From Danger Zone to World of Wonder: The 1950s Transformation of the Ocean's Depths

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Introduction

With the development of environmental history, historians no longer find it surprising to learn that cultural perceptions of a particular natural environment have changed over time. The ocean, though, has been understood as a place quite apart from human history, while the ocean's third dimension – the depths of the sea – is almost never considered a human environment at all.[1]

Just as the telling of the natural history of the ocean's depths draws many fields of natural science together with history and literature, so too does the project of writing the human history of the undersea world necessarily weave together disparate methods, questions and sources. Works including Callum Roberts' book, *The Unnatural History of the Sea* and the History of Marine Animal Populations project have revealed characteristics, population sizes, and ecologies of past marine environments.[2] Such projects have not, however, integrated human actors in roles other than as extractors of marine resources. While people have, unarguably, caused devastating effects on marine populations all around the planet, and while this history is extremely important for understanding the past as well as for framing future policy, more historical understanding of a different type is also needed.

People have used the sea for food and other resources, including as an avenue for transportation, since pre-historic times, probably reaching back even before the era of *Homo sapiens*.[3] Anthropology teaches us that coastal peoples interact with the ocean in cultural ways as well as physical ones. Origin stories and knowledge creation in coastal cultures are firmly tied to the sea.[4] Alongside our histories of extraction of marine resources, we would be wise to create histories of cultural conceptions of the ocean.

This paper explores one moment of sudden and dramatic cultural change in human perception of the undersea environment. That moment was the 1950s, the decade following the first commercial availability of what is now referred to as scuba technology. This paper concentrates on diving depths achievable by people using breath-holding or scuba technology and does not discuss submarine or submersible technology, which deserves a separate, parallel effort to chart changing perceptions of essentially a different part of ocean space.[5] While there were technologies that allowed people to work under water before self-contained breathing apparatus, nothing before had opened the undersea realm to so many people, and so many different kinds of people, allowing them to pursue a wide variety of work and recreational activities under water. The cumulative experience of this first generation of divers profoundly changed western cultural conception of the ocean's depths. What was understood as an unknown, dangerous zone came to be perceived as a mysterious and wonderful place that was safe and inviting for human divers.

Charting and analyzing this transformation requires of the historian attention to the physical and technical, including the history of diving, but it equally demands consideration of culture and imagination. The desires of early divers, their technological

enthusiasm, their experience under water, and their hopes for using the undersea world exerted at least as much influence on their perceptions and encounters as the technical capacities enabled by their equipment. This study employs sources including advertisements, diving training materials, popular and scientific literature, and fiction, films and television programs to investigate changing perceptions of the ocean's depths. During the 1950s, as postwar oceanography dramatically expanded scientific knowledge of the depths, ordinary people went underwater by the thousands. Their experiences were filtered through, and magnified by, the use of diving in advertising, film, and literature. Cued by an impression of the sea as full of dangerous creatures, the first generation of divers gradually let go of fears that were based on lack of knowledge of the undersea environment and instead concentrated on new threats that emerged from their newfound familiarity with the undersea realm.

Historians have identified so-called "extreme" environments as a category that renders remote and inaccessible places, such as Antarctica, outer space, and the ocean's depths, into sites susceptible to historical analysis. Extreme environments require technological intervention but their history is embedded in the cultural and scientific traditions of western geographic exploration.[6] One crucial difference between the ocean's third dimension and other "extreme" environments is that it is not necessary to conjure up the deepest reaches of the sea; even a few feet of water can be fatal to people without breathing technology.[7] Conversely, it was relatively much easier for ordinary people, including civilians and amateurs, to explore under water than to visit other extreme environments. Both technology and culture, then, are essential categories for a history of the undersea world.

The Dangerous Depths

Because no comprehensive history of western cultural conceptions of the ocean's depths exists, this paper begins with glimpses of perceptions of the undersea world at a few points in time before the mid 20th century, to establish that this part of the planet did, indeed, inspire fear. Although there were people and cultures for whom free diving formed an integral part of their lives and livelihoods reaching far back in time, such as the famous Ama pearl divers or Mediterranean sponge divers, the diving tradition that dramatically shifted perception of the undersea realm began with commercial availability of self-contained breathing apparatus in the late 1940s. It emerged from the efforts of a handful of Mediterranean divers who popularized the new sport, which became a "national fad" in the United States and a handful of other

Figure 1. Ama pearl diver in Japan. Source: Wikimedia.

countries, mainly Italy, France, England, and Australia, as well as in a number of American and British territories and former colonies.[8] As such, exploration of the undersea world formed part of the trajectory of western geographic exploration.

That exploratory tradition began with the "discovery of the sea" described by J.H. Parry, in which European explorers of the 15th and 16th centuries found ocean routes between known places and to newly discovered lands and islands.[9] This discovery focused on the ocean's surface, not its depths, and was more concerned with hurrying over the sea than focusing upon it. Although the literature of the English Renaissance is filled with maritime voyages and instruments, Jonathan Raban, the editor of *The Oxford Book of the Sea*, commented with surprise, "there is so little sea in it."[10] Accounts of voyages dwelled on approaches to land, on events and people on board ships, and on encounters with other vessels. When the sea did appear in the writings of sixteenth- and seventeenth-century voyagers, the occasion was almost always a horrific storm.[11]

Explorers at that time and in subsequent periods also called attention to the profusion of fish or other desirable marine life, such as sea turtles or whales. Cod, for instance, provoked observations such as, "The sea there [off Newfoundland] is swarming with fish, which can be taken not only with the net, but in baskets let down with a stone."[12] Other explorers claimed that cod were so numerous that they slowed the passage of ships and appeared to equal "the grains of sand which cover this bank."[13] Particularly menacing sea life also garnered attention. Sharks were noted for their profusion, for their extremely large size relative to what voyagers knew from seas closer to home, and also for their ferocity. One late 18th-century observer, voyaging along the Colombian coast, complained that sharks disrupted their fishing when they "destroyed our hooks and lines." They also seized the hand of a sailor, "a circumstance not uncommon at the Sandwich Isles [Hawaii]," and also "continually seiz[ed] the steering oar…so that we were obliged to lay it in."[14]

Figure 2. A view of an encounter with a whale from Konrad Gesner's ***Nomenclator aquatilium animantium,*** 1560.

In the second half of the nineteenth century, scientists inaugurated serious investigation of the ocean's depths and gained confidence in their ability to impose their will upon the ocean's depths as they extracted zoological wonders and succeeded in laying a telegraph cable across the sea floor between Europe and North America.[15] Efforts – both imaginary and real – were made to place people underwater. Verne's *20,000 Leagues* fantasy outstripped the reality of helmet diving, which allowed salvage and construction at limited depths.[16] In fiction, sea creatures including sharks and giant squid endangered people who went under the sea to dramatic effect. For example, Victor Hugo's 1866 novel (in English, titled *Toilers of the Sea*) featured the hero battling an octopus to find the valuable engine from a wrecked ship along with a stolen treasure and

the skeleton of the thief, who had been grabbed and eaten by the creature. Such frightening characterizations of marine monsters were not limited to fiction; a popular treatise on the "Water World" published in 1883 described sharks as, "objects of dread to those who behold them in their native element." The dread derived from the shark's "preference for human flesh," in pursuit of which "the shark has been known to bound several feet out of the sea, and seize the unwary sailor, and to leap into fishing-boats, and grapple with the men at their oars."[17] Despite the inauguration of scientific study of the ocean, its third dimension remained forbidding and frightening.

In the decades of the 20th century before and during the Second World War, there were new forays into the underwater world. These ranged from spear fishers promoting diving as a recreational activity, to the exploits of the naturalist-explorer William Beebe diving in his bathysphere, to film-makers experimenting with means to get underwater footage, to the dangerous work of military frogmen.[18] There were many new motives for going under water and even more technologies employed to allow people to go there.

If this chronicle so far sounds like one of slow, gradual development, what happened next touched off rapid and dramatic change. In 1949, a technology invented in 1943 by Jacques Cousteau and an engineer colleague, Emile Gagnan, was distributed and marketed commercially. The Aqua-lung, soon joined by self-contained breathing apparatuses manufactured by competing companies, opened the ocean's third dimension to all comers. Whereas previously most people who went under water did so for work, off-the-shelf gear invited recreational users in vastly greater numbers (at least, compared to previous recreational divers – who included only those willing to spearfish while holding their breath). Civilians, rank beginners, women – and even children – joined former frogmen as undersea explorers.

Under the category of "diving" lay a wide variety of activities. Throughout the 1950s and early 1960s, the term "skin diving" frequently referred to either breath-holding diving or scuba diving. Diving manuals encouraged new divers to learn with mask, snorkel and fins before trying artificial breathing apparatus, and the sport of spearfishing remained a breath-holding activity, at least for official competitions.[19] The exploits of naval frogmen inspired many novice divers; in 1955 there were 50,000 members of the U.S. National Frogman Club, headquartered in California. Ten percent were women and a good many were teenagers.[20] *Skin Diver* magazine was first published in 1951 and, by the mid 1950s, had compiled a list of 213 dive clubs, in the United States and 49 elsewhere.[21] Some of the club names, such as "Sons of Beaches," "Kelptomaniacs," and "Davy Jones Raiders," suggest the light-hearted, social dimension of these clubs that formed to inform and educate members, organize spearfishing competitions, and partner with local search and rescue, oceanographic or other organizations with a use for volunteer divers. In 1958, divers from eighteen countries gathered in Brussels to found an international diving organization, the Confederation Mondiale des Activities Subaquatiques, headquartered in Monaco. The following year the Underwater Society of America organized to provide an umbrella group for divers and dive clubs. The unlikely location of its headquarters – in Champaign, Illinois – neatly demonstrates that the "undersea" of the 1950s was by no means limited to the ocean. As Bill Barada, a pioneer of skin diving in the U.S. put it, "Every new vista encountered invites exploration, and not only in the sea. An abandoned quarry, small lake or quiet river offers limitless

opportunity for adventure. Almost every body deep enough for swimming is being probed by skin divers."[22]

With more people going beneath the sea, the underwater realm was transformed from a place of danger to a place of wonder. This transformation did not happen overnight, but very quickly, within a decade or so, creatures such as octopus and shark enjoyed better reputations, while the new danger of the "rapture of the deep" threatened divers who pushed the limits of diving technology and equipment. By the early to mid 1960s, the undersea realm – at least at recreational diving depths – was considered to be "a safe and friendly place," according to one 1965 diving manual.[23] Let's examine this transformation in more detail, starting with the rehabilitation of terrifying wildlife.

The Rehabilitation of the Octopus

Many marine animals had reputations for endangering people. Giant squid provided dramatic moments in fiction from the time of Verne until today. Experts recognized that these creatures inhabit the deep, open ocean and thus did not believe they posed any real threat to divers, although filmmakers such as Irwin Allen, creator of the 1960 film *Voyage to the Bottom of the Sea*, included a scene in which a diver attempting to tap an underwater telephone cable was attacked by a giant squid.[24] The fear divers faced derived from the unknown. As Barada explained, "We had no idea what to expect. … every animal in the sea was considered a potential enemy."[25] In 1949 Barada bought one of the first twenty Aqualungs sold in the United States from the sports shop of Rene Bussoz in Westwood, California.[26] Early divers, such as John Sweeney, author of *The How-To Book of Skin Diving and Exploring Underwater*, attended nervously to the sharks, octopus, moray eels, and barracuda he encountered while experimenting with diving as a child in Bermuda.[27] Sweeney went on to train as a military frogman in the Canadian Navy, then made a career as a professional civilian diver. Rick and Barbara Carrier, authors of the 1955 book titled simply, *Dive*, likewise expressed concern: "Perhaps the thing about exploring this strange world which most worries the diver is the presence of hostile marine life."[28] Another skin diving pioneer was the actor Lloyd Bridges, who starred as Mike Nelson in the popular television series *Sea Hunt*, which aired from 1958 to 1961. In 1960, Bridges and Barada together published a book, *Mask and Flippers: The Story of Skin Diving*, which admitted that, in the early days of diving, the sight of creatures with ferocious reputations "was enough to send us scampering to the beach."[29]

Small octopus was quickly debunked as a danger to divers, but apprehension persisted about what might happen if a diver encountered a giant one. An introduction to oceanography first published in 1947, before widespread availability of scuba technology, remarked that, "a sizable octopus does not offer a pleasant encounter for a diver."[30] Bridges and Barada explained the basis of worries about large specimens: "It was taken for granted that a frightened or angry octopus would latch tightly to a skin diver and hold him helpless underwater until he drowned." They added, "We even speculated that one of the giants might attack."[31]

Such fear provided grist for the 1955 Ray Harryhausen monster movie, *It Came from Beneath the Sea*, in which a giant octopus, dislodged from its home in a deep-ocean trench by atomic testing, restlessly roamed the Pacific in search of food. Finding humans easy prey, the creature attacked Japanese fishing boats and people visiting beaches. Its unsuccessful attack on the first atomic-powered submarine set in motion investigations leading to its eventual defeat. Despite the modern armaments, the octopus's demise required a scientist-skin diver to leave the sub to shoot a harpoon gun into its only vulnerable spot, which he knew to be its eye. There was also, in 1953, a movie adaptation of the Victor Hugo novel, *Toilers of the Sea*, which was titled *Sea Devils* and starred Rock Hudson.

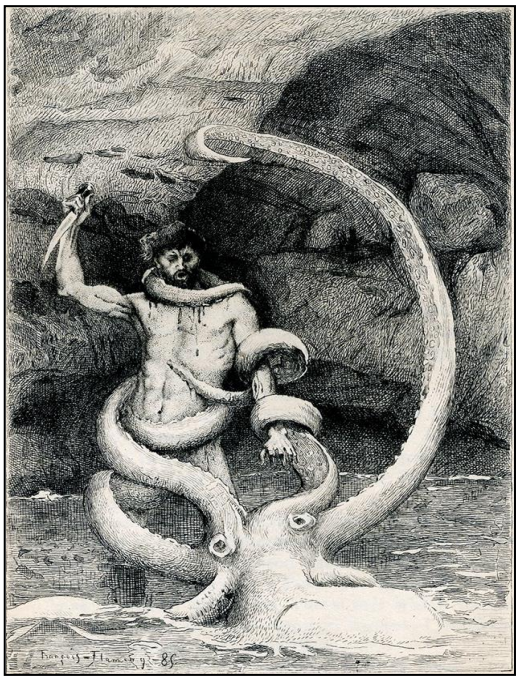

Figure 3. *Gilliat in the Clutches of the Devil-Fish* from Hugo's ***The Toilers of the Sea*** (Boston: Estes and Lauriat, 1866.)

Actual experience with octopus under water did not stand up to the fears and fantasies. According to a 1950 *Life* magazine article, Jacques Cousteau's divers "waltzed" with an octopus.[32] Within a decade, Arthur C. Clarke, the well-known science fiction writer who was also an enthusiastic diver and author of numerous fiction and non-fiction works on the ocean, dismissed octopus as "shy."[33] Diving clubs on the northwest coast of the United States, whose waters contain giant octopus, began holding annual wrestling competitions in which bare-handed divers grappled with an individual with an arm-span of up to 20 feet or slightly more, weighing up to 80 pounds. According to Barada, the first diver to capture a large octopus with his bare hands was Jack Meyers, a member of the Seattle Mudsharks club, who lost his temper at a big specimen that latched onto his five-dollar harpoon and would not release it.[34] "If all goes well the divers can tire an octopus in twenty minutes and pull it to the surface," where "the captive is a changed mollusk." The Scubaneers, a diving club whose members explored waters off Tacoma, turned over captured live octopus to the University of Washington Zoology department for research.[35] By 1965, Barada dismissed the octopus as "the most over-rated villain in the sea."[36]

From Vicious to Unpredictable

The trajectory of changing views of sharks did not match that of the octopus. A *Life* magazine advertisement for Ethyl Corporation's anti-knock gasoline shows that the late 19th century impression of sharks had not changed much by 1950. It has drawings of several sharks, each with a label and short description. "Tiger Shark: Don't go swimming with it." "Hammerhad Shark: It's one of the few sharks known to be dangerous to man." "Great White Shark: Maneater." And, finally, "Leopard Shark: One of well over a hundred species of sharks that are quite harmless."[37] Despite the reality of many innocuous species of sharks, the few perceived as dangerous riveted the attention of

divers. At the same time, at the start of recreational scuba diving, experienced divers found no cause for alarm. Cousteau dismissed worry about sharks, insisting, "sharks have proved no great peril," and proceeding to issue a reassuring description of shark repellent chemicals.[38] Hans Hass, a Viennese diver, underwater hunter and documentary film-maker who used military re-breather diving gear before the second World War, likewise insisted that sharks posed minimal danger if precautions were followed.[39] Although sharks, especially big ones, inspired fear in 1950, in fact few people had direct experience with them. Shark repellents, developed during World War II for downed pilots, suggested the viability of a technological solution.

As more scuba divers entered the sea, shark encounters mounted up, some reassuring, and others inspiring new worries. In the book Bridges wrote with Barada, page after page is filled with stories of narrow escapes from sharks.[40] Twice in 1957 *Life* magazine featured stories of dramatic experiences with sharks, the first, in August, when Clare Booth Luce, a former member of the US Congress who had also served as US ambassador to Italy, tried diving in Bermuda. Despite her "near encounter" with a shark, she emphasized her delight with the feeling of weightlessness.[41] Much more serious was the experience of Peter Gimbel, son and heir to the owner of the Gimbels department store chain who was an investment banker-turned-explorer. He and a friend dove on the wreck of the *S.S. Andrea Doria* only 28 hours after it sank in 1956 off Nantucket, Massachusetts, in over 200 feet of water, a depth that was well beyond what was recommended for amateur divers. That foray ended quickly due to a problem with the diving gear, but Gimbel made a return visit a year later that included an unnerving moment when a 10-12 foot shark "lashed by us once, his rhythm agitated and swift." The shark, "beautiful in his dreadful perfection," appeared when Gimbel and his diving partner had twenty minutes of decompression time left, just ten feet shy of the surface. The lengthy decompression was necessary because of the extreme depth of the wreck. After circling, the shark came in "straight and very slowly, as they often do on their initial strike," to a point just eighteen inches from Gimbel's belly. Although familiar with the theory of avoiding offensive behavior toward sharks, Gimbel "sense[d] strongly that the shark's aggressiveness had left us no choice." He drove his knife blade handle-deep into the animal's snout and waited "for a long, terrible moment" until it swam away. Rather than continuing the prescribed decompression stop, the two divers risked the bends and scrambled up and into the waiting vessel.[42]

Sharks were a common feature in the many movies and television shows with underwater scenes that were produced from the mid 1950s through the mid 60s. Some examples are: *20,000 Leagues Under the Sea* (the 1954 Walt Disney production); the Jane Russell film, *Underwater!*, whose executive produce was Howard Hughes, the eccentric industrialist billionaire whose interests ensured that the film was mainly about the new scuba technology…and Jane Russell in swimsuits; *Sea Hunt* (the TV series starring Lloyd Bridges which ran from 1958-61); *Assignment Underwater* (a similar, half-hour television show that ran for a short period in 1960); *Voyage to the Bottom of the Sea* (film, 1961); the James Bond thriller *Thunderball* (1965), and many others. In the science fiction undersea world of 1954 created by Frederik Pohl and Jack Williamson in *Undersea Quest*, sharks were so feared that the Cadet Eden's first nighttime training dive at the Sub-Sea Academy, the military academy to train officers for the Undersea Fleet, was scrubbed when sharks were sighted on the microsonar a quarter of a mile away.[43]

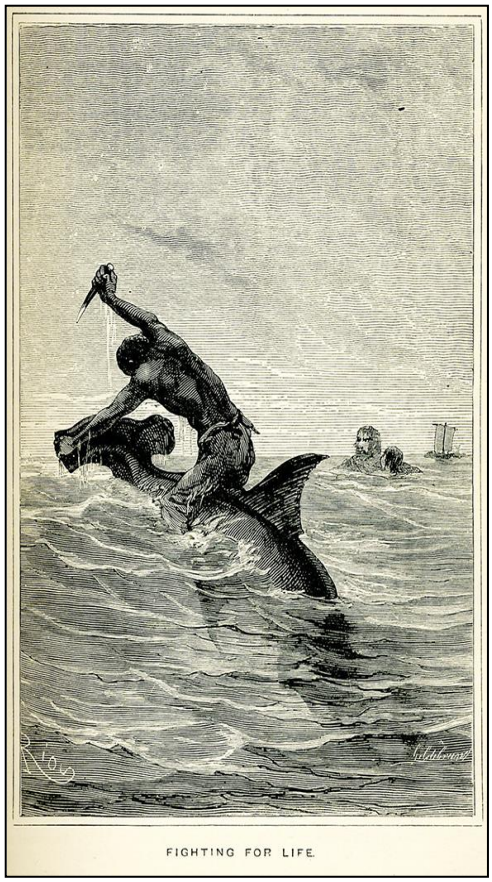

Figure 4. A struggle with a hammerhead shark from ***The South Sea Whaler*** (London: T. Nelson and Sons, 1882)

With relatively few serious shark attacks even as the numbers of divers spiked, the fear of sharks moderated. Experienced divers, however, retained a healthy respect for big sharks of certain species. Dr. Eugenie Clark, a skin diving ichthyologist who in 1955 founded what became Mote Marine Laboratory, on Florida's west coast, gained fame as a shark specialist. She had already written a popular book about her diving and scientific work before she published, *The Lady and the Sharks*. She admitted (perhaps with chagrin?) that she, personally, had no "good story" to tell about a close encounter with a shark. She, and a number of other authors of guide books and popular accounts of diving, compared the likelihood of being attacked by a shark to less than the chance of being hit by a car while out for a drive. However, she also vehemently dismissed the efficacy of any known shark repellent, including the various electrical devices then being tested, commenting, "an experienced skin diver will usually leave the water with as little commotion as possible if he sees a small six-foot white shark, tiger, or any so-called 'carcharhinid' shark coming too close."[44]

Bridges and Barada noted the failure of sharks to attack divers as often as their ferocious reputations would suggest. Their stories, though, reveal profound respect for the potential danger. In one instance, while hunting for fish for dinner during a film shoot, Bridges and his diving partner ended up treading water, back to back, while sharks that had just devoured their freshly-caught grouper "dart[ed] in close as if bluffing or intending to strike." Eventually the sharks moved away and left them a path to swim back to shore. Bridges summed up the film shoot this way: "All plans for hunting fish around the reef were abandoned. We ate beef the rest of the trip."[45] The danger, in Bridges' assessment, came from the unpredictability of the shark. "Some sharks do bite," he reminded his reader, "and it is impossible to tell which ones." He concluded candidly: "It doesn't pay to make a mistake."[46]

The danger posed by sharks attracted media attention as the popularity of scuba grew. In a July 1960 issue of *Life* magazine, with an inside front cover ad for AMC's Rambler sedan showing a car roomy enough to hold scuba gear, there appeared a lengthy article about sharks. The purpose was to provide "the facts that all swimmers should know," namely that sharks are dangerous, most especially to "an ordinary spear fisherman…the moment he draws blood." Reflecting the sentiments expressed by Clark, a scientist, and by expert divers such as Barada and Bridges, the article emphasized the unpredictability of sharks. "No method [of defense] is certain" against the "arcane ways" of circling sharks. Much more than the number of attacks – there were 11 authenticated

attacks in US waters during 1959 – the article emphasized the horror they inspired, making the danger seem so great.[47] Six years before the release of *Jaws*, a shark-themed movie starring Burt Reynolds was released. Originally titled *Shark*, the film *Caine* gained infamy because a stuntman was killed while filming a shark scene, not by the animal actor, a "docile bull shark that previously had been dragged onto a beach for a period to make it groggy," but by a large white shark that "punched through a protective net strung across the seaward side of the set."[48]

By the mid 1960s, despite continued respect for the real but remote danger posed by sharks, divers were cued to worry more about other things. "The danger of attack by marine animals is the least of a diver's worries…the possibility…is about equal to his chances of being struck by lightning," Barada reassured beginners.[49] Instead of worrying about such monsters as giant octopus, ferocious sharks, or even barracuda, moray eels, or any of a range of menacing marine life, training materials for divers emphasized the danger posed by fear, by the lack of proper preparation, and by human error.

Danger from Within

When Barada purchased his Aqualung, the instructions given were simple. "There is nothing to it. Just put it on and breathe. The lung does all the work, it's foolproof." Yet, in Barada's first foray he ran out of air faster than expected and barely made it back to his boat.[50] Sweeney, author of a 1955 how-to book on diving, was also self-taught. While he did recommend that readers seek instruction, he had no qualms about sending them underwater alone, stating, "if no such person is available, then you must make your first dive by yourself."[51] Soon after this time, with the development of formal training programs and common procedures such as the buddy system, this recommendation would become unthinkable.[52]

Before diving was perceived to be open to all comers, there was a brief period when practitioners and promoters assumed that divers would be adult men capable of great physical feats, reflecting the image of military frogmen.[53] A 1962 book on water sports, written by a well-published travel and recreation writer, Arthur Liebers, presented the "grim side" to diving, warning that, "the untrained and the physically unfit who participate are risking injury and even death." He singled out children as especially vulnerable, lamenting that, "toy counters carry skin-diving equipment in sizes to fit the smallest child." He pointed out that the Boy Scouts had adopted a policy never to use scuba equipment except in an emergency, and insisted that experts agreed that "only persons eighteen years of age or over should be encouraged to go into scuba diving." The YMCA training program, begun just three years earlier, was limited to those aged 17 and older, and required not only a medical exam and a swim test, but also a physical fitness test "which may require preliminary practice and conditioning."[54] Sweeney, who also trained as a frogman, warned in his chapter titled, "It's Not All Fun," of the need to maintain physical coordination and stamina by diving regularly, suggesting volunteer search and rescue as a means to do so.[55]

Although the photographs in Liebers' book, and most other diving guides, feature a man teaching a woman to use scuba gear, the activities anticipated for those who went underwater were, in the early years of scuba, more work- than play-oriented, and were mainly the kind of work normally undertaken by men. "Scuba diving is one form of water sport that has commercial possibilities," the author intoned, listing as examples

propeller and ship bottom inspections, recovery of equipment lost under water, work with oyster and clam fishermen, spearfishing, underwater photography, salvage and wreck exploration, and specimen collection for marine biology.[56] "Skin divers will become more and more necessary in the research and development of the sea's resources," remarked the Carriers in their 1955 book.[57] Former British frogmen who wrote a popular book about the growth of their field mentioned several examples of former colleagues who had started free-diving commercial ventures to compete with conventional helmet diver companies.[58] Barada explained that scuba equipment "has opened a whole new concept of underwater work and exploration which, someday, may have a profound impact on civilization."[59]

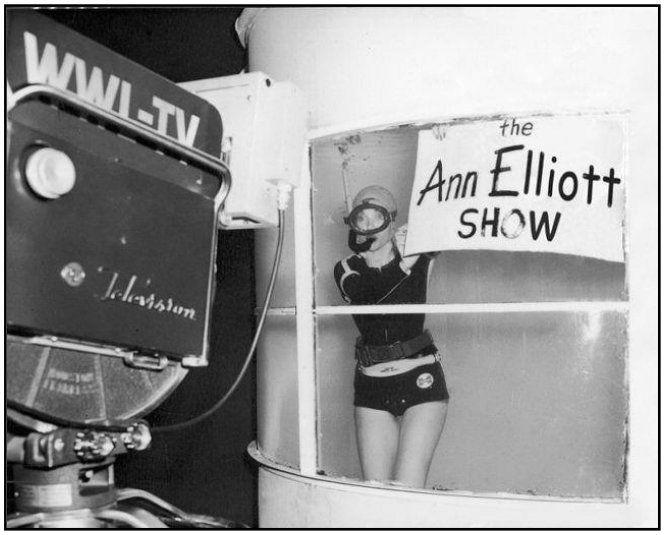

Figure 5. A publicity picture of the late Ann Bodenhamer Elliott, by Richard CBB Elliott from Wikimedia Commons, showing her getting her scuba certification on her TV show in the early 1960's.

While earlier sources portrayed scuba as a strenuous activity, by the 1960s similar types of sources conveyed a different impression. Barada dubbed the new world below "the playground of the skin diver."[60] While his diving manual listed applications for scuba technology "for the serious diver" which included "entire new industries," "new professions," and new fields of science and engineering, he devoted many more pages to the recreational diver, enumerating the possibilities for shell collecting, wreck diving and underwater hunting, among other activities. Most of all he wanted his readers to understand that underwater exploration was safe "for the whole family."[61] The pages of his manual, and similar books, are filled with photographs of men, women and children, alone, in pairs and in groups, both in or under the water, or out of the water surrounded by piles of scuba gear lined up neatly on the beach. "'Aqua-Lung' diving offers fun, relaxation and adventure for the whole family," Barada declared. Divers, he continued, "pity the timid land bound soul who still believes the underwater world to be a gloomy, mysterious region inhabited by terrible sea monsters and housing frightful dangers." Instead, "the diving fraternity" has discovered the undersea realm to be a place of unparalleled beauty, "inhabited by friendly creatures," whose "dangers are no greater than the daily existence in the surface world of modern civilization."[62] This new view of the undersea world emerged from the experiences of divers like Barada and his generation, who became boosters for this new territory, urging anyone and everyone to enter and explore it.

The ocean was clearly an alien environment for the human body, but many early diver-commentators remarked on how easily people took to the under water realm, surmising that the evolutionary origins of life might explain our so-called "return to the

sea." As Bridges put it, "Scientists tell us that all life originated in the sea and, in some ancient ocean... Perhaps this accounts for our quick adaptation to the fluid world."[63] Sweeney similarly reminds his diver-readers, "In your underwater explorations, you are returning to the atmosphere in which life began millions of years ago."[64] The Carriers mused that "man" has been drawn to the sea, "in which he had his beginnings and whose mineral content is still reflected in the composition of his blood."[65] Such sentiments were also articulated by well-known figures including Cousteau, Hans Hass, and Arthur C. Clarke.[66] This evolutionary perspective encompassed technology, which was often treated as an extension of the human body. As Sweeney put it, "Instead of being a man or woman inside your equipment, you make your equipment a part of you."[67]

This impulse to naturalize the act of putting the human body underwater contrasted with a simultaneous insistence on the novelty of being there. Early divers reveled in the exhilarating sensations offered by experience underwater. "We feel a sense of freedom impossible to describe," enthused Bridges, who added, "Probably the greatest attraction is the sense of well-being."[68] In 1953, Herb Pfister, author of a *Popular Science Magazine* article about how to build a diving rig at home, touted the new sport as offering, "a brand-new sensation, a feeling of really being out of this world."[69] While this wording appears to invoke outer space, more frequently analogies from sources in the early 1950s compared diving to swimming like a fish or flying like a bird.[70] Gustav Dalla Valle, an Italian *bon vivant*, a spearfisherman and diver who immigrated to the United States in 1957 and embarked on a series of business ventures importing diving equipment, published an illustrated scuba guide manual which celebrated, "the joy of a new and unique sensation" in the underwater world.[71] Emphasizing "this new degree of freedom and mobility in a strange, beautiful and largely unexplored world," the Carriers noted that underwater experience "has had an intense psychological effect" on sensitive divers.[72] In this and many other descriptions of underwater novelty, physical and mental experiences were inextricable, as when Barada explained, "The fascination of skin diving stems not only from the excitement and adventure to be found beneath the sea's surface, but from a feeling of release and freedom which comes from submergence. It is an exhilarating sensation."[73]

Figure 6. July 1953 cover of ***Popular Science*** encouraging the home enthusiast to make their own air tanks.

In this new and exciting domain, the danger associated with diving was more frequently blamed on human error than on sea life. Sweeney, the former frogman, compared diving to crocodile hunting, cave exploration and mountaineering, declaring that like these, "the diver dies usually through his own carelessness or negligence."[74] Barada, though he emphasized the safety of diving for people

of all ages, reminded prospective divers, "man is out of his natural element when underwater."[75] Diving manuals described the common dangers to divers, usually as part of a discussion of the importance of proper training. Some common accidents included air embolism, caused by excess air pressure in the lungs when a diver ascends too rapidly or too far while holding her or his breath; spontaneous pneumothorax, caused by air trapped in the chest cavity outside the lung; overexpansion of the stomach or intestinal organs, caused or exacerbated by eating or drinking inappropriate things before diving; and, finally, drowning.[76] There were also physiological problems brought on by diving, such as the bends, carbon dioxide poisoning, and the toxic effects of pure oxygen under pressure, but none riveted attention as much as the so-called "rapture of the deep," or nitrogen narcosis.[77]

Nitrogen narcosis represented the most fascinating of the undersea dangers in the 1950s. It attracted at least a passing mention in virtually every book or manual about diving and it featured prominently in the plots of undersea fiction and films. Defined by one manual as, "a euphoria in which the instinct for self-preservation disappears," the condition was frequently compared with alcoholic intoxication.[78] The danger was greater in deeper water, as Bridges explained.

> "Sometimes, in deep water, we feel a dangerous intoxication caused from breathing air under great pressure. In this state we occasionally feel an irresistible urge to descend deeper and deeper into areas where no man has been before. Thus enraptured, some divers have succumbed to the fascination of the depths and continued down, never to be seen again."[79]

By the late 1950s, it was understood that depths below 100 feet were associated with the onset of rapture of the deep.[80]

In fiction, of course, heroes who battle nitrogen narcosis must survive, but the plot relies on the physical and mental tests provided by the nitrogen in their systems. Symptoms began with feelings of light-headedness or numbness. Reasoning and dexterity were impaired, and emotional instability and irrationality followed. In fiction as in reality, the trick was for the diver experiencing the symptoms to recognize them and return to a safe depth, at which point they would disappear. If not, stupor, blindness and even blackout could occur. One of the many dramatic moments in Arthur C. Clarke's 1959 novel, *The Deep Range*, found the main character, Walter Franklin, traveling to the deep sea bottom at 1100 feet, wearing experimental diving gear and holding onto the outside rail of a small submarine in order to place explosive charges to blow a collapsed derrick away from a big submarine, full of VIPs, that had become pinned to the ocean floor. Fighting lethargy and disorientation, and annoyed by the mini-sub commander's voice in his facemask speaker, Franklin tried to throw the mask away but was thwarted when its straps proved too strong. With the vague thought of halting the increasingly strident yet detailed instructions echoing in his head, he sluggishly obeyed the commands, finally emerging from the tangled wreckage to be snatched by the sub's manipulator arm and moved far enough away to survive the explosion that successfully freed the trapped sub.[81]

Cultural fascination with rapture of the deep was fanned by the belief that different people responded differently to its effects. The second in a series of science

fiction stories about a future in which people routinely lived and worked undersea, *Undersea Fleet* by Pohl and Williamson, published in 1956, follows the training of Cadet Jim Eden at the Sub-Sea Academy to the qualifying dives, which would "separate the real sea cows from the jellyfish."[82] With each round of dives at deeper depths, some cadets failed and others passed but were disqualified from taking the next depth test, until only eleven took the 700-foot dive, five started the 900-foot dive, and three, including Eden, tried the 1100-foot dive. Although he completed that test, Eden did not continue alongside the final two cadets who attempted the record-breaking 1300-foot dive.[83]

In the real world, too, some people appeared less susceptible to the rapture of the deep. Eugenie Clark, who managed to avoid any close calls with sharks, experienced a frightening episode of narcosis diving in a cold spring in Florida. She recalled holding onto a guide rope at 200 feet, looking down at the muddy bottom at her diving companion, Bill Royal, an Air Force veteran who had learned to dive in the Pacific during World War II, who was searching for evidence of prehistoric human habitation. She had the sensation of fresh air coming in that was loaded with oxygen, then saw Bill's hand sticking up from the mud and concluded he was dead. She was filled with "a rather calm sweet sadness" then imagined she was having a baby (she had had four) and wanted to go to sleep. Finally she realized that she could not be having a baby because she was diving, and she tried hard to concentrate until "the words 'nitrogen narcosis' came into my mind." Aware that divers in such a state sometimes remove their mouthpieces, she clamped her hand over hers as she moved up the rope until she could think clearly again. Bill followed her up, entirely unaffected. He had travelled to depths of over 200 feet many times and apparently never experienced narcosis.[84]

There was an assumption that overcoming narcosis depended as much on mental toughness as on physical ability. Cadet Eden described his successful dive at 700 as an exertion of willpower over bodily weakness:

> "I felt ancient, weary, exhausted, without knowing why. I was drained of energy. Every stroke of the flippers on my feet, every movement of my arms, seemed to take all the strength in my body. Each time I completed a stroke it seemed utterly impossible that I would find the energy and strength necessary for another. It would be so much easier to let myself drift… But somehow I found the strength."[85]

Dive manuals shared the belief that an individual's psychology mattered. Citing the experience of Cousteau and the U.S. navy, the Carriers' 1955 book *Dive* explained that, "stable phlegmatic personalities tend to react to the phenomenon [increased pressure at depths] by increased vigor and effort which may result in eventual loss of consciousness, while less stable or more nervous and imaginative intellectuals experience vivid attacks on all senses and are incapable of purposeful effort throughout the dive."[86] Liebers' 1962 manual asserted the possibility of a diver controlling his or her response: "the diver may lessen the effect of possible nitrogen narcosis by exerting strong will power and self-control by slowing down his activity."[87] The third episode of *Sea Hunt* chronicled Mike Nelson's search for divers able to recognize the onset of rapture of the deep and thus to qualify for an experimental effort to mine beryllium (used in the aerospace industry) in a 170-foot deep trench off Madagascar. The final pair of divers

tested included a man who began behaving erratically, ignored orders to ascend, then attacked his diving partner, apparently thinking he was a giant squid. Despite the near disaster, both Nelson and the diving partner waved off the enraptured diver's post-decompression apology. Nelson declared, "Forget it. We both know how 170 feet of sea water can knock a guy off base."[88] Though no apology was needed, the diver who succumbed to narcosis failed to qualify for the job.

The attention to narcosis reflected an inward turn in the analysis of the danger associated with scuba diving. Rather than menacing wildlife, the greatest danger, experts agreed, were divers themselves. As Sweeney put it bluntly, "man himself is his worst enemy."[89] The danger derived not from mistakes or negligence alone but from human error in the context of the unforgiving undersea environment. As Barada explained, a diver "must learn a new set of nature's rules and laws… The greatest danger to skin divers is ignorance of these rules."[90] The Carriers criticized diving promoters who conveyed the impression that scuba gear was free from danger and training unnecessary, declaring, "It would be just as ridiculous to say that anyone can fly an airplane, steer a battleship, or play a good game of golf without special training."[91] Formal dive training for the public began in 1954 in California when Los Angeles County began its education program based on a scientific diver course developed at Scripps Institution of Oceanography. A formal instructor certification program followed and the Los Angeles course became the template for courses worldwide.[92]

The emphasis on human error emerged hand-in-hand with an insistence that proper training was essential for beginning divers. Training served to inoculate divers against fear as much as it prevented mistakes. The first time that Walter Franklin, the main character of Clarke's novel *The Deep Range* went undersea by himself, he recognized that he was "totally surrounded by the element which would be his new domain." He reflected that the water could support him, or might kill him in minutes. However, as Clarke explained, "That knowledge did not disturb him; it had little weight against the increasing confidence and the sense of mastery he was acquiring day by day."[93] By the mid to late 1960s, the undersea realm was considered safe, even inviting, for amateurs as well as experts, for children as well as adults, as long as inductees to this new world had undergone appropriate instruction in the use of diving technology and education about the undersea environment and its inhabitants.

Cultural Histories of the Ocean

In the 1950s and early 1960s, the undersea world changed from a danger zone to an appealing realm of wonder and mystery that even novice divers could safely explore. This dramatic transformation was a product of access to the undersea afforded by self-contained breathing apparatus. However, the result was not simply a product of technology, nor the inevitable outcome of human experience underwater. Instead, technology and the capabilities it enabled intersected with the preconceptions, hopes and desires of divers who emerged from the depths with a new understanding of the ocean. These people included experts who created new scientific knowledge about the ocean, but they also included hunters, film-makers, technology enthusiasts, and adventure-seekers who were amateurs, novices, and even children. They included, for the first time, people who went under water for recreation, not primarily for work, although this new accessibility of the undersea realm also spurred new industries, including underwater

Figure 7. Publicity picture from the ABC television series ***Voyage to the Bottom of the Sea*** from 1968. Source: Wikimedia.

filming, the manufacture and sales of dive equipment, and the delivery of diver training and other recreational diving support and tourism services. The pioneers of these novel enterprises exerted an outsized effect on cultural perceptions of the undersea world. Their books, manuals, advertisements, films and television programs cued the next generation of divers about what to expect and how to feel under water. Their cultural products also made non-divers feel as though they knew the undersea realm from their armchairs or movie theater seats.

The inviting under-water world explored by divers in the 1950s reminds us that the characterization of the ocean – either as remote, extreme and inaccessible, or as an inviting and fun zone for novice explorers of all ages – is cultural rather than absolute. When octopus was believed to be capable of holding a strong, fit diver underwater until his air ran out, and when sharks were perceived as vicious predators of human flesh, the underwater realm appeared very different than it did after a handful of years of recreational access. Expectations about what dangers or delights a diver might encounter and assumptions about what kinds of activities could be conducted under water influenced who chose to dive and what they did in the sea.

Technology enabled people to breathe underwater but failed to keep human bodies safe from sharks. The development of wetsuits allowed people to dive in cold water and remain in the sea for long periods of time. Yet diving gear itself also posed dangers, such as when users held their breath while ascending and suffered from air embolism. Whereas the first generation of diving boosters assumed the technology would make humans a seamless and natural part of the marine environment, the need for training to use this equipment at various depths soon became apparent. Instruction addressed the manipulation of gear but equally included the mandate to learn about marine life and the ocean environment.[94] It also involved consideration of psychology to seek to understand common mistakes that could prove fatal, such as poor decisions made under the influence of nitrogen narcosis. In the end, as most historians of technology well know, it is impossible to separate diving technology and consider it apart from the people who used it. Conversely, it is equally inadvisable to write the history of the ocean environment apart from the technology that provided access to it.

This study focused on that part of the ocean environment accessible to human bodies through early, mass-produced scuba technology. Different histories could, and should, be written about other ocean spaces, and Philip Steinberg's work demonstrates

the rich yield of trying to do so.[95] The undersea relevant to submarines during and after World War II, though it overlaps with the actual ocean space and time period discussed here, has a very distinct cultural history rooted in Cold War ideology.[96] Similarly, a parallel history remains to be written of the ocean's depths in the 1950s and 1960s as sites of fantastic potential wealth and industrial production. That story is visible in the early expectation that diving technology would mainly enable work access to the ocean; one thread, the achievement of deep-sea oil extraction, extends to the present-day. A third example from this same time frame, represented in the excellent work of Carmel Finley and Kurkpatrick Dorsey, reveals the ocean and its living resources as a critical arena for international diplomacy.[97] Even for a single time period, then, it is possible to chronicle different cultural histories of different, or overlapping, ocean spaces.

Cultural history of the ocean adds a promising new dimension to existing historical attention to technology, resource extraction, politics, international relations, the creation of scientific knowledge, and other categories that have been important in maritime or ocean-related history. Alongside expert scientific knowledge or experience derived from work on or in the sea, understanding of the ocean has been influenced by imagination. Divers' motives and their experiences underwater were shaped by friends' stories, media coverage, and cultural representations of the undersea realm. Despite the safety record of recreational diving, and contrary to the assurances of dozens of popular books and manuals, the plots of movies, television shows and novels revolved around life-threatening dangers undersea. Despite actual hazards, the underwater realm was frequently described as playground or wonderland. Neither characterization, of course, was exclusively true. Instead, when divers gazed into the ocean, they saw, and probably continue to see, in part a reflection of their imagination.

NOTES

[1] Kären Wigen, ed., "AHR Forum: Oceans of History: Introduction," *American Historical Review* Vol. 111, no. 3 (June 2006): 717-780; see especially 721.
[2] Callum Roberts, *The Unnatural History of the Sea* (Shearwater, 2008); For information on HMAP, see http://www.coml.org/projects/history-marine-animal-populations-hmap.
[3] Jon M. Erlandson, "The Archaeology of Aquatic Adaptations: Paradigms for a New Millenium," *Journal of Archaeological Research* 9(4)(2001): 287-350.
[4] Barry Cunliffe, *Facing the Ocean: The Atlantic and its Peoples* (Oxford University Press, 2001). John R. Gillis, *The Human Shore: Seacoasts in History* (University of Chicago Press, 2012).
[5] This paper relies on geographic concept of ocean space; see Philip E. Steinberg, *The Social Construction of the Ocean* (Cambridge: Cambridge UP, 2001).
[6] Steve Pyne, ed., " Extreme Environments: An Interdisciplinary Forum," *Environmental History* 15(3)(2010): 508-532.
[7] Helen M. Rozwadowski, "Ocean's Depths," in "Extreme Environments," ed. by Pyne, 520-525.

[8] Guy Gilpatric, *The Compleat Goggler - Being the First and Only Exhaustive Treatise on the Art of Goggle Fishing - That Noble and Excellent Sport Perfected and Popularised by Guy Gilpatric in the Mediterranean Sea - Though Long Practiced Elsewhere by Other Benighted Savages; Setting Forth the Proper manner of Making the Goggles, Spears and Other Needful Gadgets Together with Descriptions of Many Marvels Witnessed Upon the Bottom of the Sea And Fully Exposing the Author's Cunning Methods of Swimming, Diving & Spearing Fish and Octopi* (New York: Dodd, Mead and Company, 1938). Rick and Barbara Carrier, *Dive* (New York: Wilfred Funk, Inc.: 1955), quote on p. 2; see also Appendix B, "The Diving Clubs," 282-284 (reprinted from *Skin Diver* magazine). Other countries with one to three diving clubs on this list include: Brazil, Mexico, and Japan. Early books by diving pioneer-popularizers include: Hans Hass, *Diving to Adventure* (1951); and Jacques-Yves Cousteau, Frédéric Dumas, and James Dugan, *Silent World* (1952).

[9] J. H. Parry, *The Discovery of the Sea* (New York, Dial Press, 1974).

[10] Jonathan Raban, ed. *Oxford Book of the Sea* (Oxford [England]; New York: Oxford University Press, 1992), 3.

[11] See for example, "the vast and furious ocean," from William Bradford, *Of Plymouth Plantation, 1620-1647: The Complete Text*, ed. Samuel Eliot Morison (New York: Alfred A. Knopf, 1952), 59-61; "Greater violence we could not apprehend in our imaginations. Winds and seas were as mad as fury could make them," from William Strachey, Esq., "A True Reportory of the Wracke, and Redemption of Sir Thomas Gates, Knight, . . . in *Hakluytus Posthumus, or Purchas his Pilgrimes, . . .* by Samuel Purchas, vol. 4 (London: William Stansby, 1625) and quoted in Jason Smith, "'Controlling the Great Common': Hydrography, the U.S. Navy, and the Sea in the Nineteenth Century (Ph.D., Temple University, 2012); and "men which all their life time had occupied the sea, never saw more outragious [sic] Seas," from Raban ed., *Oxford Book of the Sea*, 50, 53.

[12] Milanese ambassador to England, 1497, quoted in Roberts, *Unnatural History of the Sea*, 33.

[13] Peter Martyr, recalling Sebastian Cabot's description, 1516, and quote in paper text is from Pierre de Charevoix, 1719, both quoted in Roberts, *Unnatural History of the Sea*, 33.

[14] Roberts, *Unnatural History of the Sea*, 73.

[15] Helen M. Rozwadowski, *Fathoming the Ocean: The Discovery and Exploration of the Deep Sea* (Cambridge, MA: Harvard University Press, 2005).

[16] Jules Verne, *20,000 Leagues Under the Sea* (1870).

[17] J. W. van Dervoort, *The Water World: A Popular Treatise* (New York: Union Publishing House, 1883), 154, 155.

[18] Gilpatric, *Compleat Goggler*. William Beebe, *Half Mile Down* (New York: Harcourt, Brace and Company, 1934). T. J. Waldron and James Gleeson, *The Frogmen: The Story of Wartime Underwater Operators* (London: Evans Brothers Limited, 1950). Trevor Norton, *Stars Beneath the Sea: The Extraordinary Lives of the Pioneers of Diving*, (London: Arrow, 2000), 176-197.

[19] Carrier, *Dive*, 150. Bill Barada, *Underwater Adventure* (Los Angeles, CA: Trend Books, Inc., 1959), 44-47.

[20] Carrier, *Dive*, 2, 220.

[21] Carrier, *Dive*, Appendix B, "The Diving Clubs," 282-284.
[22] Bill Barada, *Let's Go Diving: Illustrated Diving Manual* (Santa Ana, CA: U.S. Divers Co., 1965), 11-14; quote on 4-5. These countries were foundering members of the CMS: US, West Germany, Belgium, Brazil, Spain, France, Great Britain, Greece, Malta, Holland, Italy, Monaco, Poland, Portgual, Austria, Morocco, Finland and Russia.
[23] Barada, *Let's Go Diving*, 7.
[24] Lloyd Bridges, with Bill Barada, *Mask and Flippers: The Story of Skin Diving* (Philadelphia and New York: Chilton Company Publishers, 1960), 118.
[25] Barada, *Underwater Adventure*, 5.
[26] Bridges, *Mask and Flippers*, 63. Eric Hanauer, *Diving Pioneers: An Oral History of Diving in America* (Aquaquest Publications, 1999), 12.
[27] John Sweeney, *The How-To Book of Skin Diving and Exploring Underwater* (New York: McGraw-Hill Book Company, Inc., 1955), 3-23.
[28] Carrier, *Dive*, 31.
[29] Bridges, *Mask and Flippers*, 110.
[30] R. E. Coker, *This Great and Wide Sea: An Introduction to Oceanography and Marine Biology* (New York: Harper & Row, 1947, 1949, 1954; first Harper Torchbook 1962).
[31] Bridges, *Mask and Flippers*, 117.
[32] "Underwater Wonders," *Life* 29(November 27, 1950)(no. 22): 119-125.
[33] Arthur C. Clarke, *The Challenge of the Sea*, with Introduction by Wernher von Braun (New York: Mayflower Book/Dell, 1960), 132.
[34] Barada, *Underwater Adventure*, 18-21.
[35] Quotes are from: "A Wrestling Match with an Octopus," *Life* 51(September 29, 1961)(no. 13): 68-69. Bridges, *Mask and Flippers*, 116-117.
[36] Barada, *Let's Go Diving*, 57.
[37] Ethyl Corporation advertisement, *Life* 28(April 17, 1950)(No. 16): 1. Bromine extracted from seawater was used in making anti-knock compounds, which likely explains why the Ethyl Corporation employed ocean-themed advertisements in this period. Carrier, *Dive*, 62.
[38] Underwater Wonders," *Life* 29(November 27, 1950)(no. 22): 122-123.
[39] Hans Hass, *Men and Sharks*, translated by Barrows Mussey Hass (Doubleday, 1954).
[40] Bridges, *Mask and Flippers*, 111-116.
[41] "A Versatile Lady's New Adventure," *Life* 43(August 5, 1957)(No. 6): 68.
[42] "An Epic Sea Rescue," *Life* 41(August 6, 1956)(No. 6), 18-30. "Camera in a Sea Tomb," *Life* 41(August 13, 1956)(No. 7): 12-13. "Down to the 'Doria' Again," *Life* 43(October 28, 1957)(No. 18): 66-67, 69-70, 75. A 1962 chart labeled diving to depths between 130 and 200 feet as "Risky" or "Very Risky" (for durations of less than 15 minutes). Arthur Liebers, *The Complete Book of Water Sports* (New York: Coward-McCann, Inc., 1962), 105. Kevin F. McMurray, *Deep Descent: Adventure and Death Diving the Andrea Doria* (Atria Books, 2002).
[43] Frederik Pohl and Jack Williamson, "Undersea Quest," in *Undersea Trilogy* (Riverdale, NY: Baen Books, 1992, first published in 1954), 27.
[44] Eugenie Clark, *The Lady and The Sharks* (Sarasota, FL: Mote Marine Laboratory, 1969), 107-118; quotes on 115 and 113. The previous book was Clark, *Lady with a Spear* (New York: Harper & Brothers, 1951). Authors who employed the car accident

comparison included: Clark, *Lady and the Sharks*, 109; Bridges, *Mask and Flippers*, 5; Carrier, *Dive*, 91; and Sweeney, *How-To Book of Skin Diving*, 132. Barada, *Let's Go Diving*, 54, compared the likelihood of shark attack to a lightening strike.

[45] Bridges, *Mask and Flippers*, 114-115.

[46] Bridges, *Mask and Flippers*, 116.

[47] "Look Out for Sharks," *Life* 49(July 11, 1960)(No. 2): 58-67, 69-70, 72.

[48] "Shark Kills A Man," *Life* 64(June 7, 1968)(No. 23): 86-87.

[49] Barada, *Let's Go Diving*, 54 (quote). Sweeney, *How-To Book of Skin Diving*, 124.

[50] Bridges, *Mask and Flippers*, 63.

[51] Sweeney, *How-To Book of Skin Diving*, 100.

[52] Hanauer, *Diving Pioneers*, 216-253.

[53] Waldron and Gleeson, *Frogmen*.

[54] Liebers, *Complete Book of Water Sports*, 55, 65-67.

[55] Sweeney, *How-To Book of Skin Diving*, 43.

[56] Liebers, *Complete Book of Water Sports*, 73. See also Bridges, *Mask and Flippers*, 173.

[57] Carrier, *Dive*, 63.

[58] Waldron and Gleeson, *Frogmen*, 190-191.

[59] Barada, *Underwater Adventure*, 11.

[60] Barada, *Underwater Adventure*, 4.

[61] Barada, *Let's Go Diving*, 5-7.

[62] Barada, *Let's Go Diving*, 7.

[63] Bridges, *Mask and Flippers*, 5.

[64] Sweeney, *How-To Book of Skin Diving*, 53

[65] Carrier, *Dive*, 17.

[66] Hans Hass, *Wir Kommen aus dem Meer* (Ullstein, 1957); and Hass, *We Come from the Sea*, Trans. by Alan Houghton Brodrick (Jarrolds, 1958). Helen M. Rozwadowski, "Arthur C. Clarke and the Limitations of the Ocean as a Frontier," *Environmental History*, 17 (3)(2012): 578-602.

[67] Sweeney, *How-To Book of Skin Diving*, 43. A comprehensive history of wetsuit development remains to be written. Wetsuits played, arguably, as important a role as scuba gear because they enabled human activity underwater for longer than very brief periods of time and opened up cold waters to scuba diving. See Carolyn Rainey, "Wet Suit Pursuit: Hugh Bradner's Development of the First Wet Suit," (La Jolla, CA: UCSD Libraries, 1998). http://scilib.ucsd.edu/sio/hist/rainey_wet_suit_pursuit.pdf.

[68] Bridges, *Mask and Flippers*, 3-4.

[69] Herb Pfister, in *Popular Science Magazine* (July 1953). Hanauer, *Diving Pioneers*, 12-13.

[70] See, for example, Carrier, *Dive*, 10, 14, and Barada, *Let's Go Diving*, 9.

[71] Ellipses in the original. Valle, et. al., *Skin and Scuba Diving*, 22.

[72] Carrier, *Dive*, 14.

[73] Barada, *Underwater Adventure*, 4.

[74] Sweeney, *How-To Book of Skin Diving*, 124.

[75] Barada, *Let's Go Diving*, 5-7.

[76] Carrier, *Dive*, cartoon on p. 80 and discussion of the accidents on pp. 86-89.

[77] Carrier, *Dive*, 73-84.
[78] Carrier, *Dive*, 77. See also Barada, *Let's Go Diving*, 47; Bridges, *Mask and Flippers*, 4; Sweeney, *How-To Book of Skin Diving*, 76.
[79] Bridges, *Mask and Flippers*, 4.
[80] Liebers, *Complete Book of Water Sports*, 76. Carrier, *Dive*, 79.
[81] Arthur C. Clarke, *The Ghost from the Grand Banks*; and *The Deep Range* (New York: Aspect/Warner Books, 2001), 465-482; quote from 482.
[82] Pohl and Williamson, "Undersea Fleet," in *Undersea Trilogy* (first published in 1956), 168
[83] Pohl and Williamson, "Undersea Fleet," 182-192.
[84] Clark, *Lady and the Sharks*, 158-166.
[85] Pohl and Williamson, "Undersea Fleet," 183. Ellipsis in the original.
[86] Carrier, *Dive*, 77.
[87] Liebers, *Complete Book of Water Sports*, 75.
[88] "The Rapture of the Deep," *Sea Hunt*, Episode #3.
[89] Sweeney, *How-To Book of Skin Diving*, 32.
[90] Barada, *Let's Go Diving*, 7.
[91] Carrier, *Dive*, 150.
[92] Zale Parry and Albert Tillman, *Scuba America: The Human History of Sport Diving* (Olga, Wash.: Whalestooth Pub., 2001). E.R. Cross, *Underwater Safety* (Los Angeles, Healthways, 1956) represented an important milestone in the development of formal training programs.
[93] Clarke, *The Ghost from the Grand Banks*; and *The Deep Range* (New York: Aspect/Warner Books, 2001), 289.
[94] Robert B. Leamer, Wilfred H. Shaw, and Charles F. Ulrich, *Bottoms Up Cookery* (Gardena, Calif.: Mastergraphix, 1970).
[95] Steinberg, *Social Construction of the Ocean*.
[96] *Naomi Oreskes, Science on a Mission: American Oceanography in the Cold War and Beyond* (University of Chicago Press, forthcoming).
[97] Carmel Finlay, *All the Fish in the Sea: Maximum Sustainable Yield and the Failure of Fisheries Management* (University of Chicago Press, 2011); and Kurkpatrick Dorsey, *Whales and Nations: Environmental Diplomacy on the High Seas* (University of Washington Press, forthcoming in 2014). See also Dorsey, "Putting a Ceiling on Sealing: Conservation and Cooperation in the International Arena, 1909-1911," *Environmental Review* 15(3)(1991): 27-46.