-to-one scale relationship. This enormous proportional deviation creates a powerful visual impact unique to macro wide-angle photography.

Typically, when sunlight penetrates the sea surface, visibility distance and range are severely limited as light is absorbed by water with increasing depth. Due to water's effect on light, the scenery visible to the human eye undergoes "distortion" underwater. Water' s absorption of light waves causes dramatic color shifts: red light disappears at five meters depth, yellow light vanishes at ten meters, and below twenty meters, only blue light remains, rendering the seabed a blue world —hence the term "blue ocean." Deeper still, the underwater world becomes pitch

black. Low-light cameras are therefore crucial underwater, as auxiliary lighting can disturb marine life and prevent filming. The advent of low-light cameras solves this problem, enabling desired footage to be captured even in insufficient light conditions.

1.3 Application of Bionic Cameras and Specialized Equipment

In the "Blue Planet" documentaries, many shots create an immersive experience, as if placing viewers directly among the blue marine life. This achievement is attributed to another technology: bionic cameras.

People have continuously developed new photographic equipment. With the assistance of technical engineers and equipment specialists, the footage of wildlife that humans can capture has become increasingly rich and intimate. As is well known, the greatest challenge in wildlife cinematography is the distance between camera and animal. Bionic cameras were born from this need and are crafted in diverse forms to approach target groups. Photographers can remotely control these bionic cameras from a distance via electronic screens, shaping the cameras to resemble the subjects' forms and better integrate into wildlife communities—at least preventing animals from fleeing as they would from a perceived enemy. This technique has been widely applied in many BBC nature documentaries, with cameras disguised as penguins, monkeys, or fish. Through technological means, these cameras' movements are remotely controlled. In an earlier documentary, *The Cove*, the production team even disguised cameras as rocks to capture the shocking scenes of dolphin massacres in the cove—heart-wrenching images that were filmed for the first time thanks to bionic cameras.

The "Blue Planet II" team also collaborated with Gates Underwater Products to build a camera with a 24-inch hemispherical dome port to capture those sublime split-screen shots that became the poster image for "Blue Planet II" and its most powerful visual moment. The lens could simultaneously focus on both above-water and underwater scenes, as demonstrated in footage of walruses resting on sea ice, illustrating the ocean' s magnificent dynamism.

Since tripods and fixed supports cannot be used underwater, stability becomes extremely challenging. Photographers must control both their bodies and the camera simultaneously. For split-screen shots like those in BBC productions, stability control also relies on spherical camera stabilization gimbals. Underwater photography is highly susceptible to losing balance from even minor currents. Mastering body control in relatively calm water—what we call "neutral buoyancy" —allows for stable stationary positioning to capture steadier footage. Through proper training, photographers can also master switching between "neutral" and "negative" buoyancy to maintain body stability in currents. Another crucial factor for stability is breathing; steady breathing also contributes to stable footage. Therefore, an excellent underwater photographer requires rigorous training and abundant physical stamina—the key distinction between amateur and professional diving photography. Equipment updates and accompanying

stabilizers are also critical metrics for determining whether stable images can be captured.

2. New Perspectives Through New Technologies

In natural history documentaries where the protagonists are uncontrollable animals and everything is unpredictable, a director' s storytelling ability faces greater challenges. "Blue Planet" director Orla stated in an interview that during the four-year preparation period, the team continuously planned what new content to present to audiences and how to structure each episode' s narrative: "We spent considerable time on story presentation. For instance, some stories must first be inherently compelling, then we consider how they will work visually. This process involves many factors—from knowing how to edit upon returning from location to presenting the best possible version."

Underwater filming means being completely at the mercy of the ocean, enduring extreme challenges from tides, currents, sea winds, waves, deep-sea pressure, and low visibility. Through revolutionary new technologies, the team gained access to new worlds and filmed marine animal behavior using methods that were impossible just a decade ago.

All technological innovations in "Blue Planet II" illustrate one principle: technological revolution brings new perspectives, new visual sensations, and new artistic presentations to documentary cinematography. In today' s era of advancing science and technology, scenes that were once desirable but impossible to capture—those marine sprites invisible to the naked eye—now seem to leap before our eyes.

2.1 Using New Technologies to Tell New Stories

How does BBC bring fresh perspectives to natural animal documentaries? "Blue Planet II" producer Orla Doherty explained that BBC seeks unique story angles, focusing on little-known behaviors of specific animals, then deconstructing and assembling these into narratives. The viewing experience has been a core element of BBC' s productions over the years. A scientific and rigorous attitude makes BBC documentaries premium quality. The interview' s use of the term "deconstruct" is noteworthy. When filming marine life, we typically capture fragmented footage rather than deconstructing entire narrative threads, constrained by equipment limitations that prevent tracking marine organisms' habits and migration routes. "Blue Planet II" demonstrates how high-tech methods capture desired footage and assemble it into coherent stories, advancing beyond traditional cinematography and audiovisual language.

BBC's approach to storytelling involves more than simple panning and tilting—it traces origins and understands creatures' habits and migration routes. Overall, movement is paramount. However, underwater filming of marine life makes movement particularly crucial. Using long takes to tell stories is also a technique employed in "Blue Planet II."

2.2 Documenting Reality

The most important aspect of documentaries is authenticity. One episode of "Blue Planet II" focuses on the deep sea, capturing a complete whale fall phenomenon— "one whale falls, all things flourish." The documentary fully records this process: after death, a whale continues to provide nutrients for the marine ecosystem, a cycle that can last a century. Fewer than fifty whale falls have been discovered worldwide. When filming this episode, BBC used high-tech methods to track the entire whale fall process, completely retelling the wonder of this phenomenon. After death, whales seek tranquil waters to fall thousands of meters to the seabed. During descent, their bodies are consumed by sharks attracted by the scent of blood. The production team filmed from the sharks' perspective, allowing audiences to more intuitively experience the scene from a shark' s viewpoint. The narrative' s visual language and fragmented footage are deconstructed into a complete story thread, followed by footage of various marine organisms arriving for the feast, captured from different angles and perspectives of different sea creatures. The whale' s body becomes a crucial link in the marine ecosystem, and most remarkably, its bones eventually become home to seabed microorganisms, maintaining ecological balance in that region. The crew filmed from macro to micro perspectives, using submersibles to capture unprecedented footage of the microscopic world, allowing audiences to witness the magnificent beauty of whale falls on the big screen for the first time.

Rich preparation and new technologies bring fresh perspectives. In essence, "Blue Planet II"feels new—new stories, new technologies, a new audio-visual feast. These compelling narratives and continuous technological exploration give birth to great documentaries. During my own diving experiences, I have frequently encountered ecological destruction caused by human pollution and marveled at the uniqueness and beauty of marine life. Such documentaries achieve universal acclaim not only through exquisite imagery and the wonder of unknown worlds, but also through scientific rigor. Most importantly, they reveal unprecedented views of the ocean, carrying profound educational significance for environmental and marine species protection.

In the final episode of "Blue Planet II," an interview with the production crew reveals their philosophy. "Blue Planet II" producer Orla Doherty stated that BBC focuses on finding story angles, such as little-known behaviors of specific animals, then deconstructing and assembling these into narratives. The viewing experience has been a core element permeating BBC' s productions. A scientific and rigorous attitude makes BBC documentaries premium quality. The interview' s use of the term "deconstruct" is particularly noteworthy. When filming marine life, we typically capture fragmented footage rather than deconstructing entire narrative threads, constrained by equipment limitations that prevent tracking marine organisms' habits and migration routes. "Blue Planet II" demonstrates how high-tech methods capture desired footage and assemble it into coherent stories, advancing beyond traditional cinematography and audiovisual language.

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Note: Figure translations are in progress. See original paper for figures.