The Significance of Sharks in Human Psychology

Jon Magnuson, M.Div., M.S.W.
4525 19th Street
Seattle, WA 98199

Abstract: This paper examines the history of the shark as a mythological and religious creature, tracing legends and rituals that have included projections of the shark in the course of human history. A clinical investigation of the terror and fear associated with the portrayal of sharks in current media and popular literature, along with selected reflections on the shark as a particularly unique, symbolic carrier of repressed human emotion is addressed.

Introduction

> When a man sought to know how he should live, he went into solitude and cried until in vision some animal brought wisdom to him. It was the Holy One, in truth, who sent his message through the animal. He never spoke to man himself, but gave his command to beast or bird, and this one came to some chosen man and taught him holy things. These were the sacred things given to us through the animals. So it was in the beginning.....
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> Letakots-Lesa, a Pawnee Indian in a conversation with Natalie Curtis, an anthropologist, in 1907 (Campbell, 1983)

In 1971 I met my first shark. It was early January. I was three months away from being married and had hitchhiked with my younger brother down through Mexico over the New Year's break. Early one sun-filled morning we took a rickety Mexican bus north from Acapulco with plans to spend a leisurely afternoon at an isolated but well-known beach about 45 minutes north of the city. After a few hours swimming in the surf, I was laying on the beach, casually sipping a bottle of Mexican beer, when I heard a sudden burst of shouting, all, of course, in Spanish. Sitting up, I quickly became aware that everyone was out of the water except for my 14-year-old brother who now was swimming about 25 yards off shore. I saw the crowd shouting and pointing,

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1 The author is currently a psychotherapist in private practice and Lutheran campus pastor at the University of Washington, Seattle. He holds a special interest in the area of psychology and religion, and has served on the teaching faculty of the Honors College at Oregon State University.

trying to catch his attention. At first baffled and puzzled, I recognized for a split second the outline of a fin cutting through the water, then, again, and again, making a wide circle around him. Heart pounding, stomach queasy with panic, I yelled a warning in English and moments later he was on shore, safe but shaken. Later during that ten-day trip we were robbed by thieves and became sick with dysentery, but nothing will ever compare to, or match, the pure terror of those moments for me on the Mexican coastal beach. The memory, as one might imagine, has been told and retold at family gatherings. Only last summer he and I shared the story with a dinner table of wide-eyed teenage cousins in Michigan. Each time, of course, the shark becomes a little larger, the dorsal fin closer, the danger more intense. But such are what legends are made of.

It is July, 1985, late afternoon on rough seas 30 miles off the Oregon coast on a 52-foot charter boat and I watch a white-haired retired school teacher land a thrashing blue shark just south of Nelson Island. Sid Cook, coordinator of this Sea Grant conference and professional guide for the trip, will remember my words as I watched, mesmerized by that creature's clean white underbelly, glistening, alive, fighting, being lifted up into the boat against a setting western sun. Amidst the shouts of triumph and glee by the crew in response to a successful hunt, I am overwhelmed, almost embarrassed, with awe at the shark's raw, wild beauty. I whisper to myself quietly, repeatedly, "Beautiful...beautiful...."

These two quite different encounters and experiences provide a framework for this brief, playful, but hopefully insightful examination of the history of the shark as a psychological, mythological, and religious creature. Tracing the development and profusion of legends and rituals that have involved these creatures during the course of human history, the following considerations seek to integrate certain clinical observations regarding the high degree of terror and fear that dominates portrayals of the shark in current media and popular literature. This study also highlights selected reflections on the unique role that the shark appears to have carried for repressed, exaggerated emotions, both historically, but even more critically, currently, in contemporary Western society.

The Shark in Legend and Ritual

The shark has long held a fascinating place in the story of human beings and their relationships to creatures of the sea. These predators of the deep have been regarded down through human history as vengeful gods, to others as guardian spirits, to still others, cunning devils. Legends, Pacific island tribal rituals, and religious rites appear to reflect a bi-polar (good-evil) understanding of the shark's power and presence.

In the Solomon Islands, deified sharks lived in sacred caverns built with stone altars in lagoons. Ancient rituals often entailed the sacrifice of human victims.

Along the Vietnamese coast, among the scars of the Vietnam War, craters and abandoned rusting tanks, one can still find temples made of stone to honor

"Ca Ong" (the whale shark) who is believed to cruise and protect the long and winding tropical shoreline.

In Pearl Harbor dredging operations for a dry dock in 1907 uncovered remnants of an ancient shark pen. When the $4 million structure collapsed because of unsure foundations midway through the project, local native peoples whispered among themselves that the Queen Shark was bringing her wrath down on the construction companies.

Among native populations in the South Pacific, a close and unique relationship has developed over hundreds of years. A.J. Laplante, in the period between 1928 and 1943, recorded that islanders in the Figi Islands could subdue sharks by kissing them. Twice a year when the natives made a drive for food during tribal feasts, or when they wanted to make the swimming areas safe from sharks, he wrote:

> The night before the drive the man who wants the shark fishing done goes to the house of the chief, who is also a sorcerer or medicine man. There they enact a ceremony which survives from their oldest beliefs. This ceremony includes the presentation of Kava, a mildly narcotic beverage made from juice extracted from a ground root. The next day the natives drive the sharks into a large net, the shark kissers wade out, seize the man-eaters, kiss them on their up-turned bellies, and fling them on to bank. Among native people, it is taken for granted that once a shark is kissed upside down, it will be safe, cooperative, and harmless.
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> McCormack et al. 1963

For the Hawaiians, sharks are frequently seen as incarnated ancestors, and among the Tongans, a neighboring island people, divers who regard the shark as a guardian spirit continue to dive among them, for commercial reasons, with no fear. There remains no record of any attack, rumored or otherwise.

Hamilton Green, Makah tribal member and longtime resident of the tiny whaling village of Neah Bay, located out on the edge of the Olympic Peninsula in Washington, tells a story handed down through his ancestors, that, on the other hand, represents the dark and threatening nature of these roaming carnivores of the sea. Off the edge of Cape Flattery, he says, there is a rock formation which marks the place where a great monster fish (a great white shark) was said to have been killed by the supernatural warrier Klady after being taken into the shark's belly and carving out the shark's heart from the inside with a mussel shell (Green, 1985).

Tall tales have, of course, grown up around the shark's mysterious reputation for its nomadic traits and well-documented ability to travel great distances. Sailing ships often left a trail of garbage behind them followed by sharks, and, for centuries, sailor's imaginations were fired by

superstitious terror. Mark Twain told a story, for instance, that was believed for years as fact. Supposedly, by catching a shark near Australia that had swallowed a newpaper in London ten days before, one Cecil Rhodes obtained advanced information about a rise in the wool market and thus made prudent investments that were responsible for his ability to amass his vast fortune!

The Shark as Myth and Symbol

The word "shark" is as hazy as the origin of the ancient shark family itself. Apart from more specifically scientific categories and designations such as Carcharodon carcharias (white shark) and Lamna ditropis (salmon shark), etymological roots point to certain characteristics of the shark itself. "Schurke" is the German word for villain, the Anglo-Saxon root "sceron" means "to cut or shear." Since Elizabethan times, frequent images and meanings have accompanied casual popular usage of such terms as loan shark, pool shark, card shark, and business shark. The sound of the term itself is sharp and carries a harsh, piercing note of emergency, terror, surprise, and cunning.

Below is a sample of images that are associated with the word "shark," and gleaned by the author from an informal sampling of commercial shark fishermen, educators in the oceanography field, and residents from a typical urban environment.

From a Samoan Island businessman

danger
man-eater
scavenger
killer

From a chef in an exclusive hotel

recipes
marketability
customer comments
price structure

From a hotel maintenance worker

great white
"Jaws"
fishing
teeth

From a commercial shark hunter (sport)

money
tackle
weather
mako

From a university student

teeth
fin
"Jaws"
fish

From an Alaska State Fish and Wildlife worker

deep water
helpless
white foam
frantic swimming

There are two rather intriguing aspects or patterns that emerge from the preceding responses. The first is that none of the respondents has ever witnessed an attack by a shark on a human being nor has ever had an

acquaintance who has experienced such a traumatic event. A second note of interest is the remarkable similarity of images regardless of the wide variety of their personal vocation and life experience, some of which reflected a strong reality factor in terms of working with the sea in practical scientific and commercial endeavors.

The responses might suggest that the shark as an image of terror and destruction might be more influential than the actual experience of the shark as a specific, biological creature with distinctive habits and characteristics. What is disconcerting is that this holds true with persons who work in close proximity with sharks themselves.

One can witness the collective aspect of this phenomenon in recognizing that among traditional Japanese culture, one of the gods of the storm is the Shark Man. In fact, the shark is so terrifying in Japanese legends that when the Chinese looked for a symbol to paint on their war planes while raiding the Japanese during World War II they chose the leering face of the Tiger shark, and these planes became known throughout the world as "flying tigers." In actuality, they might have been more appropriately nicknamed "flying sharks."

There are, upon closer examination, peculiar characteristics about the shark as a creature of the deep that point to several specific reasons that underlie the shark's reputation as a potent symbol of power and fear. Among them could be considered these four:

1. The shark is, in a very real way, "king" of the primordial seas. Human beings have lived perhaps a million years. Shark fossils go back as far as 350 million years, and their structure and biology has remained basically unchanged. The shark is the largest fish in the sea (the whale is classified as a mammal).

2. Unlike most creatures of the natural world, the shark has the unique characteristic of feeding on its own kind. It knows no natural predator except a killer whale and an occasional swordfish.

3. The shark holds an amazing, remarkable, tenacity for life. Gaffed, shot, harpooned, and even gutted, its jaws can still rip and cut the hand or leg of a careless fisherman.

4. It lives at great depths in the ocean and is constantly on the move. Jacques Cousteau in his famous study, **The Silent World**, writes, "From my own experience covering many varieties, I can offer two conclusions: First, the better acquainted we become with sharks the less we know them. Two, one can never tell for certain what a shark is going to do. Because they are more a potential than an actual danger to a diver, they lead the swimmer to a disregard for them that can prove to be fatal." (Cousteau, 1952)

The Shark as Projection

One of the more fascinating discoveries that emerges from any serious study of the shark and its impact on human consciousness is the contrast between expectation and fact, image and data. There are basic fundamental contradictions. Among them is the simple acknowledgement that the International Shark Attack File, which monitors all shark attacks on an international basis, has tracked less than 1500 actual shark attacks since 1560 A.D. Twice that number will die from AIDS this year in the United States alone. Fifty thousand will be killed each year in traffic accidents on our own nation's roads. Airline catastrophes cause the death of at least that many persons in any given year. Then why the inordinate fear?

In the scientific discipline of psychology, the study of human behavior, there is a phenomenon, identified by analysts, as projection. It colors all human relationships and is often subtle, sometimes humorous, frequently dangerous.

Projection was first identified and defined in a formal way by Sigmund Freud, the father of modern psychology, at the turn of the century (Nicholi 1978). Simply speaking, it is a common and important action of the personality that involves taking that which one cannot or will not internalize or accept and "projecting" that characteristic or emotion onto another person, place, or thing. Examples can be found in large families where there is frequently someone, usually a child, regarded as the "bad seed." This individual carries, in many situations, the unconscious negative projections for the rest of the family. Sociologists identify the same parallel among criminals or delinquents in a social system. The projection, in that instance, would involve "bad" or "dangerous" individuals who need to be removed from society. This is a less threatening alternative than recognizing that the great majority of "criminals" are products of abusive families, poverty conditions, and violence which is often indirectly related to the inadequacies of any social system that demands unhealthy degrees of conformity and standardization.

Animals, too, carry projections, as we all are aware. In my own family, our golden retriever is the focus of a lot of my own projected feeling of frustration. The other day when I was shouting at him, my six-year-old daughter approached me and asked, "Dad, why are you talking to Pippin like that?" Now she didn't know the fancy name for projections, but she knew something was wrong, out of balance.

And so we might ask ourselves, if with a smile, is our friend the shark getting a rap? Is there something that is carried by our imagination and fear that meets us in our sometimes diabolic fascination with this king of predators? I suggest that in this question lies the opportunity to look closer at ourselves. Three possible issues present themselves in this regard, and each of them holds implications not simply for the potential future of a commercial shark fishing industry, but also in terms of an integration of our own psyches as children of a modern world.

First, contemporary attitudes toward the shark reflect a hostile attitude toward nature. Few people celebrate the fact that sharks play an important and invaluable part in the great ecological cycle. From a more balanced perspective, they are the greatest carnivores of the sea—a vast collective, natural, organic, disposal system. All we tend to see, however, is potential death, terror, and destruction. Our dominant posture of fear and domination of the shark may suggest a basic alienation from the natural world. Certainly the parallel extinction of both animal and plant species in the natural order would suggest such. The full implications of such an analysis, of course, remain to be explored, but the danger of an antagonistic attitude toward nature reflects an increasing and dangerous split in the psyche of contemporary man himself.

A second projection mirrors itself in the possibility that the shark is, for most of us, representative of a terror of the unknown. The fear of the shark may be directly linked with a fear of the deepest parts of our own being, traditionally linked to and honored by religion, but in more modern times, usurped by materialism, technology, and the resulting desperate need to conquer and control. The fear of the shark, protrayed by such movies as "Jaws" and its subsequent exploitive sequels, may reflect a fear of our own inner instinctual world.

The third issue that emerges takes shape as a warning that we implicitly receive from native groups, in this case island people, who have continued far longer than us, to live close to the earth and to the cycle of nature itself. As we have seen in our earlier exploration of legend and symbol, the shark has carried for them a bi-polar attraction and repulsion. In other words, for the more primitive psyche, the shark has always carried both a negative and positive projection. In contrast, to children of a modern world it carries an almost exclusively morbid, negative meaning.

In the centuries-old symbol system of Asia and Africa, archeologists have deciphered certain symmetrical forms which carried important meanings for the world as ancient cultures understood it. One such little known geometric form was the "mandrola" (Fig. 1) (Cirot 1967). For primal peoples, the circle was the basic dimension and shape of reality, a sign of wholeness, seasonal change, biology, psychology, and ecological balance. But an accompanying perspective on the basic nature of the life process involved the mandrola.

This symbol entailed a recognition of a certain polarity and tension underlying nature and virtually all human relationships. The intersection of two dimensions (light vs. dark, male vs. female) is the area of the mandrola. It is a sacred space and ancient peoples chose several animals and creatures to represent this two-faceted experience. One was the snake, another the bear. The third, interestingly enough, was the shark. This recognition corresponds to a long-time custom of the Samoan islanders who eat shark as a "chieftain's food." In other words, the shark itself may carry for the human species a potential connection to an untamed, primitive and beautifully powerful world that lies deep within our own collective psyche.

This may account for the fascination of the "hunt" for the shark and the renaissance of its study and power. It also carries an implicit warning perhaps that the shark will never permit itself to be domesticated and produced commercially for consumption. Among native peoples, its mystery and elusiveness, its unpredictability, beauty and terror, protect and enhance its symbolic power as the great predator of the seas. For those with different more utilitarian agendas, I will watch with interest in years to come, but my bet will be with the elusiveness and final victory of an animal that remains mysterious, free, and untamed. Not unfit for human consumption, but, in a unique and mysterious way, too "sacred" for such.

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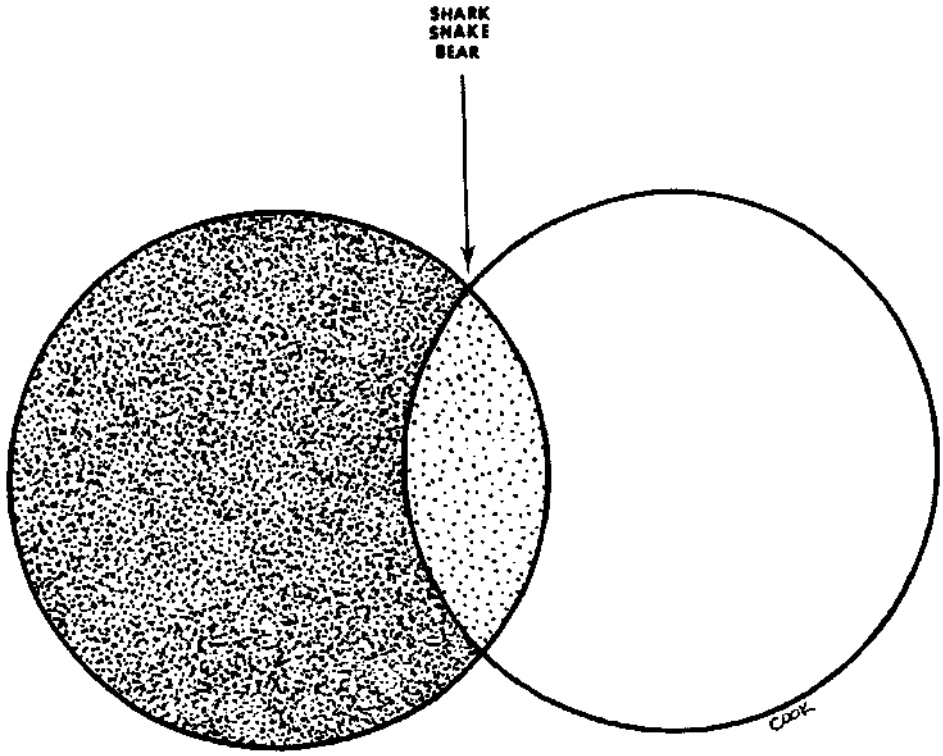

Figure 1: The Mandrola Symbol

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Pacific Coast Shark Attacks: What is the Danger?

Robert N. Lea
Marine Resoueces Division
California Department of Fish and Game
Monterey, California 93940

Abstract: Since 1926, sixty-one unprovoked shark attacks have been recorded for the California-Oregon coasts. Attacks are also known from off Baja California, Mexico but reliable information for this geographic area is incomplete or sketchy. No shark attacks are known for Washington, British Columbia, or Alaska - it is probable that this record will not stand

Recent attacks involving humans have included surfers, skin divers, scuba divers, and swimmers. Wind surfers and ocean kayakers have not as yet been implicated; it is likely that these modes will be affected in future encounters.

There has been much recent speculation regarding increased numbers of white sharks off our coast. This concept is not supported by recent human-shark interactions. Of 37 species of sharks occuring in the eastern North Pacific (north of Mexico), only six or seven are potentially dangerous. It is the great white shark, Carcharodon carcharias, which is of greatest concern.

The probability of an encounter, by a surfer, diver, or swimmer, with a dangerous shark is exceedingly low; there is an average of only two attacks per year (range 0 - 7). Measures which can lessen the incidence of potential encounters can hopefully be gained from the analysis of shark attack data.

The Forensic Study of Shark Attacks

Sid F. Cook
Argus-Mariner Consulting Scientists
P.O. Box 393
Corvallis, Oregon 97339

Abstract. The infant science of forensic shark attack investigation and analysis traces its origins to the formation of the Shark Research Panel by the American Institute of Biological Sciences (AIBS) and the U.S. Navy in 1958. In the ensuing 28 years, a group that has never numbered more than 300 field investigators has begun to untangle the myths of attack-related behavior, advancing us from the realm of observation toward one that is quantifiable and empirical.

Historical Background

Shark attacks have been recorded at least as far back as the writings of the Greek historian Herodotus in 492 BC (Burgess 1970). Since little scientific information existed on sharks until recently, the reporting of such incidents resided largely in the realm of popular myth, superstition, and fanciful speculation (Gilbert 1963; Gilbert et al. 1967; Baldridge 1974; Ellis 1976; Wexler 1982). Sharks and bears, among a small group of wild animals, have traditionally represented such a mysterious and unfathomable force in nature that nearly anything that is attributed to them is accepted without critical testing (Jon Magnuson, psychotherapist, pers. comm.). Because sharks inhabit a concealing environment in which humans have been awkward and temporary visitors, they have resisted mankind's attempts to understand and to dominate them better than most animals (Myrberg 1976). As with other things that man cannot control, he assigns them stereotypical "human-like" (anthropomorphic) characteristics which tend to reduce the value and magnificence of these animals or to convey characteristics to all sharks which may, under specific conditions, apply only to single individuals. In formal logical arguments, this would be referred to as both a "fallacy of hasty generalization" (invalid argument predicated upon an example which is not representative of the group) and a "fallacy of composition" (invalid argument that occurs when certain characteristics of the parts are construed to be also characteristics of the whole) (Hurley 1985). In the case of shark behavior such arguments might take the common form, "a shark viciously attacked a man last Saturday, therefore all sharks are vicious man-attackers."

When all of this is further viewed in the context of the public's affinity for media reporting of seemingly sensational events (Steve Boyer, Bellevue Journal-American Newspaper, pers. comm.), it is not difficult to see how legends have grown without much regard for the degree of reality contained

in them. This has seriously interfered with our understanding of cause-and-effect relationships in shark attack behavior toward humans.

Though humans have undoubtedly interacted with sharks down through history, it has only been in the twentieth century, more particularly since World War II, that there has been a keening of interest in the scientific community toward unlocking the secrets of attack behavior. The vast preponderance of the work in the infant science of forensic shark attack investigation and analysis has been completed since the formation of the Shark Research Panel (SRP) by the American Institute of Biological Sciences (AIBS) and the U.S. Navy in 1958 (McCormack et al. 1963; Miller and Collier 1980; Compagno 1984). Prior to the mid-1950's the major interest in sharks centered upon finding effective means of preventing attacks through the use of mechanical barriers (Australia) and chemical deterrents (U.S. Navy during World War II). Little effort was directed toward discovering underlying causes and effects related to ways in which human behavior might affect shark behavior. Most information entering the scientific record was gathered from military debriefings of personnel stranded at sea (Llano 1957) and from passive accounts derived from newspaper clippings without field investigators being able to interview victims and survivors first-hand (Miller and Collier 1980; Bernard Zahuranec, U.S. Navy, pers. comm.).

One of the first detailed on-site investigations of shark attacks by a qualified field observer was made after the fatal white shark attack upon Barry Wilson at Monterey Bay, California, in December 1952. The investigation, which was conducted by Rolf L. Bolin of the Hopkins Marine Station at Pacific Grove, California, was prototypic in its thoroughness and by its application of an in-depth analysis of contributing factors of weather, chronology of the attack, rescue efforts, possible causes of the attack, photography of the victim's wounds, and full medical description of the injuries (Bolin 1954). This investigation marked the beginning of application of forensic scientific methodology to shark attack analyses.

Yet the work of Bolin was the rare exception and not the rule in the mid-1950's. No system that hinted at a uniform approach to investigation or a central repository for case files existed; therefore, no comparison was possible nor was sufficiently defensible data available to begin the process of quantifying and qualifying shark attack behavior. In 1959 the SRP initiated a program to investigate and categorize information on worldwide shark attacks knows as the Shark Attack Files (SAF) (Gilbert et al. 1960). The SAF represented the formal birth of the science of forensic shark attack investigation and analysis. A number of important "tools" were introduced through the SAF:

1. the attempt to record all attacks worldwide;
2. the development of a standardized questionnaire which requested all pertinent physical data attendant upon the attack;
3. the solicitation of assistance from a physician or scientist near the scene to document the attack;
4. centralization of all shark attack information;

5. statistical comparison of the accrued data in the files; and
6. screening of incoming reports for spurious or doubtful accounts.

Application of these tools allowed researchers to make some preliminary recommendations about shark activities and human activities that might provoke attacks (Gilbert et al 1960; Gilbert 1963; Schultz 1967; Baldridge 1974). Baldridge and Williams (1969) were able to bring into question a long-held belief that shark attacks were acts of feeding behavior. Through analysis of data in the SAF, they were able to establish that for every attack that could be linked to feeding (bite contact with both of the shark's jaws and/or removal of substantial amounts of the victim's flesh) three attacks could be linked to defensive behavior (raking of victim with the upper jaw only and little loss of flesh). Where before precious little information had existed about shark attack and then mostly limited to advice that bore almost no relationship to reality (Cousteau 1812; McCormack et al. 1963), large numbers of books devoting themselves in part to the phenomenon became available (Gilbert 1963; Davies 1964; Budker 1971; Baldridge 1974; Ellis 1976; Wallet 1978; and Sibley et al. 1985).

As more sophisticated scientific techniques have been adapted to use in the investigation of shark attacks, particularly since the late 1970's, knowledge of this phenomenon has grown almost exponentially. In-field investigations have been increasingly applied to North American and South African attacks (Wallett 1978; Miller and Collier 1980; Cook 1980; Cook and Brzycki 1981; Martini and Welch 1981; Cook and Frank 1984; Lea and Miller 1985; Cook et al. 1986; Cook et al. MS). These investigations have been enhanced by application of "soft" x-radiography of surfboards (Cook et al. MS), testing of blood samples imbedded in the foam core of a victim's surfboard (Lea and Miller 1985), advanced analyses of concurrent weather (Cook 1980; Cook and Brzycki 1981; Cook and Frank 1984; Cook et al 1986), analyses of physical oceanographic conditions, and complex medical or autopsy work-ups (Wallett 1978; Cook 1980; Cook and Brzycki 1981; Martini and Welch 1981; Lea and Miller 1985).

The concept of forensic shark attack investigation and analysis will be discussed along with several current techniques of study and their advantages and limitations.

Forensic Shark Attack Investigation Defined

In the broadest context, forensic science is "the application of analytical techniques in medicine, chemistry, biology or other scientific disciplines to establish evidentiary facts necessary for the effective dispensation of criminal and civil law" (Turner and Hilton 1949; Walls 1974). However, the application of forensic science to shark attack investigation hardly ever involves violations of criminal or tort law, although the famous "Shark Arm Murder Case" in Australia in the 1930's stands as a notable exception (McCormack et al. 1963). Therefore, we need a somewhat different definition of forensic science when applied to shark-human interactions. For the purpose of discussion in the context of the current paper, the following

definition is offered: "Forensic shark attack investigation is the application of analytical scientific techniques to accurately quantify and qualify information obtained from attacks upon humans and animals with the purpose of discovering underlying causes and developing effective means to reduce the likelihood of future attacks."

Chronology of the Investigation

The following investigational procedure has been developed by Dr. Robert N. Lea, California Department of Fish and Game, and the author to support their work with shark attacks on the Pacific Coast of the United States. It is designed to garner the most detailed information available. While to some field investigators this may seem to be a "lot of work just to record a shark attack," it is structured on the supposition that in the more obscure and seemingly unimportant information often omitted from investigations may lie the key elements to understanding what causes sharks to attack.

There are three principal phases to the investigation: 1) post-attack field investigation, 2) offsite data collection and analysis, and 3) reporting.

Post-Attack Field Investigation. This phase involves visiting the site of the attack, collecting field data and physical evidence of the attack and first contacts with the principal parties to the attack. The primary tasks are:

1. Identifying Principal Parties: This can be accomplished by contacting the police, sheriff, or other agency having law enforcement jurisdiction, hospitals, newspaper accounts, and/or the county medical examiner's office (when fatality occurs). Principal parties include the victim, on-site witnesses, paramedics, doctors, police, the U.S. Coast Guard, and/or the coroner.

2. Contacting Principal Parties: Either by telephone, mail, or preferably in person, all parties to the shark attack should be contacted and interviewed. Time is a key element here. The longer the time interval that elapses between the attack and the interviews the less the value will be of the information the field investigator obtains. The reasons for this are: that accounts tend to change as they are repeated over time due to memory lapses and more importantly "reprocessing" of the memories of the incident. It is not uncommon for a victim to be uncertain of events and the species of the attacking shark soon after the attack. However, one month after the attack, due to reprocessing, the shark becomes first a great white shark (Carcharodon carcharias) then, with retelling of the story, a 3 m...4 m... 5 m... sized individual. This is greatly enhanced in those cases where the victim or survivor-witnesses learn that the media wants to make them into celebrities or that they can make money from an "I survived the jaws of death" story (see Wexler 1982). Interviews should be carried out as soon as practicable after the attack but not more than three weeks thereafter. Be sure

to obtain all the information you can get at the time of interview, including impressions of water conditions, noting of animals in the water near the attack site, possible contributing factors (dead animals, garbage, fishing activities, processing waste or other possible attractants).

3. Obtain Physical Evidence and Field Data: This includes reports from paramedics, police, doctors and autopsy findings (if applicable), water temperatures at the attack site, water samples (in sealable jars) for salinity analysis, inanimate objects bitten by the shark (surfboards, oars, waterskis, floats, etc.), and personal gear worn by the victim(i.e., wetsuits, etc.). Reasonable care should be taken not to further damage personal effects or gear. The items should be returned to their owners as soon as possible after the investigation.

4. Photography: Where possible photographic records should be made of the attack site (if near shore), physical items that are too large to transport to the lab for analysis, and other pertinent subjects. Two excellent books are available for reference: **Scientific and Technical Photography** (Blaker 1975) and **A Field Photography** (Blaker 1973).

5. Autopsies: In those cases where the victim dies as a result of the shark attack, an autopsy will usually be performed by county or state medical examiners or federal laboratories specializing in the deaths of federal employees and military personnel. Although it is difficult for most of us to view the bodies of victims of traumatic injuries, if at all possible the field investigator should attend the medical examination of the body. Much important information can be obtained in this manner, particularly from the observation of damage to bones and internal organs. If it is acceptable to the next of kin, you should obtain photography of pertinent injuries (Bolin 1954).

Offsite Data Collection and Analysis. This phase involves collection of statistical and mean-annual information about contributing factors, analysis of physical data, analysis of meteorology and statistical treatment of physical information to attempt to determine the species of the attacking shark and its relative size and weight. The primary tasks are:

1. Salinity Analysis of Water Samples: This task should be carried out quickly to avoid the possibility of concentration due to evaporation from improperly sealed jars. Depending upon the equipment you have available to you, you may want to carry out the analysis yourself or "farm" it out to an analytical lab. Most marine chemistry books and oceanography books describe the techniques for completing such work.

2. X-radiography of Inanimate Objects: Often objects are bitten by sharks during the course of an attack. These items are very

valuable to the investigator because they contain at least a partial impression of the shark's jaw and possible tooth fragments. Prior to the late 1970's the only methods that were readily available for examination of shark-bitten objects were blind-probing and/or destruction of the object to remove all foreign material. The disadvantages of blind-probing are that it tends to distort and deepen the areas of penetration made by the shark's teeth, thereby giving false impressions of the true size of the tooth, and the probe may crush small pieces of tooth, rendering them useless for identification. The physical tearing down of the object to recover foreign materials has often been applied in the past. It is undesirable because it requires the total destruction of the object. Often in the case of surfboards, for example, the owner either wishes to repair and reuse the board or keep it for a memento of the encounter. This destructive form of examination is highly unpopular with owners of such objects, and often will color their decisions to release the board for forensic examination (Cook et al. MS). Scattered attempts were made in the 1970's to apply x-ray techniques to the examination of shark-bitten boat hulls and a surfboard with variable success (Cook 1980), but no uniform method was derived to maximize the promise of this technology. To address this problem a system was developed by the late Dr. John Kelley of Oregon State University, Dr. Barbara Watrous of Oregon State University, and the author for utilizing "soft" x-ray techniques characterized by low kilovoltages and long exposure times. This technique produces very high resolution radiographs with high photographic densities that enhance very small differences in radio-opacity of low density objects. The advantages of this technique over previous methods of examining surfboards and similar objects are:

1) the process is non-destructive;
2) a map of locations of foreign objects as small as 1 mm in the surfboard is obtained;
3) areas of greatest bite force can be determined from compression of the foam core which alters radio-opacity; and
4) topography of the shark's teeth can be ascertained, which may aid in species identification (Fig. 1) (Lea and Miller 1985; Cook et al. MS).

Limitations of this technique lie in equipment requirements and need for a properly outfitted x-ray room; however, this can be overcome in part by utilizing the services of medical x-ray facilities or those at universities and commercial laboratories. The only constraint is that the investigator must specify that this procedure requires low power (30 kvp) and long exposure times (270-540 mAs). "Patient exposure times" are not critical as the target is inanimate.

3. Physical Examination of the Shark-bitten Object: The object should be measured for length, width, and thickness. Next the position of

the shark bite should be recorded with respect to distance from a clearly identifiable reference point. Then the overall dimensions of the bite impression (width and depth onto the object) should be measured (Fig. 2).

Individual tooth impressions should be measured for length, width, and depth of penetration. To determine depth use a blunt, straight-tipped probe. Sharp-tipped probes are unsuitable as they tend to pass through the bottom of the impression for some distance, thereby yielding erroneous data (Fig. 3).

Center-to-center distances between adjacent tooth impressions can be determined by placing probes in the center of the tooth marks and measuring between them (Fig. 3).

Often blood stains have been found on styrofoam surfaces exposed during attacks. It was long assumed that the blood was the victim's. In part this is probably true; however, blood has been found embedded in the foam core of surfboards bitten by sharks in cases where the victim was entirely uninjured. Many sharks have a tendency toward "pulpy" gum tissues that bleed easily. Undoubtedly shark blood often remains as an artifact of the attack. Recently investigators have begun to look at the possibility of using such blood samples to identify the attacking species (Lea and Miller 1985; Robert Lea, California Department of Fish and Game, pers. comm.). Clearly this technique needs more work to be brought to fruition. However, given the likelihood that sharks can be separated by species based upon unique hematological characteristics, this presents exciting prospects for future forensic work.

4. Weather and Oceanographic Data: Two of the most neglected topics in the reporting of shark attacks have been meteorology and physical oceanography. In part this has been due to reliance upon news clippings in many cases where no on-site investigator was present (passive reporting). But also this has been the result of field investigators being unaware of the available resources for this information. Especially in the United States, extensive literature and ongoing data collection services have become available in the past 15 years with advances in satellite-remote weather and oceanographic sensing systems. Increasingly, foreign nations are also placing satellites in stationary (geosynchronous) orbits for the purpose of collecting weather and oceanographic information (at present France, China, and Japan launch satellite payloads for commercial clients). For North America, information is currently available on sea surface temperature and temperature anomalies from the METOC CENTRE, Maritime Forces Pacific (British Columbia) and Maritime Forces Atlantic (Nova Scotia). The National Weather Service (NOAA) (Washington, D.C.) provides a variety of weather information and also many types of oceanographic information

collected from NOAA operated satellites and surface stations (Figs. 4 and 5). This information may also be obtained from regional Ocean Service Centers (OSC's) operated by the National Oceanic and Atmospheric Administration (NOAA).

5. Assessing Medical/Law Enforcement Data: For the most part, this information should be presented without amendment by the investigator in the final report on the attack. There are some exceptions, however, of which the investigator will need to be aware.

Law Enforcement Data: Unless the shark attack results in serious injury or death to the victim (when an officer will be assigned to handle an investigation for police, sheriff or other authorities), the law enforcement report on the incident will probably be the result of a report by the victim at the station. It will probably be short with a notation that no follow-up investigation need be taken. Inaccuracies may be noted by the investigator in the report, but it must be remembered that the police report can only be as good as the information communicated by the involved parties.

Medical Data: Data recovered by medical personnel as a result of treatment of injured victims or autopsy findings in the case of fatality nearly always will be presented by the investigator without substantial qualification of the data. The possible exception to this is that spacing between tooth impressions in wounds, especially in severe wounds or if a body has been recovered after putrefaction has begun, is exaggerated by a process known as "spreading." In the case of severe wounding the dimensions of the damaged area will appear to be larger than they actually are due to unnatural flexure of the body section involved as a result of loss of support in the area of the excised tissue. This was observed in the case of a dead harbor seal (Phoca vitullina richardii) which was bitten by a white shark on the central Oregon coast in the 1970s. On cursory examination the wound appeared to be a single bite of nearly 1 m width due to a massive loss of tissue along the body wall. Closer examination revealed that there were two overlapping bites that had been greatly exaggerated by spreading of the wound (Carl Bond, Oregon State University, pers. comm.). Similarly individual tooth impressions may be exaggerated by flexure. An analogous example of this would be in the case of cutting into a piece of meat with a knife. Though the knife is narrow-bladed, and hence the cut is narrow when the meat rests on a flat surface, if one were to pick up the meat and bend both ends down relative to the center, the cut area will assume a triangular cross section (Fig. 6). In the case of putrefaction the wound area will be exaggerated due to the breakdown of soft tissues along the cut surface of the wound at a higher rate than uninjured adjacent areas. Interpretation of medical data can be provided by attending physicians or the medical examiner; however, additional references may prove useful. Some of the books available on the subject include Camps and Cameron (1971), Morse et al. (1984) and Polson et al. (1985).

6. Treatment of Statistical Data: Depending upon how much information you have available to you, i.e., bite impressions in inanimate objects, weather data, etc., you may wish to apply statistical tests to determine length and probably weight of the attacking shark or significant deviations from "normal" weather and sea conditions. In the case of length:weight ratios, a good source for general shark information is Compagno (1984) and for specific information on white sharks, Tricas and McCosker (1984).

7. Photography: Photographic records of objects examined in the follow-up analysis of the attack provide very valuable information for other researchers and for your own future reference. The importance of the scientific application of photography to the science of shark attack investigation cannot be overstated. The photographic references already mentioned will aid you in obtaining the highest quality pictures.

Reporting. This is the final phase of the investigation, but certainly not the least important. The best investigation will prove of little value if the information cannot be conveyed to other researchers and interested parties in a usable form. A workable format used in reporting investigations on the Pacific Coast of the United States contains the following elements:

1. Introduction (contains pertinent supporting information on the subject matter to be covered);
2. General Background (contains location, attack site physical oceanographic information);
3. Attack Scenario (contains a narrative chronology of the events leading up to and including the actual attack);
4. Particulars of the Victim (physical description);
5. Investigational Procedures (contains all pertinent data on methodology applied to investigation of attack);
6. Analysis of Data and Discussion (self-explanatory);
7. Conclusions; and
8. Appendices (contains names, addresses and phone numbers of all persons involved in attack and all persons involved in the investigation of the attack, photostatic copies of all medical and law enforcement reports, all meteorological and oceanographic reports submitted during the investigation, and a polyethylene (archival quality) slide page (contains all color slides of injuries, surfboard damage, wetsuits, etc.).

The inclusion of black and white photography in the body of the report and suitably reproducible pen-and-ink drawings of site location, bite damage, and other pertinent data is essential (Figs. 7 and 8).

Toward a Uniform Shark Attack Reporting System

In recent years the International Shark Attack Files have had to rely largely upon "passive" additions and have been greatly hampered by the lack of funds to support their active maintainence. As persons to whom the files have been entrusted have retired, the files have been shifted to new locations which has further complicated the process of accessing information (Bernard Zahuranec, U.S. Navy, pers. comm.). At the writing of this paper the files are maintained at the Underwater Accident Center (NOAA), University of Rhode Island, Kingston, Rhode Island 02882.

To address the problems of maintaining the files and improving the system of investigating and reporting shark attacks, the American Elasmobranch Society has undertaken to develop a uniform worldwide network of scientists and interested field investigators. If you are interested in participating in the reporting network contact Mr. Ralph S. Collier, American Elasmobranch Society, P.O. Box 3483, Van Nuys, California 92407 (213) 995-7966.

Conclusion

The application of forensic scientific methods to the investigation and reporting of shark attacks holds the potential for helping researchers to better understand the phenomenon. While the use of forensics in this context is still an infant science, new techniques are being adapted and evolved all the time. As of 1986 "tools" include x-radiography, photography, sophisticated weather and ocean analyses, and increasingly uniform techniques of gathering physical and chemical data. While it is a recognized fact that shark attacks are a rare occurrence compared to the number of persons utilizing the oceans every year, they still represent a hazard to work and recreational use. Work to create a uniform worldwide reporting system will surely benefit people using the oceans in future years, especially in the area of psychological reassurance.

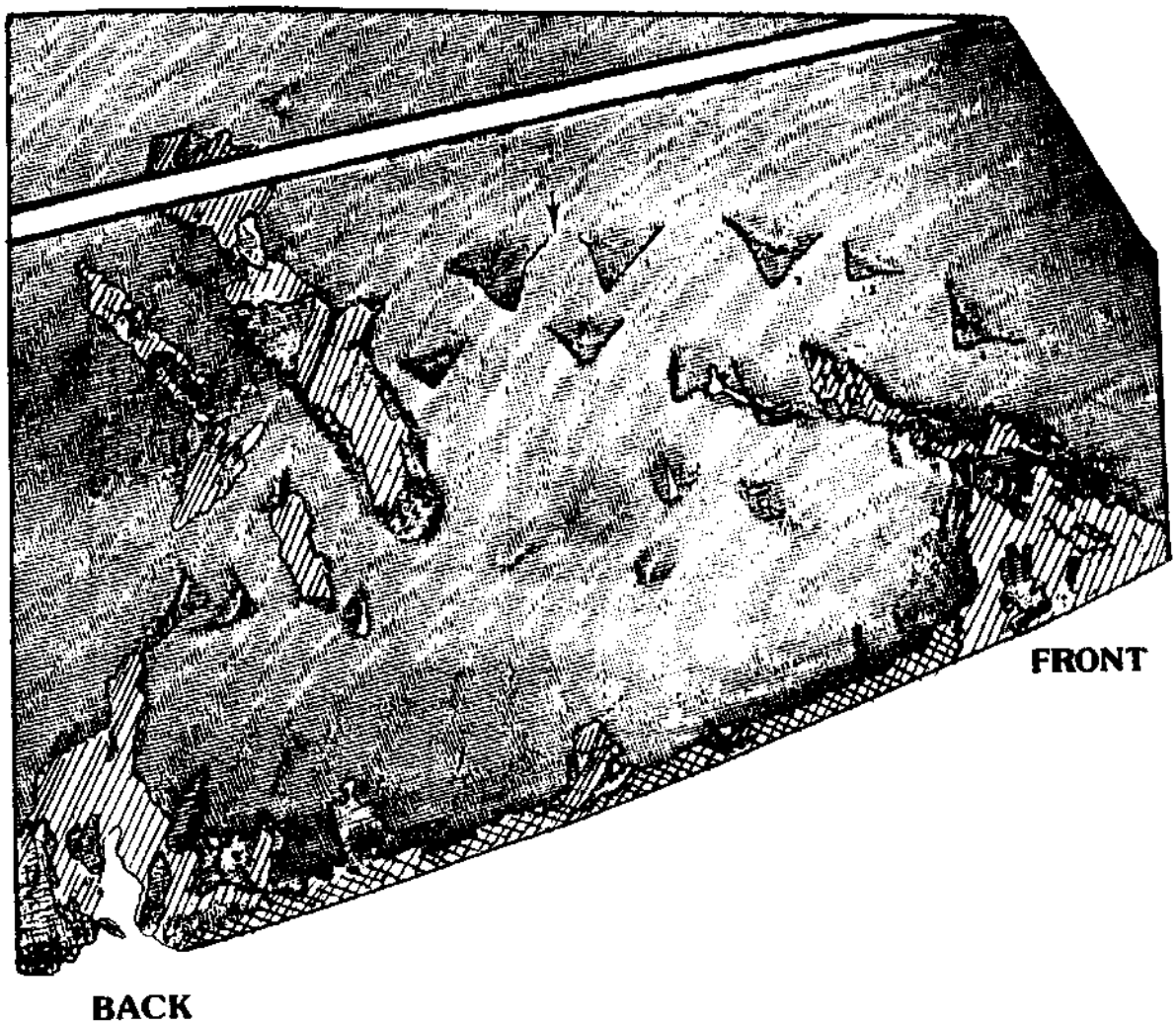

Figure 1: Facsimile of positive image of a radiograph of a white shark bite in a surfboard showing topography of the upper right jaw (teeth 1, 2, 3, and 4). Drawing is about 34% of actual size of bite (Cook and Frank 1984; Lea and Miller 1985). Cross-hatched areas represent sloping surfaces at board edge. Lines represent areas compressed during bite (crushing damage).

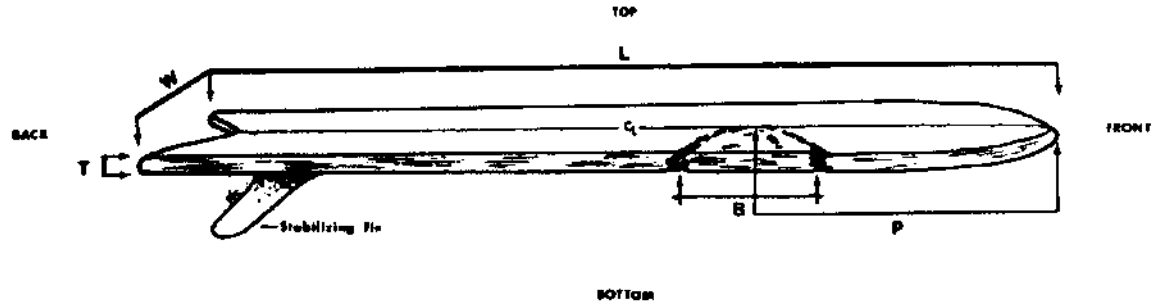

Figure 2: Diagrammatic oblique view of shark-bitten object showing the areas to be measured during the investigation. A surfboard has been illustrated here, but the techniques can be applied to an object of any shape. L = length of board; W = width of board; T = thickness of board; B = width of bite from the center of the deepest penetration on each side; P = positioning of bite from its center to the nearest clearly identifiable landmark (front of board); C_L = centerline of board.

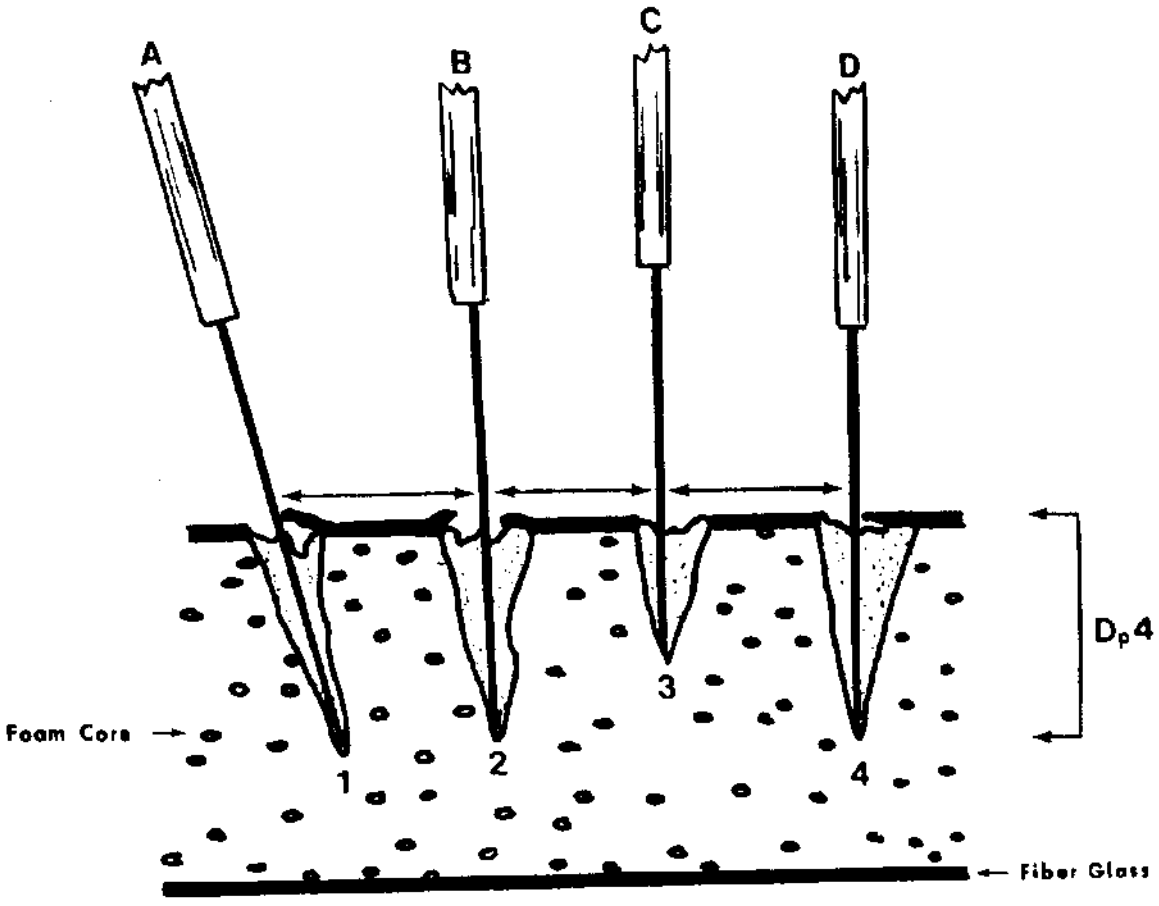

Figure 3: Diagram of method of measuring depth and center-to-center distances of tooth marks in surfboard or other soft-cored objects. Tooth marks are numbered. Measuring probes are lettered. The distances from probe to probe should be measured at the surface of the surfboard or other object to avoid inducing errors caused by non-parallel tooth marks (#1). Probe C at tooth mark #3 is illustrated in an incorrect position to one side of the impression. In such a case, three errors would result: 1) the impression would appear to be shallower than it is; 2) the distance between probes B and C would show a center-to-center distance for teeth #2 and #3 that is too small; and 3) the distance between probes C and D would show a center-to-center distance for teeth #3 and #4 that is too large. Dp4 = correct depth measurement for tooth impression #4.

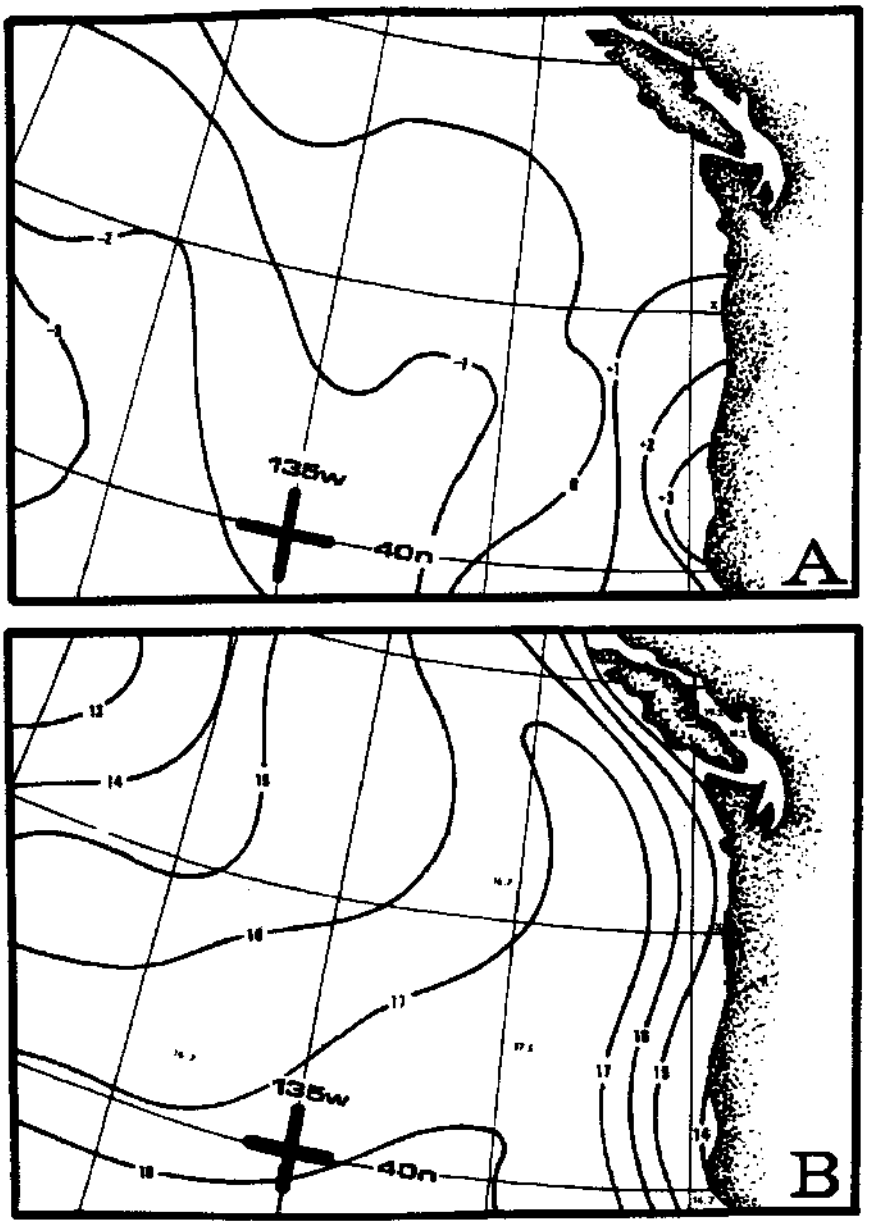

Figure 4: Examples of information on sea surface temperatures provided by the METOC CENTRE/MARITIME FORCES PACIFIC, British Columbia. A = Monthly sea temperature anomalies in °C. B = Isothermic map of sea surface temperatures in °C with point temperatures for selected monitoring stations in the North Pacific. X = the site of the white shark attack upon Randy S. Weldon on 20 August 1983 (from Cook and Frank 1984).

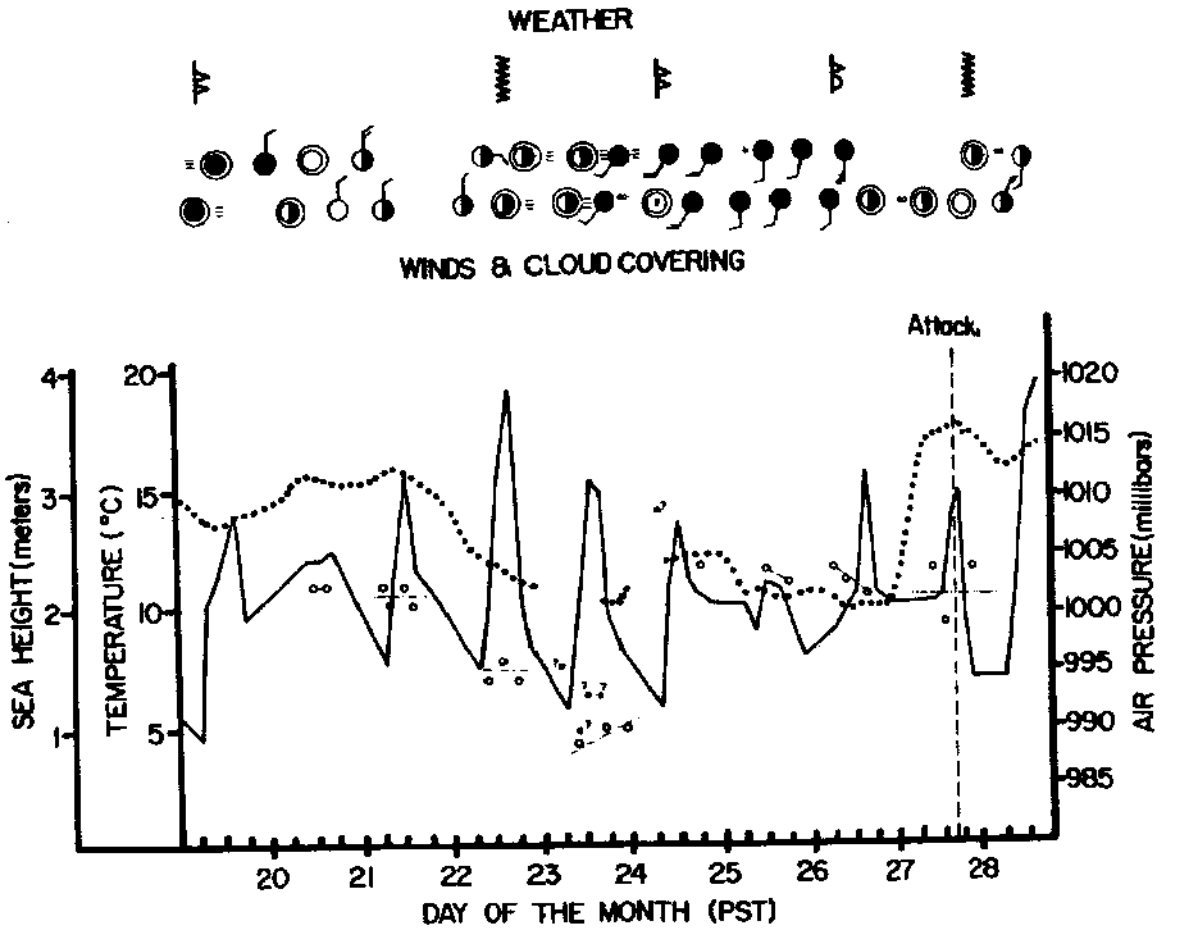

Figure 5: Composite graph of concurrent weather at the time of the white shark attack upon Christopher Cowan at Winchester Bay, Oregon. The solid line represents diurnal air temperatures. The dotted line represents barometric pressures. The open circle/hashed line combinations represent average sea heights. This information was provided by the United States Coast Guard. The wind, cloud cover and weather information was provided by the Atmospheric Sciences Department at Oregon State University (Corvallis) from U.S. Weather Service data. For complete treatment of this material see Cook and Brzycki (1981).

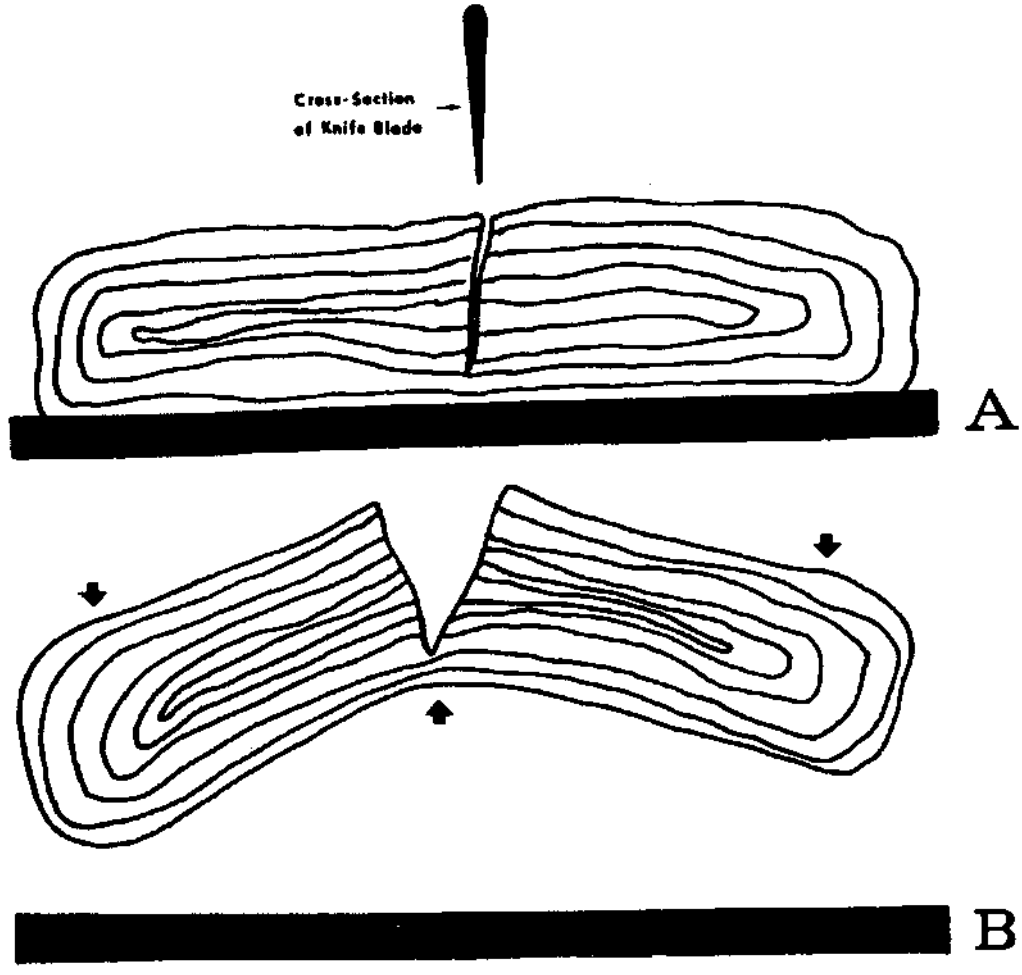

Figure 6: Demonstration of "spreading" of a cut surface in a piece of meat (diagrammatic). The meat has only a narrow cut in it from the knife blade (shown in cross-section) so long as it remains on a flat surface. However, once it is picked up and the ends depressed, the cut surface assumes a triangular cross-section due to distortion.

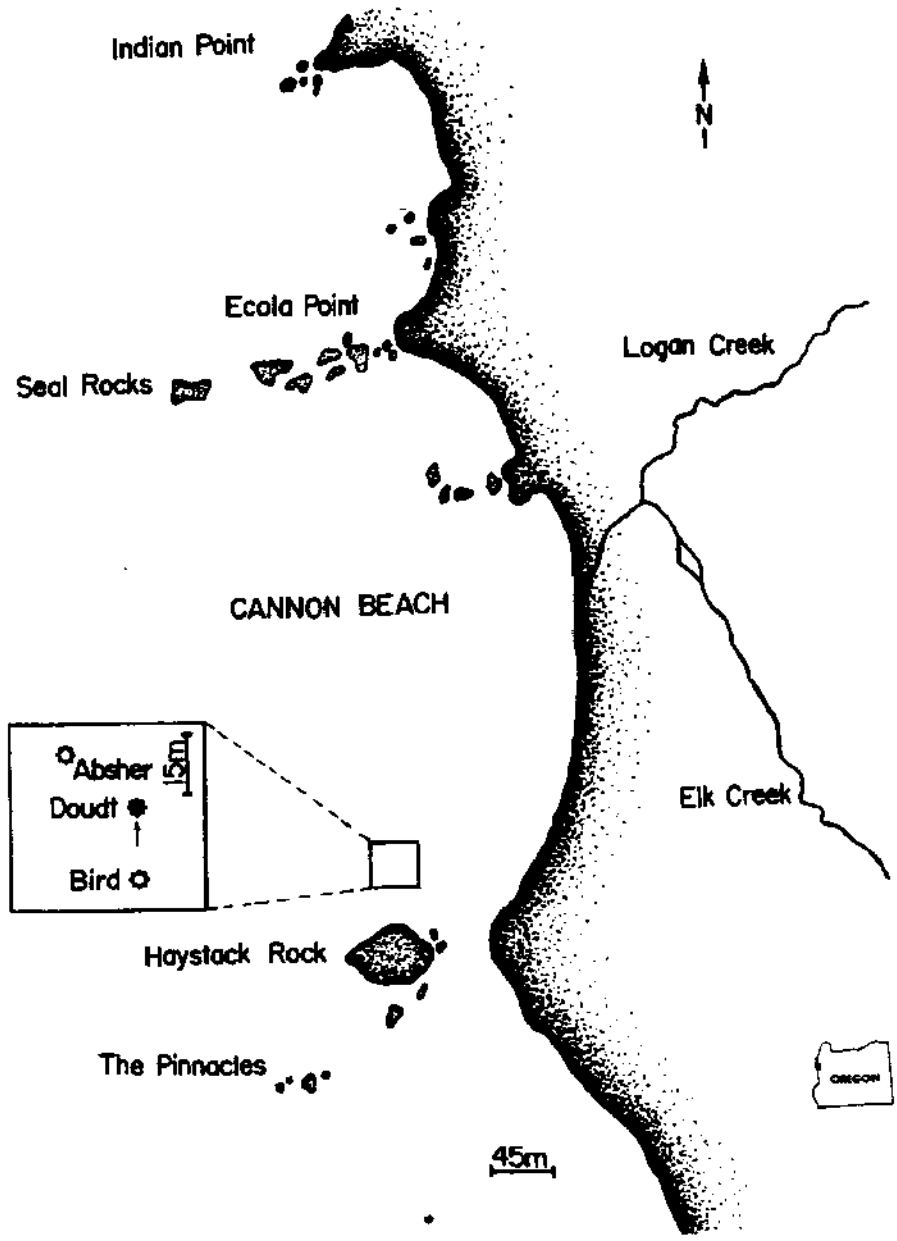

Figure 7: Drawing of the site of the white shark attack upon Kenneth Doudt at Cannon Beach, Oregon. Such maps should include all pertinent information regarding important streams and rivers, locations of geographic reference points, etc. The map should be drawn to scale and insets of the position of the attacked parties and an inset of the attack site on a larger geographical reference (in this case Oregon state map) should also be entered (Cook 1980).

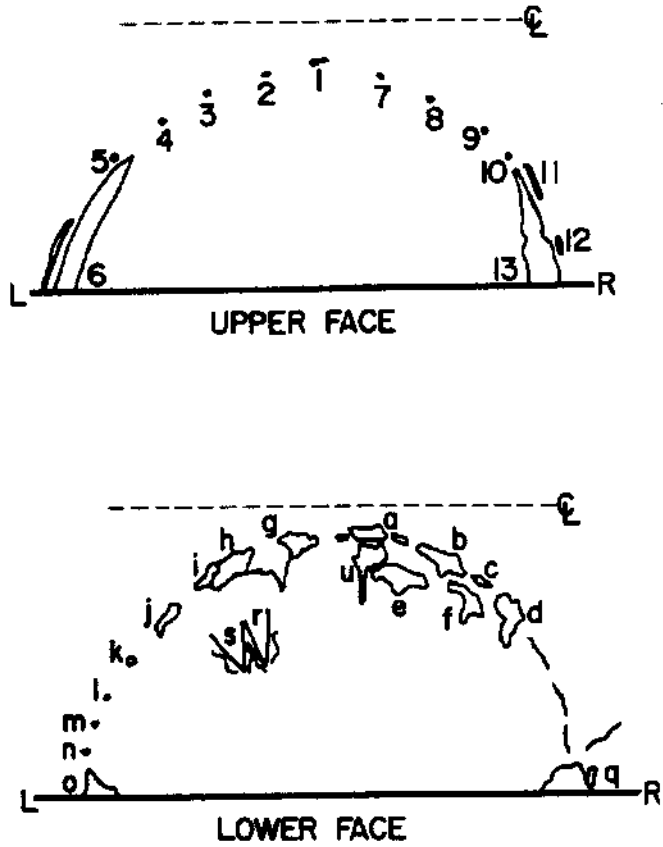

Figure 8: Diagrammatic view of damages to upper and lower surfaces of the surfboard involved in the white shark attack upon Kenneth Doudt (27 November 1979 at Cannon Beach, Oregon). Even if you include photographs of the damage, you will need to have some master drawing with reference points on it to explain your center-to-center measurements of tooth marks. This will also aid you in identifying where tooth fragments and other foreign materials of interest were recovered from the surfboard (see Cook 1980).

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Sharks and the Media

Steve Boyer
Assistant Editor
Bellevue Journal American
8057 W. Mercer Way
Mercer Island, WA 98040

Abstract: The shark is a creature tailor-made for media sensationalism. As typified by the great white, it's a huge, primitive, carnivorous force whose diet occasionally includes people, or at least that's the popular view. The average journalist's definition of news is: an event that concerns people, and is occurring now. Unfortunately, sharks generally become an event that concerns people only when a person is eaten by a shark.

That provides the media with the opportunity for "man-eating shark" stories, and newspapers and television in particular take it, generally without plugging in a lot of scientific information for perspective. Though journalists are professionals at gathering information, they aren't shark specialists. They have mere hours—or even minutes—to get the basic information and get it on the air or in print. If the event falls into the category that journalists call the "holy shit" story, meaning it's guaranteed to make the reader mutter "holy shit" when he sees it, so much the better. A shark attack can draw that expletive from just about anyone.

But that reaction is the shark professional's window of opportunity to get solid scientific information before the public. Journalists—believe it or not—are trained to give their readers or viewers as much background as they can, to put the basic events in an accurate context for the public. When stories break, they welcome help from professionals in the field. But the key is the time peg, the fact that an event is happening now, whether it's a shark attack or a trend in shark research or shark-people interaction, such as more people swimming, scuba diving and surfing, thus coming into more frequent contact with sharks. Without some kind of time peg, a story isn't news.

As shark professionals, you need to recognize those time pegs when they occur and make yourselves available as competent news sources. If it's a breaking story, contact whichever reporter is covering it, or simply the editor in charge of the newspaper or television newsroom. Be prepared to talk not just about sharks in general but about how shark behavior relates to that particular

incident. Be prepared to speak in terms anyone with no special scientific knowledge can understand.

There are additional windows of opportunity besides simply attacks. Trends in scientific research are of interest. So are such developments as shark fishing and shark cooking. If it's a growing trend, reporters want to know about it. They may not be able to use the information right away, and maybe not at all, given the many topics, events and special-interest groups that compete for time, attention and news space. But if nothing else, you've made a personal contact, and when a reporter needs information he's liable to come back. Any reporter is only as good as his sources, and that means you.

The title of this talk is listed as "Debunking the Myths: Sharks and the Media." But I'm not going to debunk any myths about sharks because I think you already know them. Instead, I'm going to show you a bit about how the media works so you can use it to debunk those myths yourself.

Unfortunately for debunkers, the most popular myth has a sound basis in fact. That's the man-eating shark. When most people hear the term, they don't think of the 306,125 mt (675 million pounds) of shark that people ate worldwide in 1984. Instead, they think of the approximately three dozen times annually that sharks attack humans.

And like it or not, the shark, particularly the great white, is the heir of the Moby Dick tradition. It's a huge, powerful, mysterious creature that rises from the ocean depths to crush human beings like nutshells. "Jaws" was born out of this, and of course it also enhanced it.

Even some of the minor parallels between "Jaws" and "Moby Dick" are striking. Conveniently, both the whale and the shark are white. In the book, Quint, the shark-fishing captain is killed by the shark after being caught in the harpoon line much as Ahab was strapped to Moby Dick. And the actor who played Quint in the movie must have taken his cues from Gregory Peck playing Ahab, though there was a lot of "snoose-chewing wild west bad guy" mixed in.

Our modern society is less well equipped to separate "Jaws" myth from fact than the "Moby Dick" readers were in the 1800s. Whaling was a common industry when "Moby Dick" was written. Everybody knew whales killed whalers, and residents of New England seacoast towns probably knew personally men who had died or at least been to sea. They probably knew enough to realize the whales didn't stalk men who had died or had been at sea. They probably knew enough to realize the whales didn't stalk man deliberately. But, we don't live that close to nature anymore. Look at the way the movie "Bambi" has cast a rosy, unrealistic glow over modern views of deer and hunting. That's the kind of influence something like "Jaws" can have on fears and myths concerning sharks.

The rarity of shark attacks and our lack of knowledge about sharks in general only fuels those fears and myths. That's reflected in the media's treatment of shark stories. By any definition, a shark attack is news. The fact that it is so rare only makes it more newsworthy. Can you imagine finding a story on page 4 of your July 3 newspaper that begins: "Approximately 350 people are expected to die during this year's July 4 holiday on the nation's beaches as a result of shark attacks. That's down from a high of 425 in 1976 before the 55 mph speed limit prevented so many people from getting to beaches more quickly...."

We see that kind of story every year for auto deaths. The difference is that after 50,000 every year we've become more immune. Whether it should be that way or not, auto deaths are somewhat old hat, just as whaling deaths probably were in the 1800s.

Further, shark attacks fall into the category of news story that Ben Bradlee, editor of the Washington Post, defines as the "holy shit" story. For those of you who never hear of Bradlee, he was the Jason Robards character in "All the President's Men." Anyway, that kind of story is one that makes you mutter you-know-what as you sip your morning coffee. Bradlee was mainly talking about investigative stories, like defense contractors billing the Pentagon for $650 wrenches, but the category is broader than that. There's no question that shark attacks can draw expletives from just about anyone.

Journalists are always looking for stories with that kind of impact, that kind of shock value. For a few years I was at the paper in Bend, a town of about 25,000 about 135 miles southeast of Portland, Oregon, across the mountains. Down there I worked with a guy who had a real nose for stories like that. Bend is a nice little town--hunting, fishing, skiing, logging, tourism, etc. Well, this guy found a Hell's Angels chapter there. But he always said his real ambition was to cover a shark attack in the Deschutes River.

I don't have to tell you that stories are sometimes played to give them more impact than they deserve. One of the best examples comes from my very own newspaper. The Bellevue Journal-American is a suburban daily with a circulation of 27,000 that tries to be lively and still reflect its conservative Republican readership. It used to be a lot more lively than it is. Since this example occurred, the management has changed, and this wouldn't get past the present high sheriffs. And I can't take any credit for this because I wasn't there at the time. For my career, that's probably fortunate.

Anyway, several years ago the paper ran a front-page five-column color photograph and story of a certain critter causing trouble for homeowners in our area. The photo of this critter had some small headlines on it that read: "They came from Canada with little warning....They can kill your grass in a matter of days....I didn't think it could happen to me, said one Redmond homeowner....But it did." And in three-inch-high red letters that looked like

the title credits to "The Blob" was the punch line--"Attack of the Lawn Killers."

The critter was an ordinary woolly caterpillar. They were pretty thick, I guess. If a caterpillar can rate that kind of treatment, the sky's the limit for a shark.

I think some of that shows up in a **Time Magazine** story that ran on November 19, 1984, called "Dangers of the Red Triangle." The story discusses an increase in great white shark attacks along the northern U.S. Pacific coast after Labor Day 1984. I've talked to a couple of people who were interviewed for the story who say that its slant is skewed, and some of its biological information is simply inaccurate. They say the real name of the area is the White Triangle, for great white sharks, not red for blood. They told **Time** that if there had been an increase in seals and sea lions in the area it would have been too recent to have allowed an increase in the birth and survival rate of shark young. They said sharks play a natural role in the environment and shark attacks are extremely rare. Their comments were stuffed into the last paragraph in a six-paragraph story. Oh, yeah--the photo with the story is a shark with its mouth open.

I suspect part of the problem with the story's treatment is that the information was gathered by a reporter in Los Angeles, but the story was written by an editor in New York. I suspect another problem--probably the major one--is that **Time** had a preconceived notion of the story they were looking for. They found at least one expert who backed up their notion, and the information that didn't jibe suddenly took a back seat. At least it did make it into the story.

Besides editor pressure, another place where slanting or outright errors can occur is headlines. It may come as a surprise to some of you that the reporters who write the stories don't get to write their own headlines. That's done by copy editors. They're the ones who decide how the stories will fit together and what size and length the headlines will be. Those headlines can vary depending who's writing them.

Let me give you some examples from a story by Hillary Hauser of the **Santa Barbara News-Press**. The story was sent out over the Associated Press wire and ran in a number of other papers. The original headline in the Santa Barbara paper said, "Is seal, sea lion boom luring more sharks?" That headline is a fair representation of what the story said.

Things deteriorated from there. One other paper's headline was in the ballpark: "More seals may mean more sharks."

Then came "Experts say seal population is drawing great white sharks....A growing debate over what causes white shark proliferation." And the worst, "Great white sharks infesting waters off Santa Barbara." By the way, "infesting" should be banned from use with the words "shark" and "waters." I've heard "shark-infested waters" so often I wonder if there's any other kind.

Headlines also can be just plain inaccurate. The one from my paper, which again I can't claim credit for, is the best example of that: "Sharks, seals harassing divers." The story's slant was on sharks. The seals harassing divers in addition to serving as shark food was a minor part.

I've spend a lot of time so far criticizing my own profession, but now I'm going to tell you that you have much less to worry about in talking to the media than you might think, and that its treatment of shark issues depends in large part on you.

The reason you have less to worry about is that despite what I've said, journalists have some of the higher ethical standards around. If they wanted to make money telling lies and screwing people over, they'd have gone into advertising. There are always arrogant, unscrupulous, incompetent people in any profession, but journalism has less than most fields. They want to report the news accurately and fairly, and they feel they have almost a sacred obligation to do so. They spend more time debating ethics and criticizing themselves than most professions.

The reason the media's treatment of shark issues depends largely on you is that a journalist is only as good as his sources. The more knowledgeable people he talks to, the better his information--and his story--will be. You're the sources.

So how do you go about it? First, by making contact, or by making yourself available when a reporter contacts you. And any newsworthy incident involving sharks is your window of opportunity.

A good example occurred in September 1985 north of Miami, Florida. Two kids went fishing in the Atlantic, and one apparently was eaten by a shark as he was swimming around the boat. At least that's what his companion said. The kid said he saw a fin, and the water was red with blood for five or 10 minutes after the shark pulled the alleged victim under.

Not likely, said a state marine patrol captain. Sharks generally attack from below so you don't see a fin. And blood dissipates in water extremely fast. The "victim" was found a couple of weeks later in Los Angeles, where he'd gone after stealing his girlfriend's car, jewelry and gasoline credit cards. He'd also taken out $200,000 in life insurance on himself made out to her, which she didn't know about.

The incident doesn't have to be an attack. If you're involved in shark research, or any trend involving sharks, that's a potential news story. Sid Cook's development of sport shark fishing along the Oregon coast has gotten several articles in newspapers in the area. Hillary Hauser's story is a good example of using scientific information--the increase of seals and sea lions followed by the increase in sharks--as the basis for a fair, well-balanced story.

Russell Sadler, a well-known Oregon commentator and columnist, once told a conference of wildlife biologists something I think is applicable here. "Don't think that because you're scientists and we're laymen that we're not interested in what you're doing," he said, or words to that effect. "Let me know when you think you've got something interesting. Help me do my job better."

When you're being interviewed, you can help yourself and the reporter in a couple of ways. Be prepared to explain things clearly in words anybody at a cocktail party could understand. Reporters have to deal with many topics on which they aren't experts. The more nontechnical you can make your explanations, the more chance you have of getting your points across. Welcome stupid questions. They insure nobody looks stupid in the story.

Speak slowly. Pause now and then. Give the reporter time to record what you're saying. Speak in shorter sentences. If you can say something that's short and clear, it has a better chance of being used as a direct quote just as you said it. Reporters prize good quotes. They tell the information, liven up stories, and hold the readers' interest.

Recognize that the process is probably going to involve your information being merged with information from other sources. It may be balances with people--even other experts--who don't agree with your point of view. Don't blame the reporter for that. If experts can't agree among themselves on technical, biological information, about all the reporter can do is present each side of the issue as fairly as he can. Sometimes, as with the **Time** article, that may not be done as fairly as it could have been.

Be accurate, and be aware of what you're saying. In researching this talk, I saw one expert quoted on shark attack behavior as saying that great white sharks rarely swim faster than three miles an hour, while a good human swimmer can swim four miles an hour. Maybe so, but not for many yards. I think I'm a good human swimmer. At least I competed in a one-mile open water swim two months ago that drew 700 people. If there had been a shark at the back of the pack, I'd have been eaten in the first quarter mile, along with a lot of other people. The winner's time was exactly 20 minutes, which I guess means he'd have been nipped at the finish.

Lastly, remember that a story is often put together under incredible deadline pressure. That's a problem for journalists as well as sources, but it isn't going to change. It's the nature of the business.

And it is a business. We're a public service, and we have an obligation to be accurate, responsible, helpful, and fair. But we also have to give our readers what they're willing to buy, because, if we don't, we won't be around. You'll never see a mainstream news organization going to the limits that something like NBC TV's "Ocean Quest" has and calling it journalism or documentary.

For those of you who don't watch television, that's the multipart mini-series where the divers wear chain mail suits and go into shark feeding frenzies, or try to provoke a great white shark into making an attack. That's pure sensationalism for profit. It probably will make a lot of profit. Evel Knievel has made a pretty good living doing things like that for years.

But at the same time, I think it's indicative of what the public will buy that the acknowledged best newspaper in the United States—and probably the world—isn't the circulation leader in its own home town. The **New York Times** has a daily circulation of about 900,000. The **New York Daily News**, a tabloid that would love to cover a shark attack in the Hudson River, has a daily circulation of 1.5 million.

This business side of journalism is something news people don't like to deal with. We want to report the news, not sell it, and that's what we try to do. But it does mean there may be some entertainment mixed in with the information. The goal is to keep the entertainment angle in perspective, to make sure that the information--the news—always comes out on top. We'll never be perfect, buy we'll usually be close. When it comes to sharks, we need your help.

Recent Advances in Protecting People from Dangerous Sharks

Dr. Bernard J. Zahuranec[1]
Oceanic Biology Program
Office of Naval Research
800 Quincy Street
Arlington, Virginia 22217

Abstact: Virtually everyone who goes into the ocean is afraid of shark attacks. Thus, there has always been great interest in protecting people from dangerous sharks. Passive protection in the form of repellents or barriers are the most practical for the average person. "Shark Chaser," a chemical repellent package developed by the U. S. Navy during World War II was the first successful repellent protection but was withdrawn from service in the 1970's because it lacked total effectiveness. New chemical repellents based on research into the milky secretions from a Red Sea flatfish, the Moses Sole, give promise of resulting in a truly effective shark repellent. For some specialized uses, where the high cost is warranted, a recently developed "chain mail" suit of stainless steel links or one incorporating high strength Kevlar may also provide effective passive protection.

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[1] For additional detailed information on this subject consult: Zahuranec, B., editor. 1983. Shark repellents from the sea. American Association for the Advancement of Science, Westview Press, Boulder, Colorado.