SHARK CARTILAGE

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Katrien Vandevelde

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Haaienkraakbeen geen medicinale invloed op arthritis
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BMAA neurotoxine ook in haaienkraakbeenpillen
Studie BMAA neurotoxine in vinnen en kraakbeen veroorzaken Alzheimer en ALS
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Could shark cartilage help cure cancer?

BY CHARLES W. BRYANT

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An Australian customs officer displays drying shark fins found on board a suspected illegal fishing boat near Darwin, Australia. See more shark pictures.
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Sharks have been swimming in the Earth's oceans for about 400 million years. They predate humans, dinosaurs and just about anything that walks, crawls or swims. The average shark lives to be about 25, and it's believed that some sharks can live up to 100 years or more. This places them next to the whale as one of the longest-living sea creatures. The fact that they have such a long lifespan has prompted a great deal of research into the secret to their longevity.

Sharks have been studied closely for more than 100 years, mainly because of their low likelihood of contracting disease. Fish with bones have a pretty high rate of growing tumors. For a long time, scientists believed that sharks were immune to cancer and tumors. So what makes sharks different? They don't have bones. Their skeleton is made up entirely of cartilage. This is one reason that shark teeth are collectible -- it's the only fossil you can find from dead sharks. Their cartilage dissolves over time, and nothing is left but the hard-enameled teeth. Many researchers think that this cartilage holds the secret to the cure for some human medical conditions -- namely cancer.

The shark-cartilage industry is booming, to say the least -- some statistics place earnings at about $25 million per year [source: McGraw Hill]. Most of this money comes from the sale of over-the-counter supplements and vitamins containing shark cartilage. You can walk into any health supplement store or browse the Internet and find dozens of shark-cartilage products. It's typically sold in powdered form or packaged in an oral capsule. It's estimated that 100 million sharks are killed every year by humans. We can't know for sure how many are killed for their cartilage, but the vast amounts of shark products on the market give us a pretty good idea.

But could sharks really help cure disease? And can they aid in the fight against cancer? We'll get to the bottom of these questions on the following page.

Shark Cartilage

A fisherman cuts the fins off of a shark at the fish market in Abobodoume. The fins of the shark are dried and then exported to Asian countries, notably China and Japan.
KAMBOU SIA/GETTY IMAGES

It was once believed that sharks didn't get cancer. Recent studies, including one conducted by Johns Hopkins University, have disproved those claims. Hopkins professor Gary Ostrander and his research team found 40 cases of tumors in sharks and other **elasmobranchs** -- sea creatures with skeletons made of cartilage instead of bones. Proponents of using shark cartilage for human medication claim that it helps prevent something called **angiogenisis**. This is when a tumor continues to grow because of the formation of new blood vessels.

That sharks can and do get cancer makes it clear that ingesting their cartilage in a health-food supplement won't cure the disease in humans. To verify this, researchers have undertaken specific studies on the effects of shark cartilage in cancer patients. Studies on mice and on humans in 1998 and 2005 found that taking an oral shark-cartilage supplement had no effect on cancerous tumors. Results indicated that it didn't prevent the spread of cancer to other organs either. The study also found that taking the supplements led to some gastrointestinal side effects like diarrhea, nausea and vomiting. Shark cartilage also contains mercury, something doctors warn against because of its negative effects on the brain and kidneys.

But that hasn't stopped people from taking it. The media is quick to jump on a "miracle cancer cure" and did just that in 1993 when a "60 Minutes" episode featured a book that touted the use of the cartilage, titled "Sharks Don't Get Cancer." Professor Ostrander characterized the book's research as "overextensions" of some early experiments with shark cartilage.

Ostrander acknowledges that shark cartilage could help fight tumors if the key elements of the cartilage were isolated and administered to the tumor itself -- but a lot of research needs to take place first in order to determine any positive correlations. So while shark-cartilage supplements won't cure cancer, there may be some things we can learn by studying the predator.

Some of this research is already being performed at the Mote Marine Laboratory's Center for Shark Research in Sarasota, Fla., with the help of Clemson and South Florida Universities. Sharks have a tremendous resistance to disease, and much of the Mote laboratory research is centered on their immune system.

Most animals produce disease-fighting cells in their bone marrow. There's a delay from the time the disease appears to when the cells are produced and sent out to fight the disease. Since sharks have no bones, they produce immune cells mainly in their spleen and thymus. The Mote research indicates that because of this, the shark's immune cells are more readily available in the bloodstream and the lag time is eliminated. Their antibodies are also the smallest in the animal kingdom and are more able to penetrate tissue and get to the disease faster.

Although there may not be any evidence to suggest that ingesting shark products can have an effect on our own immune systems, we may be able to learn more about how immune cells behave by studying sharks.

For more on sharks and cancer research, please visit the links on the next page.

FDA AND SHARK CARTILAGE

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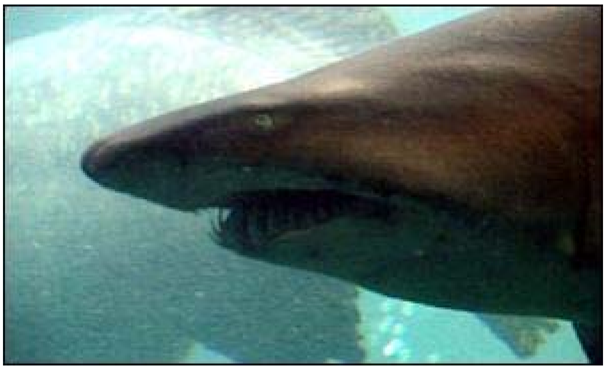
Shark cancer claims rubbished



Shark cartilage is not fully proven as a cancer treatment

Products made from shark cartilage should not be marketed as a "cancer cure", US experts say.

The market for shark cartilage has been fostered by the myth that sharks do not suffer from cancer, the American Association for Cancer Research conference was told.

In fact, according to scientists, sharks and related fish can develop a wide variety of benign and cancerous tumours.

They can even get cancers in the very cartilage being marketed as a cancer cure.

The research was carried out at the Johns Hopkins University and George Washington Univeristy in the US.

By looking at a register of tumours in animals, they found 40 cases of tumours in sharks and related animals like skates and rays.

Professor Gary Ostrander, Hopkins professor of biology and comparative medicine, said: "People are out there slaughtering sharks and taking shark cartilage pills based on very faulty data and no preventative studies to show that it works.

"That's not only giving desperate patients false hope based on misinterpreted data, it's also taking a top level predator out of an ecosystem, which could cause major disruptions."

Growing blood vessels

Advocates of shark cartilage say that it can hold back angiogenesis - which is a tumour's ability to help its growth by encouraging new

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blood vessels to form.

Cartilage naturally has few blood vessels, so scientists looking for natural chemicals in tissue which might hamper angiogenesis looked here.

And there is some evidence that shark cartilage can indeed slow down tumour growth.

However, Professor Ostrander said: "Chicken cartilage , human cartilage and all other kinds of tissue have anti-angiogenic factors in them.

"Yes, there may be some others in shark, but to suggest they will be a cure-all for cancer based on the available data is bogus."

The myth that sharks are not susceptible to cancer probably developed, he said, from the likelihood that sharks with tumours were far less likely to be caught.

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Cancer Research

Shark Cartilage, Cancer and the Growing Threat of Pseudoscience

Gary K. Ostrander, Keith C. Cheng, Jeffrey C. Wolf, et al.

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Review

Shark Cartilage, Cancer and the Growing Threat of Pseudoscience

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Abstract

The promotion of crude shark cartilage extracts as a cure for cancer has contributed to at least two significant negative outcomes: a dramatic decline in shark populations and a diversion of patients from effective cancer treatments. An alleged lack of cancer in sharks constitutes a key justification for its use. Herein, both malignant and benign neoplasms of sharks and their relatives are described, including previously unreported cases from the Registry of Tumors in Lower Animals, and two sharks with two cancers each. Additional justifications for using shark cartilage are illogical extensions of the finding of antiangiogenic and anti-invasive substances in cartilage. Scientific evidence to date supports neither the efficacy of crude cartilage extracts nor the ability of effective components to reach and eradicate cancer cells. The fact that people think shark cartilage consumption can cure cancer illustrates the serious potential impacts of pseudoscience. Although components of shark cartilage may work as a cancer retardant, crude extracts are ineffective. Efficiencies of technology (*e.g.,* fish harvesting), the power of mass media to reach the lay public, and the susceptibility of the public to pseudoscience amplifies the negative impacts of shark cartilage use. To facilitate the use of reason as the basis of public and private decision-making, the evidence-based mechanisms of evaluation used daily by the scientific community should be added to the training of media and governmental professionals. Increased use of logical, collaborative discussion will be necessary to ensure a sustainable future for man and the biosphere.

Introduction

Until this century, it was difficult to imagine that anthropogenic activities would endanger the existence of an entire class of animals in the open sea. A combination of efficient fishing technologies, susceptibility of the public to erroneous arguments, and the power of television to rapidly shape opinion has now contributed to depletions of shark populations measurable in 8 to 15 years (1). Layers of fallacious arguments, dissected below, have successfully convinced desperate cancer patients to buy ineffective products that distract them from proven or potentially useful therapies. These events comprise a wake-up call to find ways for our civilization to check negative impacts caused by combinations of poor reasoning and/or poor intentions with powerful technologies.

The direct causes of the drop in shark populations are potentially attributable to a combination of indiscriminate fishing and purposeful harvesting of sharks, primarily for their fins as food and for their cartilage as folk medicine. Crude cartilage extracts are sold as a nontraditional remedy for a variety of human ailments, including cancer. Here, we highlight the falsehoods and erroneous reasoning as justifications for using crude shark cartilage extracts to cure cancer. A primary justification for using crude shark cartilage extracts to treat cancer is based on the misconception that sharks do not, or infrequently, develop cancer. Other justifications represent overextensions of experimental observations: concentrated extracts of cartilage can inhibit tumor vessel formation and tumor invasions (*e.g.,* refs. 2–5). No available data or arguments support the medicinal use of crude shark extracts to treat cancer (6).

The claims that sharks do not, or rarely, get cancer was originally argued by I. William Lane in a book entitled "Sharks Don't Get Cancer" in 1992 (7), publicized in "60 Minutes" television segments in 1993, and reargued in another book in 1996 (8). The titles of the books do not match their texts in which the authors note that sharks actually get cancer but claim incorrectly that sharks rarely get cancer. We make three main points below: (*a*) sharks do get cancer; (*b*) the rate of shark cancer is not known from present data; and (*c*) even if the incidence of shark cancer were low, cancer incidence is irrelevant to the use of crude extracts for cancer treatment.

Materials and Methods

We examined tumors occurring among members of the Class Chondrichthyes, which includes the closely related sharks, skates, rays, and chimaeroids. Members of this class are considered by most specialists to have originated monophyletically in a straight line of evolutionary descent (9), and all chondrichthyans share at least 17 primary characteristics, including a cartilaginous endoskeleton devoid of bone-producing osteoblasts. Thus, although they have diverged in body form, they continue to share ancestral traits that establish scientific identity as chondrichthyans regardless of what they are commonly called.

Chondrichthyan neoplasms described in the literature were reviewed, and cases deposited in the Registry of Tumors in Lower Animals were examined. All cases were tabulated (Table 1) along with selected descriptive information. Obsolete or inaccurate scientific names were replaced with current names when this could be determined from the peer-reviewed literature or from consultations with taxonomists at the National Museum of Natural History, Smithsonian Institution (Washington, D.C.).

Three previously unknown cases of sharks presenting with tumors included two spiny dogfish sharks, *Squalas acanthias*, and one tiger shark, *Galeocerdo cuvier*. The spiny dogfish cases were received as formalin-fixed tissue specimens that incorporated the tumor masses. The masses were described and photographed as gross specimens. The tissues were then processed, embedded, microtomed, and stained according to routine histologic methods for the preparation of microscope slides. The tiger shark case was received as microscope slides, photographs, and a tentative evaluation (Thierry M. Work). The final diagnoses for all three cases were based on the consensus opinion of four pathologists who have expertise in medical, veterinary, or fish tumor pathology.

Results

A History of Known Shark Tumors. Because cartilage is most commonly extracted from organisms with cartilaginous backbones, we looked for tumors in the class Chondrichthyes, which includes the closely related sharks, skates, rays, and chimaeroids and share a common phylogeny (9).

Forty-two cases of malignant or benign chondrichthyan tumors were found in the literature and the Registry of Tumors in Lower Animals

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Table 1 *Neoplasias from class chondrichthyes in the collection of the Registry of Tumors in Lower Animals (RTLA) and/or in the literature*

Species	RTLA no.	Location	Diagnosis	Ref. no.
Order Chimaeriformes (chimaeras)				
Family Chimaeridae (ratfish)				
Spotted ratfish, *Hydrolagus colliei*	416	Puget Sound, WA	Myxosarcoma	19
Spotted ratfish, *Hydrolagus colliei*	3409	Vancouver Island, British Columbia, Canada	Olfactory neuroblastoma	
Order Lamniformes (mackerel sharks)				
Family Odontospididae (sand tiger sharks)				
Sand tiger shark, *Carcharias taurus*	3797	New England Aquarium, Boston, MA	Chromaffinoma	
Sand tiger shark, *Carcharias taurus*	6434	Sea World of Florida, Orlando, FL	Mucoepidermoid papilloma of the maxillary gingiva	61
Order Orectolobiformes (carpet sharks)				
Family Ginglymostomatidae (nurse sharks)				
Tawny nurse shark, *Nebrius ferrugineus*		Oceanaáio de Lisboa, Lisbon, Portugal	Osteoma	62
Order Carcharhiniformes (ground sharks)				
Family Carcharhinidae (requiem sharks)				
Blacktip shark, *Carcharhinus limbatus*	5950	Mirage Hotel aquarium, Las Vegas, NV	Cutaneous fibrosarcoma	
Blue shark, *Prionace glauca**		Black Sea	Hepatocellular carcinoma†	11, 12
Blue shark, *Prionace glauca*	7300	Off Montauk Point, Long Island, NY	Cholangiocarcinoma; mesothelioma	21
Bull shark, *Carcharhinus leucas*	212	Mote Marine Laboratory, Sarasota, FL	Cutaneous fibroma	18
Sandbar shark, *Carcharhinus plumbeus*‡	523	Gulf of Mexico, Sarasota, FL	Lymphoma, metastatic adenocarcinomas (unknown primary)	16, 17
Tiger shark, *Galeocerdo cuvier*	6887	Pacific Ocean, HI	Cutaneous fibroma	
Family Scyliorhinidae (cat sharks)				
Nursehound, *Scyliorhinus stellaris*§			Enteric adenoma/carcinoma	63
Nursehound, *Scyliorhinus stellaris*§			Cutaneous odontoma	64
Cat shark, *Scyliorhinus catulus*			Cutaneous epithelioma	15
Small-spotted cat shark, *Scyliorhinus canicula*			Cutaneous osteoma	65
Small-spotted cat shark, *Scyliorhinus canicula*			Cutaneous chondroma	65
Swell shark, *Cephaloscyllium ventriosum*	5207		Hypodermal lipoma	
Swell shark, *Cephaloscyllium ventriosum*		Florida Aquarium	Hepatic capsular fibroma	66
Family Triakidae (houndsharks)				
Dusky smooth-hound, *Mustelus canis*	4464	Atlantic Ocean off Cape Hatteras, NC	Epidermal papilloma	67
Order Squaliformes (dogfish sharks)				
Family Squalidae (dogfish sharks)				
Longnose spurdog *Squalus blainvillei*¶	938	Duck Cove, New Zealand	Neurofibroma	68
Spiny dogfish, *Squalus acanthias*	1221	Frenchman's Cove, ME	Choroid plexus papilloma	20
Spiny dogfish, *Squalus acanthias*	3144	North Atlantic Ocean	Chondroma, vertebral	
Spiny dogfish, *Squalus acanthias*	3172	North Atlantic Ocean	Renal carcinoma	
Spiny dogfish, *Squalus acanthias*			Fibroepithelial lip polyp	15
Spiny dogfish, *Squalus acanthias*‖		Pacific coast, Canada	Thyroid carcinoma	13
Shortspine spurdog, *Squalus mitsukurii*			Chondroma of lumbar vertebrae	69
Order Rajiformes (skates)				
Family Rajidae (skates)				
Gray skate, *Dipturus batis***		Rathlin-a-Milley, Ireland	Cutaneous melanoma, invasive	23
Gray skate, *Dipturus batis***		County Kerry, Ireland	Cutaneous melanoma	24
Gray skate, *Dipturus batis***		Dubh Artach Light, Scotland	Cutaneous melanoma, metastatic	24
Gray skate, *Dipturus batis*††		Plymouth, United Kingdom	Cutaneous fibrosarcoma	15
Thornback skate, *Raja clavata*	4738	Thames River estuary, United Kingdom	Epidermal papilloma	70
Thornback skate, *Raja clavata*			Cutaneous melanoma, invasive	25
Thornback skate, *Raja clavata*		Port Erin Bay, Ireland	Cutaneous melanoma, invasive	26
Thornback skate, *Raja clavata*		Fleetwood, United Kingdom	Cutaneous melanoma, metastatic	24
Thornback skate, *Raja clavata*			Cutaneous fibroma	24
Thornback skate, *Raja clavata*			Fibroma	10
Thornback skate, *Raja clavata*			Cutaneous myxofibroma	24
Thorny skate, *Amblyraja radiata*	636	North Atlantic Ocean	Seminoma	71
Twineye skate, *Raja miratelus*			Cutaneous hemangioma	22
Order Myliobatiformes (stingrays)				
Family Dasyatidae (whiptail stingrays)				
Red stingray, *Dasyatis akajei*	1851	Uneo Zoo Aquarium, Tokyo, Japan	Hepatocellular adenoma‡‡	71, 72
Stingray (species unknown)	6251	St. Lucie River System, FL	Melanocytic nevus	
Stingray, *Dasyatis* sp.			Subcutaneous fibrous hemangioma	73

* The common and scientific names have been updated (originally cited as sand shark, *Prionace glaucus*).
† Although the original publication documents an adenoma, subsequent reanalysis suggests that the lesion was actually a hepatocellular carcinoma as evidenced by the invasive margins. (J. Harshbarger and G.K. Ostrander, unpublished data.)
‡ The original report of this neoplasm (16) was of a reticulum cell sarcoma in a brown shark (*Carcharinus milberti*). The species name, common name and diagnosis were subsequently revised (17) as indicated.
§ Originally reported as *Scyllium catulus*.
¶ The original report incorrectly listed this individual as a spiny dogfish, *Squalus acanthias*.
‖ Originally reported as *Squalus sucklii*.
** Formerly known as the blue skate.
†† Orginally reported as a blue skate, *Raia macrorhynchus*.
‡‡ Originally reported as hepatocytic adenoma.

(Table 1). The tumors were widely distributed across at least 21 species in nine families among seven orders, including 24 sharks, 16 skates or rays, and 2 chimaeroids. Most of the animals were collected fortuitously from both offshore and inshore locations in the Atlantic and Pacific Oceans, and a few animals came from public aquaria. Tumors originating from the nervous, digestive, integumentary, excretory, hematopoietic, reproductive, skeletal, and endocrine systems were found, and at least 15 tumors were considered malignant based on invasion into normal tissue.

Chondrichthyan neoplasms have been known for >150 years. The first, described by Deslongchamps in 1853 (10), was a 30-cm pedunculated fibroma at the base of the tail of a thornback skate, *Raja clavata*. In 1908, a liver cell tumor diagnosed as an adenoma was

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reported in a blue shark, *Prionace glauca* (ref. 11, discussed in ref. 12). The lesion consisted of multiple, walnut-sized, white nodules, histologically resembling smaller-than-normal hepatocytes. Invasion by the neoplastic cells into normal hepatic parenchyma at the tumor's edge dictates a diagnosis of the malignant tumor, hepatocellular carcinoma, rather than adenoma.

A thyroid neoplasm was reported in one of 217 spiny dogfish sharks collected in the Straights of Georgia in 1913 and 1914 (13). The lesion had invaded through its capsule, and it was histologically described as ". . . solid cell masses taking the place of thyroid follicles and infiltrating interstitial tissue," consistent with poorly differentiated adenocarcinoma. By 1948, 16 neoplasms in chondrichthyans had been reported, of which at least 6, including 1 metastatic melanoma, were considered cancerous (12). Subsequently reported cases include a squamous cell carcinoma (then called epithelioma) in a cat shark, *Scyliorhinus catulus* (ref. 14, also reviewed by Wellings in ref. 15), a reticulum cell sarcoma in a brown shark, *Carcharhinus milbertii* [ref. 16, subsequently revised to a lymphoma in a sandbar shark, *Carcharhinus plumbeus* (17)], a fibroma in a bull shark, *Carcharinus leucas* (18), a myxosarcoma in a chimaeroid (*i.e.,* spotted ratfish, *Hydrolagus colliei*; ref. 19), and a choroid plexus papilloma in a spiny dogfish shark (20). It is, of course, impossible to confirm all of the old diagnoses without tissue sections. However, these shark and related chondrichthyan tumors, together with the new Registry of Tumors in Lower Animals cases described below, total 42. Two of these cases include animals that presented with two types of lesions (Table 1 and refs. 11, 12, 21). Other chondrichthyan cancers reported include a cutaneous fibrosarcoma in a gray skate, *Dipturus batis* (22), and melanomas in three gray skates (23, 24) and three thornback skates, *Raja clavata* (25, 26). In two of these six cases, the melanomas were metastatic, and in at least three others, the melanomas were locally invasive.

To additionally illustrate the existence of neoplasia in sharks, two of three previously unpublished shark tumors from the Registry of Tumors in Lower Animals are described below: a renal cell carcinoma and a chondroma. The renal cell carcinoma (RTLA case 3172) was received in 1984 as a 15-cm segment of dorsal body wall from a spiny dogfish shark containing a kidney with a tumor. Four masses, from 1.0- to 2.5-cm in diameter, protruded ventrally from the kidney (Fig. 1*A*). Two of the masses were centrally necrotic. The histologic features of this tumor, including invasion, high mitotic activity, poor differentiation, and necrosis (Fig. 1, *B* and *C*), are clearly consistent with malignancy and diagnostic of a well-differentiated adenocarcinoma of renal origin. The second tumor (RTLA case 3144) was collected in 1983 and submitted as a 13-cm section of vertebral column spiny dogfish shark with associated dorsal and lateral musculature (Fig. 1*D*). The neoplasm was a well-demarcated, 7 × 3.6-cm, geode-like hollow, oval mass attached to dorsal retroperitoneal tissue

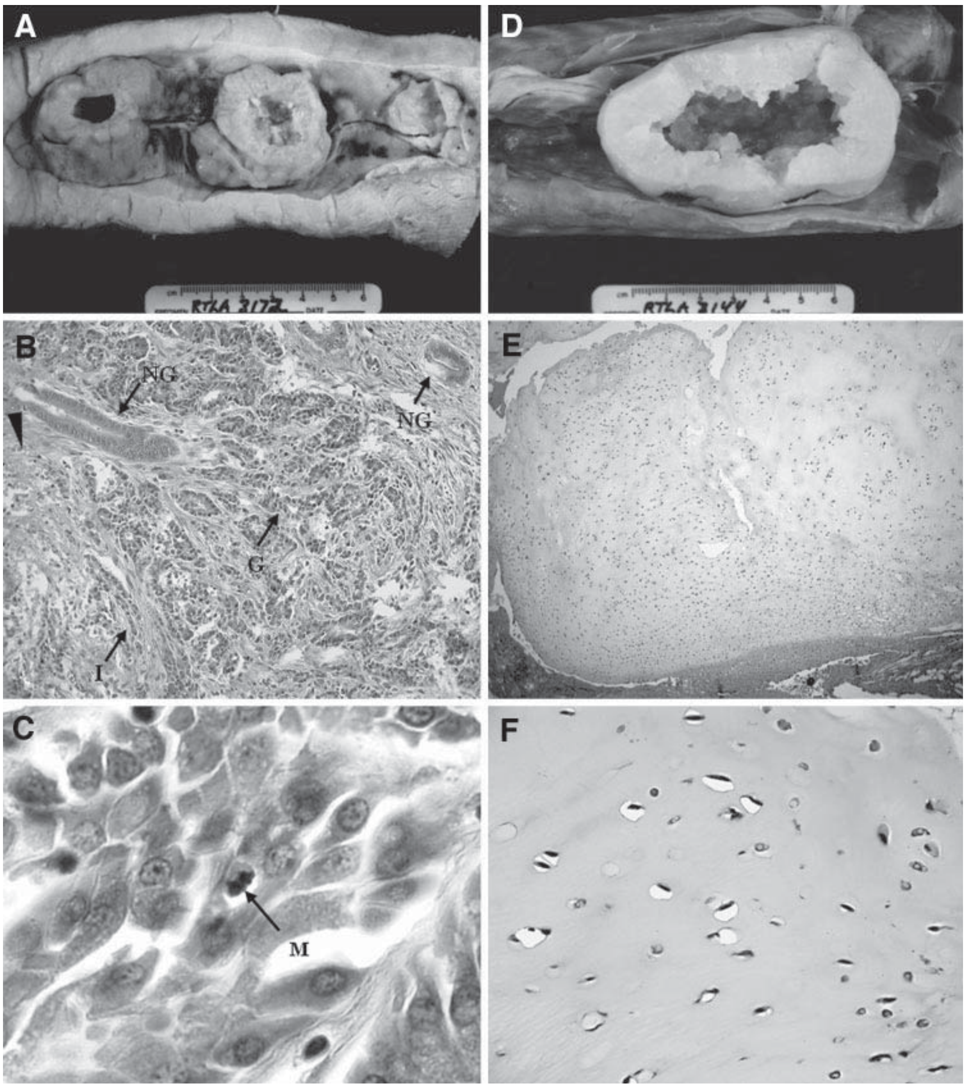

Fig. 1. A malignant kidney tumor (*A–C*) and a benign cartilage tumor (*D–F*) from spiny dogfish sharks (*Squalus acanthias*) found off the coast of Maine and donated to the Registry of Tumors in Lower Animals via the Maine Department of Natural Resources. *A–C*, a renal cell carcinoma from a RTLA case 3172 collected in 1984. *A*, ventral view of the submitted specimen, consisting of a 15-cm section of formalin-fixed skinless dorsal body wall with attached kidney. The masses protruded ventrally from the kidney and consisted of four contiguous, 1.0- to 2.5-cm masses of the same color and texture as normal kidney with confluent areas of necrosis. Sectioning revealed the hollow interior of the left and central masses (*A*). *B*, medium power view showing invasion of normal renal parenchyma. NG, normal glandular structures, most likely renal tubules. G, irregular glands formed by the tumor cells. I, rows of single malignant tumor cells invading stroma. *Arrowhead*, necrosis. The malignant cells contain similar pink refringent cytoplasmic bodies as in normal kidney tubules, consistent with renal origin (×200). *C*, high power view of renal carcinoma. M, mitosis (×1000). *D–F*, chondroma (RTLA case 3144). *D*, ventral view of the submitted 13-cm segment of dorsal body wall containing a 7.0 × 3.6 cm, oval, hollow mass projecting ventrally into the peritoneal cavity. The neoplasm was attached to the normal vertebral cartilage (data not shown). *E*, low power view showing the nodularity of the tumor. Compared with the normal cartilage, the mass has increased cellularity and a loosely fibrinous texture, and lacks the calcified perimeter apparent on normal vertebral cartilage (×50). *F*, high power view of the chondroma showing irregularly placed cartilage cells in an immature cartilagenous matrix (×500).

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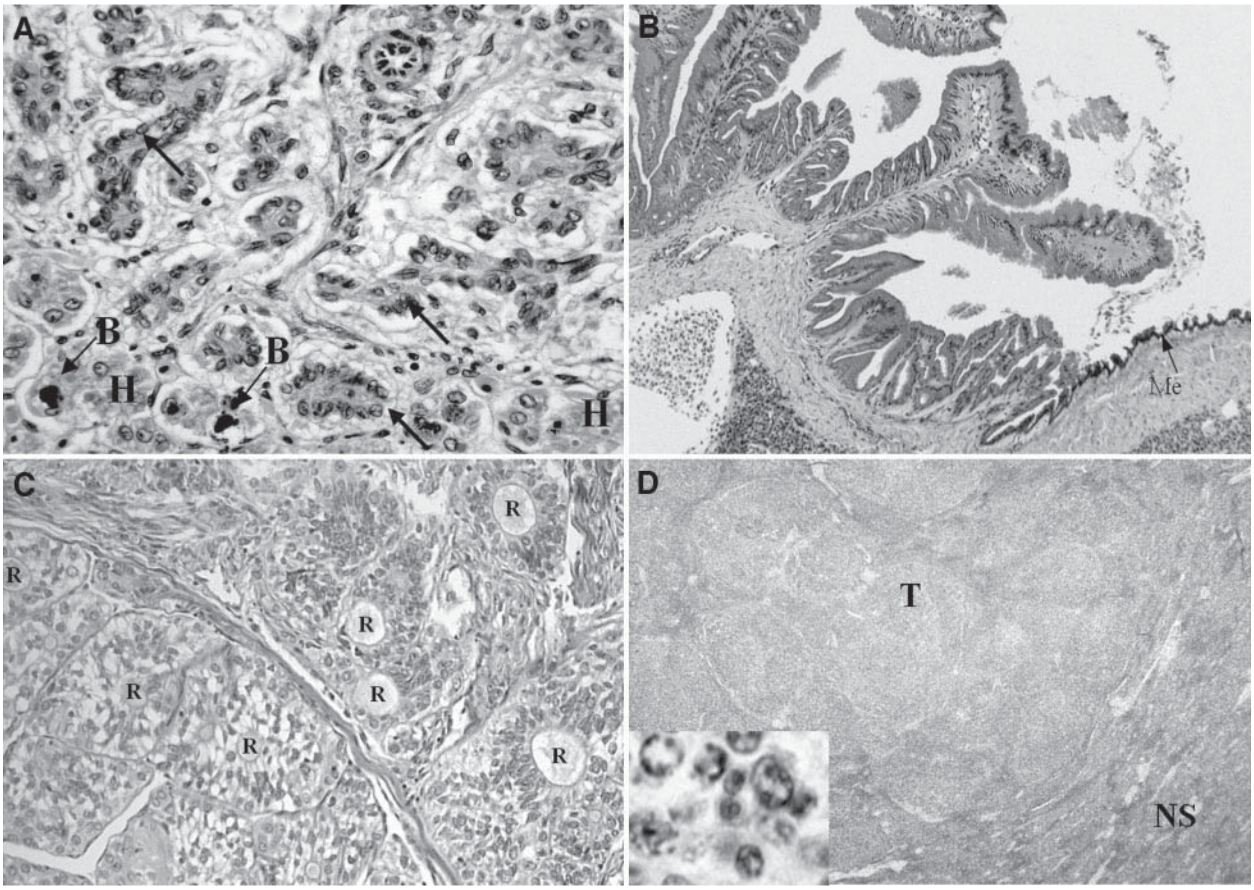

Fig. 2. Four other representative chondrichthyan malignancies. *A*, cholangiocarcinoma from a blue shark, *Prionace glauca* (RTLA case 7300). *Arrows*, malignant bile ducts; H, hepatocytes; B, bile accumulations in hepatocytes (×750). *B*, mesothelioma on the surface of the liver of the same blue shark as *A*. The tumor comprising the left two thirds of the image has a well-differentiated columnar epithelium in a convoluted, papillary architecture. Me, normal mesothelium (×25). *C*, olfactory neuroblastoma from the head of a spotted ratfish, *Hydrolagus collei* (RTLA case 3409). R, Rosette (×400). *D*, nodular (predominantly large cell) follicular lymphoma, grade 3, from a sandbar shark, *Carcharhinus plumbeus* (RTLA case 523), originally diagnosed as a reticulum cell sarcoma. T, tumor; NS, normal spleen (×25). *Inset*, ×800.

(vertebral column). The ventral part of the tumor had been removed, revealing 1- to 1.5-cm thick walls; why the center was missing is not clear. A central transverse section of the specimen showed that the mass was associated with the ventral surface of the vertebral cartilage (data not shown). The tumor appeared to arise from beneath the centrum and to pass through an interruption in the calcified perimeter of the vertebra. Microscopically, the tumor consisted of nodular masses of immature cartilage containing chondrocytes of varying density (Fig. 1, *E* and *F*). The histologic appearances of the tumor cells, together with the tumor's well-demarcated rather than invasive border, are consistent with a diagnosis of chondroma, a benign tumor of cartilage. Thus, sharks get cancer, and even their cartilage is susceptible to neoplasia.

A sampling of four chondrichthyan malignancies is shown in Fig. 2. These tumors include a cholangiocarcinoma of the liver of a blue shark (RTLA case 7300; Fig. 2*A*), a mesothelioma in the same blue shark (Fig. 2*B*), an olfactory neuroblastoma of a spotted ratfish (RTLA case 3409; Fig. 2*C*), and a nodular (predominantly large cell) follicular lymphoma, grade 3, of a sandbar shark (RTLA case 523; Fig. 2*D*), originally diagnosed with the outdated term, reticulum cell sarcoma. The invasive, nonpatent, immature bile ducts (Fig. 2*A*, arrows) in the cholangiocarcinoma had a myxoid matrix and invaded the hepatic parenchyma (livers cells; Fig. 2*A*, "H"). This particular tumor was present in a background of cirrhosis, indicated by focal fibrosis (data not shown), and bile deposition in many of the liver cells (Fig. 2*A*, "B"). The mesothelioma present on the surface of the liver of the same shark showed florid overgrowth of the mesothelium on large papillae (the left two thirds of Fig. 2*B*), which stands in stark contrast to the simple, flat, normal mesothelium (Fig. 2*B*, "Me") occupying the right third of the surface shown in Fig. 2. The olfactory neuroblastoma was an invasive, suprapalatal tumor consistent with olfactory origin, which showed formation of abundant rosettes (Fig. 2*C*, "R"). The lymphoma consisted of large, poorly differentiated cells arranged in large nodules visible at low power (adjacent tumor nodules occupy most of the center of Fig. 2*D* ("T") and are shown pushing on the normal splenic tissue, a small bit of which is shown at the bottom right of Fig. 2*D* ("NS"). The tumor cells have coarsely chromatin (Fig. 2*D*, inset). Remarkably, the same spleen contained a focus of metastatic adenocarcinoma (data not shown). The finding of two instances of sharks with two cancers each (RTLA 7300 and 523) provides particularly strong evidence that sharks can be highly susceptible to cancer because the same finding in man or mouse point immediately to the possibility of a genetic susceptibility to cancer or high carcinogen exposure. Taken together, these cases establish the susceptibility of chondrichthyans to cancers.[4]

[4] A third, previously unreported RTLA tumor (case 6887) was potentially a fibroma from a tiger shark found in the Pacific Ocean near Hana, Maui County, Hawaii. It was whitish, sessile, fibrous, 16-cm mass on the dorsal surface of the head. Microscopically, the neoplasm consisted of sparsely cellular fibrous tissue (data not shown). It was not possible to determine whether invasion had occurred because none of the histologic sections included normal tissue. The surface of the neoplasm was more cellular than the more myxoid central parts of the tumor. The location of this benign, well-differentiated fibroma suggested dermal origin. The low cellularity of this tumor is similar to that of fibroma of mice and marine turtles.

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Discussion

The evidence herein conclusively demonstrates that, as with other vertebrates, sharks and their relatives do develop both benign and malignant neoplasms. These tumors are analogous to their counterparts in other organisms, including bony fishes, rodents, and humans.

It is worth noting that neoplasms have also been reported in the more primitive cartilaginous jawless fishes. Examples of such neoplasms include a metastatic melanoma in a lamprey and an epizootic hepatocellular carcinoma in a hagfish, *Myxine glutinosa* (27). Likewise, neoplasms have been reported in a variety of evolutionarily advanced cartilaginous fishes such as lungfish, *Protopterus annectens* and *Protopterus aethiopicus* (28–30), paddlefish, *Polyodon spathula* (31), sturgeon, *Acipenser spathula* (32, 33), and bowfin, *Amia calva* (34). These are not all isolated cases, as indicated by epizootics of hepatocellular carcinoma in paddlefish from the Detroit River (35).

Shark Cancer Rates: Not Determined. Although shark cartilage distributors insist that sharks rarely get cancer, actual cancer rates in sharks have not been determined. Few neoplasms have been documented in chondrichthyans, possibly because, as primarily pelagic (open water) marine animals, they are exposed to a diluted level of environmental carcinogens (36). Consistent with this point is that tumors of pelagic bony fishes are as rare as those of chondrichthyans. In comparison, benthic (bottom-dwelling) bony fish that feed on the meiofauna of polluted waterways can have epizootic skin and liver neoplasms whose frequencies can exceed 50% (37, 38). In fact, of the ~150 reported epizootic neoplasms, all have occurred in fish from inland or coastal waters; none were from pelagic fish (*e.g.,* ref. 39).

The rare documentation of chondrichthyan neoplasms may also be due to the small number of tumors that reach investigators. Cancerous fish in open waters suffer from two synergistic disadvantages, including sparse shelter (seaweed, rocks, and/or coral) and the presence of large predators. Cancerous fish in open waters, including sharks, are thus more likely to be eaten by predators before being caught by man.

Perhaps the most compelling argument for the paucity of chondrichthyan neoplasms is that there have been no systematic tumor surveys of sharks. This is in sharp contrast to bony fishes, for which frequent tumor surveys have yielded the bulk of the known fish tumor cases (*e.g.,* ref. 39). The theory that many new chondrichthyan neoplasms would be found by systematic surveys is suggested by several examples: (*a*) James Johnstone, a Liverpool physician, solicited diseased specimens and reported four melanomas in a 3-year period; (*b*) the Maine Department of Natural Resources put out a call to fishermen for diseased specimens, yielding two neoplasms in spiny dogfish within a 6-month period; and (*c*) George Balazs of the National Marine Fisheries Service distributed a tumor solicitation form and received the tiger shark fibroma described in the present report. Beyond surveys, far fewer chondrichthyan specimens are available for examination from sportsmen and commercial fishermen compared with bony fish and shellfish. Neoplasia is commonly found among fish (39) and shellfish (40, 41) that have been methodically studied; this even holds true for other diverse invertebrates such as coral (42) and flatworms (36, 40). It is important that systematic surveys of shark cancer incidence be pursued. If tumor incidence in shark and other pelagic fish is indeed low, such studies would provide a baseline barometer for increases in cancer because of environmental contamination.

Finally, it remains possible that chondrichthyans have an innately low susceptibility to cancer. Such a finding could be due to a variety of factors relating to carcinogen metabolism or DNA repair. Differential susceptibility to carcinogens is well established in a broad spectrum of animal models, including certain species of fishes. For example, there is a high incidence of liver neoplasms among English sole, *Parophrys vetulus*, that reside in contaminated waterways in Puget Sound (43–45), whereas the incidence of liver tumors in starry flounder, *Platichthys stellatus*, from these same waters is comparatively low. The starry flounder is in the same family (Pleuronectidae) as the English sole, and the disparity in liver lesion incidences has been attributed to species-specific differences in hepatic xenobiotic-metabolizing enzymes (46). Differences in detoxification mechanisms that could contribute to low tumor prevalence have also been found among some chondrichthyans (47).

It has been argued that the failure to induce tumors in laboratory studies is additional evidence that sharks are resistant to tumors. In the primary study that forms the basis for these remarks, nurse sharks, *Ginglymostoma cirratum*, were fed maximum sublethal doses of aflatoxin B1 for up to 50 days without developing visible tumors (48). Concluding from this experiment that sharks are resistant to tumors is unjustified for two reasons. First, it is often difficult to optimize experimental carcinogenic protocols. For example, although English sole are highly susceptible to liver tumors in the wild, numerous efforts to establish tumors in laboratory studies by multiple investigators with a variety of protocols have proven unsuccessful. In addition, a 50-day postexposure period is not adequate for tumors to grow to detectable size in a cold-water species. Let us consider the most optimistic scenario in which a tumor is generated instantly upon carcinogen exposure. The doubling time of shark tumors, although not known, can be estimated from the temperature at which the sharks were kept (~21°C), the temperature at which mammalian cells grow (37°C), and the doubling time of mammalian cancers (25 hours). The temperature difference is ~16°C. We can expect that each 10°C temperature difference corresponds to a 2 to 3-fold difference in reaction rate (49), and a 16°C difference could result in about a 4-fold difference in cell division rate or ~100 hours. As such, a tumor mass would only reach a diameter of 0.16 mm in 50 days, too small to be obvious to the naked eye. The negative result in this experiment is therefore meaningless. We conclude that cancer incidence in sharks is impossible to establish based on present data and that there is no evidence that sharks are any less susceptible to cancer than bony fish from the same open ocean environment.

Even if Sharks Were Less Susceptible to Cancer. Even if sharks did show unusually low susceptibility to cancer compared with other organisms, this would not support the use of crude cartilage extracts to treat cancer. We know, for example, that there are bacterial proteins that allow other proteins to function in boiling hot environments (50). Does this mean that we should expect to survive in boiling water after eating crude extracts of those bacteria? Obviously, no. Those proteins would likely be cut into useless fragments by our digestive enzymes or denatured by the acidic environment of the stomach before entering our cells. Even if sharks were to show low susceptibility to cancer, we would need to know whether it is because of decreased exposure to carcinogens, increased immunity against cancer after it arises, or the presence of metabolic pathways that either decrease conversion of mutagens into their active forms or promote more efficient repair of DNA. Learning that a low susceptibility is due to low carcinogen exposure would not be new. Also, if the immunity of sharks to cancer is high, there is little hope of acquiring that immunity through ingestion of cartilage. If metabolic or repair pathways are different, who is to say whether sharks are exposed to the same mutagens as humans, or whether their set of metabolic pathways might be even less competent than ours in dealing with our mutagens? In conclusion, even if sharks are less susceptible to cancer, it is illogical to conclude that crude extracts of shark cartilage would be successful in curing cancer in humans.

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Shark Cartilage Contains Substances That Inhibit Tumor Angiogenesis and Invasion. Although its raw consumption is useless, cartilage contains substances that may be used against cancer. More than 30 years ago, Folkman (3) proposed that tumorigenesis could be inhibited, blocked, or even reversed by inhibiting angiogenesis. He also concluded that without neovascularization to provide nutrients, allow gas exchange, and remove wastes, tumors stop growing at a diameter of 0.5 to 1 mm (2). Since that time, antiangiogenic factors have been isolated from various sources, including cartilage from calves (4) and sharks (5). Similarly, it has been long observed that human cancer rarely invades cartilage (51). Some investigators attribute this phenomenon to the presence of collagenase inhibitors found in cartilage that have been found to inhibit invasion by cancer cells (52). Less interesting alternative explanations for rare lack of invasion of cartilage are its hardness (poor permeability of a solid matrix to cells) and the possibility that the low vascularity of cartilage makes it a less hospitable environment for growth of cancer cells and, in particular, the vascular tissue required for tumor growth.

The next logical steps in developing these anticancer components into modes of cancer therapy involve identification, purification, and characterization of these substances. The important questions to answer include: What are the key characteristics of these substances that cause their action? What are their potential toxicities? What are their effective routes of administration? What is the effectiveness of reaching the target tissue in any amount? What are their concentrations? What cancers are most effectively treated? Lane and others ignore these critical steps and suggest that consuming crude cartilage extracts by mouth or rectum can be curative of all cancers. It is notable that despite more than a decade of evaluation of shark cartilage, not a single controlled study has established any efficacy of crude cartilage extracts against cancer (6, 53).

Still Hope for Cancer Inhibitors. Despite the above arguments, it is possible that highly purified components of cartilage, including those from shark cartilage, may hold some benefit for the treatment of human cancers.

For example, squalamine, which is derived from stomach and liver of the dogfish shark, inhibited angiogenesis and solid tumor growth *in vivo* in phase I clinical trials that were initiated to evaluate the feasibility of this novel aminosterol for cancer treatment (54). This approach of carefully evaluating and testing components of cartilage or other tissues may ultimately prove beneficial. It should be noted that when unique, therapeutically valuable compounds are identified in any biological material, those compounds can be chemically synthesized or produced in microorganisms to avoid endangerment of species.

What Broader Lessons? The evidence of shark cancer presented here and discussion of the illogic behind the pursuit of shark cartilage therapies have implications beyond the reduction of shark populations and the misdirection of patients to ineffective cancer therapies. The successful sale of crude shark cartilage to the public represents a failure of our society to deal with pseudoscience. The stark contrast between the rigor of scientific peer review and the lack of any substantive review in the popular press underscores the failure of our educational and journalistic systems to ingrain the value of intellectual honesty or to promote the ability of the media and the public to think critically. The increased power of electronic media has increased the potential harm of pseudoscience, turning what would otherwise be quaint cultural curiosities into potentially serious societal and ecological problems. The growing power of our technologies and astoundingly effective means of electronic communication make it increasingly important to minimize the dangers of those technologies. Minimizing these dangers demands new competencies for societal leaders in scientific reasoning. Jean-Jacques Rousseau was not without merit when he argued in his 1750 prize-winning essay that science has a corrupting influence on society (55). Leaders in the scientific community have noted the need for effective communication between scientists and the public to counteract the tendency of overregulation caused by sensationalized discussions of issues such as cloning and bioterrorism (56, 57). Only through a reliance on reason will it be possible to fulfill the Baconian ideal of science for the benefit of man (58) without harming society or, at worst, destroying the ecosystem upon which life depends (59).

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Appendix

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Surfing the Net--information on the World Wide Web for persons with arthritis: patient empowerment or patient deceit?

M E Suarez-Almazor, C J Kendall and M Dorgan

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Surfing the Net — Information on the World Wide Web for Persons with Arthritis: Patient Empowerment or Patient Deceit?

MARIA E. SUAREZ-ALMAZOR, CHRIS J. KENDALL, and MARLENE DORGAN

ABSTRACT. ***Objective.*** In the past few years access to the Internet has become readily available. Patients are increasingly seeking and obtaining health information through the Internet, most often the World Wide Web (WWW). We assessed the content, authorship, and scope of the information available on WWW in relation to rheumatoid arthritis.

Methods. In an attempt to replicate use by the average person, a broad search of the Internet was conducted for the phrase "rheumatoid arthritis" using WebCrawler, a commonly used search engine. All the "hits" were critically assessed after visiting and collecting information from the respective Web sites in relation to relevance, scope, authorship, type of publication, and financial objectives.

Results. The search returned 537 hits. We evaluated 531 — 2 did not exist, 2 could not be contacted, one was not in English, and one required a membership to access. The 531 hits originated from 388 Web sites. Only 198 (51%) were considered to be relevant and 7 (2%) were of doubtful relevance. Thirty-four (17%) were posted by an individual, 57 (28%) by a nonprofit organization, 104 (51%) by a profit industry, and 10 (5%) by universities. Ninety-one (44%) promoted alternative therapies, the most common including cetyl-myristoleate, colloidal minerals, Pycnogenol, shark cartilage, and Tahitian Noni. Of the 107 sites with financial interests, 76 (71%) promoted alternative medicine. The first 100 hits only identified about a third of the nonprofit organizations or university owned Web pages.

Conclusion. Many sites easily accessed by consumers appear to be profit based companies advertising an alternative product claimed to be effective for many conditions. These findings emphasize the need for critical evaluation of Web site contents. (J Rheumatol 2001;28:185–91)

Key Indexing Terms:
RHEUMATOID ARTHRITIS WORLD WIDE WEB INTERNET ALTERNATIVE THERAPY

In the past few years access to the Internet has become readily available in developed countries. Patients are increasingly seeking and obtaining health information through the Internet, most often the World Wide Web (WWW). The advantages of disseminating information via the Internet are obvious. The Internet has doubled in size annually for the past 11 years. It is estimated that it is accessed by 150 million users[1]. Consumers and health professionals are using the Web in increasing numbers to locate and purchase goods, and also to access health information to assist them in medical decisions. For the provider of information the use of this medium is expedient, powerful, and inexpensive, and allows for change or substitution of contents on an ongoing basis. For consumers, access to the Web is also relatively inexpensive if they own a computer and user friendly, even for those with limited computer skills. Access to information can theoretically provide patients with enhanced skills for decision making processes and preference based choices. On the other hand, misleading or untruthful information can result in a false sense of knowledge and control.

According to a recent study by the Office of Research of the Online Computer Library Center (OCLC), it is estimated that there are about 3.6 million sites on the Web, with 2.2 million offering publicly accessible content[2]. Another recent study indicates that the publicly accessible Web contains roughly 800 million pages on more than 3 million servers[3]. Independent parties have seldom critically appraised health related contents. Nevertheless, the little information available suggests that the quality of health related Web sites is highly variable[4-6].

Patients with rheumatic disorders are among the most frequent seekers of alternative therapy[7-12], perhaps because of the

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chronic nature of their illness and the lack of curative therapies. These traits may also result in behaviors related to the retrieval of information other than that provided by "conventional" health professionals. We assessed the content, authorship, and scope of the information available on the Web for patients with rheumatoid arthritis (RA) by replicating a simple search strategy that a patient may use.

MATERIALS AND METHODS

An electronic search was conducted using WebCrawler, a commonly used search engine that allows natural language searching. WebCrawler was America Online's preferred search engine until November 1996, when it was bought by Excite, which runs it now as an independent engine. We selected WebCrawler for the study because it has a smaller index than other search engines, and provides less overwhelming results in general searches[13]. The search was broad in an attempt to replicate use by a typical patient: The phrase "rheumatoid arthritis" was searched with no restrictions or filters applied. All of the "hits" (Web pages) obtained with the search were critically assessed. Often several different Web pages from a single Web site were accessed. We assessed the page after visiting and collecting information from the associated site. The assessments were made by one author (CJK), and were crosschecked by another if the assessment was considered unclear (MSA). The following items were included in the review:

1. Relevance to patients with RA. We considered relevant those sites that included information about the clinical aspects of RA — signs and symptoms, etiology, diagnosis, treatment, or prognosis. Relevance was not judged in relation to the quality or accuracy of the data presented, only in relation to whether the information could potentially change the patients' perceptions, attitudes, and knowledge about their disease. Sites presenting only basic research facts with little clinical content were considered to be not relevant or of doubtful relevance. A limitation of this approach was that the relevance of the information was established by the authors and does not represent patient views. However, this first step was considered necessary since may of the sites were obviously unrelated to arthritis or clearly targeted a scientific audience.
2. Authorship (e.g., individual, organization, industry).
3. Type of publication (e.g., news, advertisement, research paper).
4. Scope and contents (e.g., disease targets, interventions). We categorized interventions into conventional or alternative based on the definition by Eisenberg[14] — "Medical interventions not taught widely at U.S. medical schools or generally available at U.S. hospitals".
5. Commercial/financial interests. We considered as financially driven those sites advertising or offering products for sale, or requesting unrestricted funds (e.g., donations).

Results were analyzed both for single hits (Web pages) and Web sites. Only English language sites were included. The search was conducted in May 1998, and the sites reviewed between May and September of the same year.

We also examined the order or rank of the hits in the search retrieval, comparing the median rank for the various features of interest such as authorship or financial interest. We also arbitrarily categorized the order of retrieval of the Web pages into 4 categories: (1) the first 20 hits; (2) hits 21 to 100; (3) hits 101 to 200; and (4) hits 201 to the end of the search. The purpose of this categorization was to examine the features of the most accessible sites compared to others retrieved at later stages. The frequency of specific characteristics such as authorship or content was examined for each category. In WebCrawler, as in other search engines, the ranking of the hits is based on indexing/relevance algorithms that consider a number of criteria such as whether the search terms are together or not, how early and how often they appear, whether they are in the title, links, etc.

RESULTS

The WebCrawler search resulted in 537 hits. Of these, 531 (99%) were evaluated, 2 did not exist, 2 could not be contacted, one was not in English, and one required a membership to access. The 531 hits were posted on 388 different Web sites. Of the 388 sites, 198 (51%) were considered to be relevant, 183 (47%) not relevant, and 7 (2%) of doubtful relevance. We considered for the assessment only the 286 Web pages and 205 Web sites classified as relevant or of doubtful relevance.

Table 1 shows the characteristics of the Web pages in relation to type of publication, diseases discussed, and content topics. One hundred thirty-seven pages (48%) were considered to be advertisements. Examining the diseases discussed

Table 1. Characteristics of the Web sites.

Web Pages (N = 286)*	n (%)	Web Sites (N = 205)	
Type of publication		Authorship	
Advertisements	137 (48)	Profit industry	104 (51)
Information sites	103 (36)	Nonprofit organization	57 (28)
Link pages	29 (10)	Individuals with no clear affiliation	34 (17)
News articles	22 (8)	Universities	10 (5)
Posting of research results	14 (5)	Financial Interest	
Recruiting sites for research	4 (1)	Primarily sold products	87 (42)
Chat locations	2 (< 1)	Sold products indirectly	16 (8)
Case study	1 (< 1)	Sought paid memberships	2 (1)
Site for support group	1 (< 1)	Asked for donations	2 (1)
Diseases discussed			
Rheumatoid arthritis only	23 (8)		
Arthritis	65 (23)		
Autoimmune disorders	6 (2)		
Various (arthritic and nonarthritic)	192 (67)		
Contents			
General information	124 (43)		
Conventional therapy	23 (8)		
Alternative therapy	131 (45)		
Uncertain	8 (3)		

* Total exceeds 286 — some Web pages were categorized under more than one type of publication.

in the Web pages, two-thirds covered a variety of arthritic and nonarthritic disorders and one-third contained information on arthritis or related diseases exclusively. Fifty-one percent of the pages offered general information or information on conventional therapies. Forty-six percent of the pages discussed only alternative therapies. Authorship and financial interests of the Web sites are also shown in Table 1. Profit driven industries or companies owned more than half the identified Web sites. About a third of the sites were posted by nonprofit organizations or universities. Individuals with no clear affiliation posted the additional sites (17%). Two-thirds of the sites had information about other diseases (arthritic and nonarthritic), and this was most common in sites discussing alternative therapies and those with clear financial interests.

Of 107 Web sites with financial requests, 87 (81%) sold products directly (overall, 42% of the sites were vendors); 16 (15%) promoted sales indirectly; the remainder requested memberships or donations. Figure 1 shows the proportion of Web sites with financial aims according to selected features. Seventy-two percent of the Web sites that had overt profit interests sold or advertised alternative therapies; of the sites discussing alternative therapies, over 80% had clear financial aims. The most common therapies promoted included cetylmyristoleate, shark cartilage, colloidal minerals, Tahitian Noni, Pycnogenol, and a variety of nutrients. About half the Web sites discussing conventional therapies also had financial aims such as promoting, advertising, or selling products.

We examined the order of presentation (ranking) of the hits in relation to the various characteristics of interest to examine what types of Web pages would be more readily retrieved. As expected, more relevant results were found earlier in the search. The median rank for relevant pages was 236, compared with 316 for nonrelevant hits. Examining authorship, there was a trend for nonprofit and schools sites being retrieved earlier — median rank respectively 174 and 154, compared with industries — median rank 239, and pages "authored" by individuals. When examining the rank according to contents, the lowest median rank was observed for pages discussing conventional therapies (median = 141), compared to a median rank for alternative therapies of 252 and for general information pages 235. No major differences were observed in the rank of hits with or without a financial interest — median rank for profit pages 229, and median rank for nonprofit pages 238. Figure 2 shows the relevance, authorship, financial interest, and contents of the hits categorized according to their rank in the search using the categories described in Materials and Methods (hits 1 to 20, hits 21 to 100, hits 101 to 200, and hits 200+). Although the majority of the sites posted by schools and nonprofit organizations were included within the earlier hits, many of these sites were retrieved in the bottom half of the search.

Figure 3 shows how many sites were retrieved or missed in the first 100 hits. We examined the first 100 hits under the assumption that most patients accessing the Web would only open a limited number of pages, and not all of those retrieved, since they exceeded 500. About 40% of the sites discussing conventional therapy and a third of the sites posted by nonprofit organizations or schools were identified in the first 100 hits.

DISCUSSION

We assessed the general features of Web sites that are readily available to patients with rheumatoid arthritis who access the World Wide Web through a commonly used engine. We tried to replicate access by a typical consumer, using a very broad search with no filters or restrictions. A more detailed and confined search strategy may have yielded different results. However, we hypothesized that most individuals probably use relatively simple terms when seeking information on the Net.

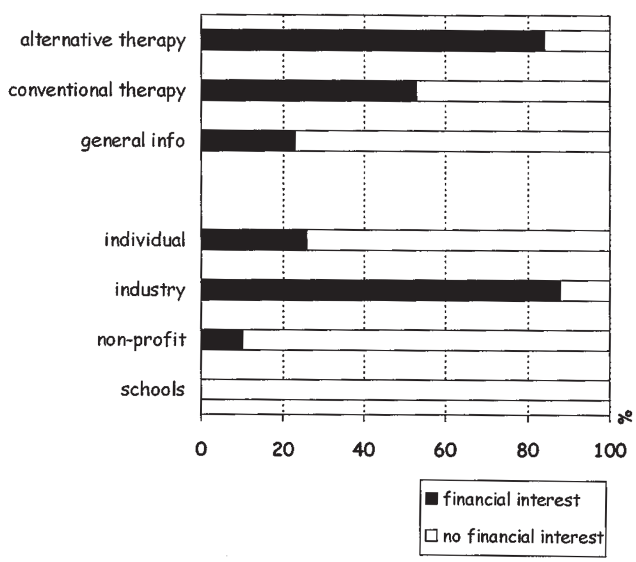

Figure 1. Web sites with commercial advertising or financial requests.

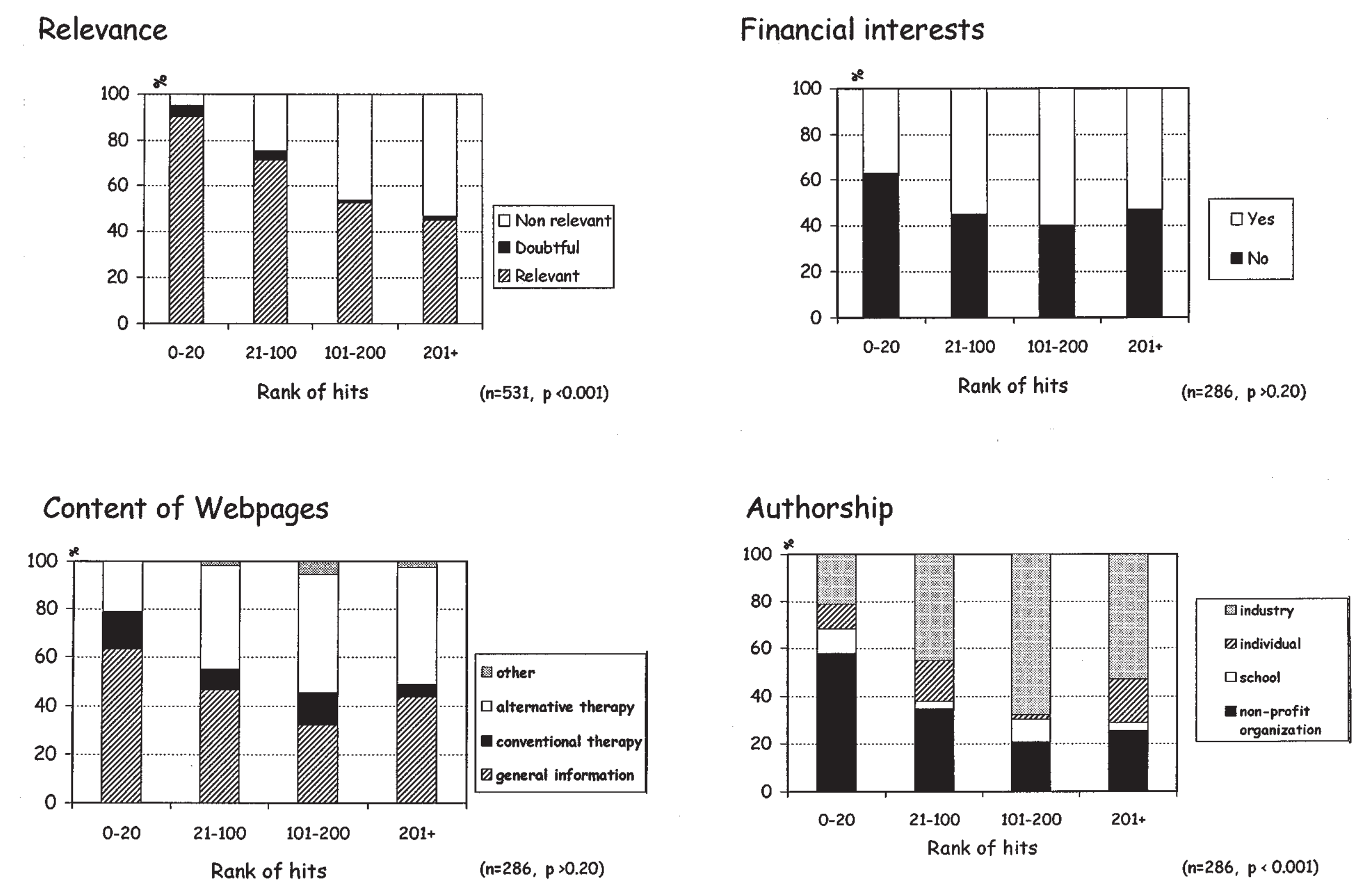

Figure 2. Relevance, contents, commercial interest, and authorship according to the ranking of hits.

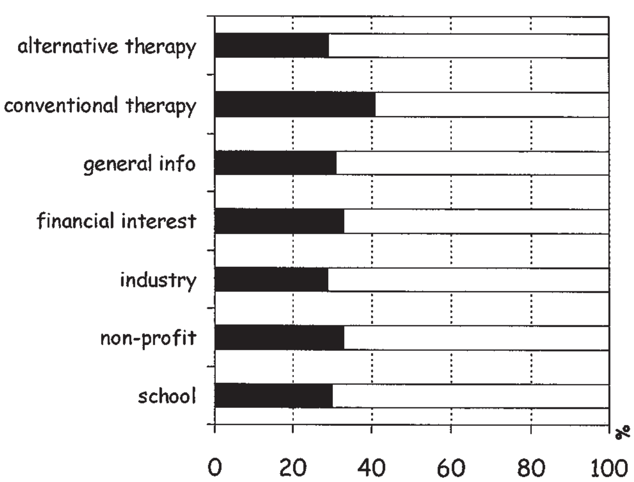

Figure 3. Proportion of sites retrieved in the first 100 hits according to selected features.

The first finding of interest was that about half the sites retrieved were judged to be of little relevance from a patient's perspective (low specificity). Hersh, *et al* examined the applicability and quality of the information on the Web to answer clinical questions, albeit from a clinician's perspective[15], and found that 89% of the retrieved pages were not relevant to the questions asked. In our study, although most of the relevant pages were retrieved in the first half of the search, a significant number of nonrelevant pages (about 25%) were found in the first 100 hits. The specificity of retrievals could probably be improved with a more restricted strategy, but this may result in a decrease in sensitivity with some relevant informative sites being missed. Sacchetti, *et al* compared search engines for the retrieval of urology related topics[16]. Yahoo identified 51 sites and Hotbot over 15,000. Although Yahoo reduced the number of irrelevant sites, it missed important sites, which were identified by HotBot, illustrating the tradeoff between sensitivity and specificity that can be expected. Our objective was not to evaluate the efficiency of alternative strategies or search engines and this point was not assessed any further.

A major concern with the information posted on the Web relates to the quality and accuracy of the data and recommendations provided. Impicciatori, *et al* assessed the reliability of 41 Web pages relating to the management of febrile children and compared the recommendations to published guidelines[4]. Only a few of the sites provided complete and accurate information. In a Web search on vascular surgery[17], most sites had non-useful or inaccurate information; moreover, the Joint Vascular Societies page was only identified as a tertiary link. Even more worrisome, McClung, *et al* reviewed 60 articles published by traditional medical sources on the treatment of childhood diarrhea and found that only 20% conformed to recommendations from the American Academy of Pediatrics[18]. On the bright side, a study evaluating 75 Web sites providing information on urinary incontinence found excellent information, and the most informative site was retrieved with several search engines[19]. In our review, only about a third of the sites were posted by nonprofit organizations or universities. Many nonprofit organization Web sites were retrieved early in the search, but many other sites were missed by the first hits, suggesting that patients may not access useful and informative sites if they fatigue after the first hits. As an example, The Arthritis Society site in Canada was retrieved 8th, the Arthritis Foundation 13th, the National Institute of Arthritis and Musculoskeletal and Skin Diseases of the National Institutes of Health 26th, the Cochrane Library 478th. A limitation of our study is that we did not critically appraise the content of the Web pages and we can only assume that the quality of the information in nonprofit sites is better than that provided by industry or individuals.

We found that over half the identified Web sites were owned by industries or companies that primarily sold products directly to the public. Nogler, *et al* reported similar results when attempting to obtain information specific to ankle and foot orthopedics[20]: 41% of the identified sites were commercially oriented and included advertisements. Another study using the word "rheumatology," which is more likely to be used by health professionals than patients, also found that of the sites directed to patients — only 16% of the total — about half contained advertisements[21]. In our study, over two-thirds of the sites with overt financial aims promoted the use of alternative therapy, often claiming that their products were effective for arthritis and other conditions. The use of alternative therapies has markedly increased in the past few years[3,13]. In the US, in 1990, alternative therapy expenditures reached $13.7 billion, exceeding hospitalization costs at $12.8 billion[14]. Many Web sites promoting conventional therapy also had financial interests in given products, or offered sales, which is an increasing trend, with both nonprescription and prescription therapies being sold through the Internet. About one-third of the general population and two-thirds of patients with chronic diseases use alternative therapies[7,8]. Most typically, in North America, Europe, and Australia, these individuals are Caucasian, female, 30 to 50 years old, and have higher education levels than nonusers. It could therefore be expected that many of them will have access to the Internet. Although some alternative therapies may be efficacious[22,23], most have not been adequately studied, and often, positive studies have major methodological flaws[23,24]. In rheumatic diseases, the few well conducted trials and systematic reviews have not shown clear efficacy[25-28]. The most common therapies advertised in the sites retrieved by our search included cetyl-myristoleate, shark cartilage, colloidal minerals, Tahitian Noni, and Pycnogenol. None of these substances has been proven to be beneficial for the treatment of arthritis. Most of these therapies may be innocuous in their biological actions, but there are some concerns about overall safety, in relation both to the expected contents of the product and to undeclared substances[29-32]. Interestingly, there is a report of acute renal failure from wormwood oil purchased through the Internet[33].

The Web provides an easy, accessible medium for a substantial proportion of patients with chronic disease to access health information. One study evaluating the motivation and expectations of patients seeking tele-advice through a university hospital dermatology Web site found that most patients had chronic disease, and were seeking a second opinion; 17% were unsatisfied about previous encounters with live physicians[34]. As an additional concern, a review of the readability levels of selected patient education material on the Web showed an average reading level at 10th grade (Flesch-Kinkaid), which is considered too difficult for a large proportion of the population[35]. If accurate information provided in a Web site is not comprehensible, it will not conform to patients' expectations. In our study, a substantial number of sites (17%) were posted by individuals with no clear affiliation. Often these sites were patient based, with individuals recounting their experiences with arthritis. Culver, *et al* reported that in an online discussion group for sufferers of painful arm and hand conditions, 89% of the messages providing medical information were authored by individuals without professional medical training, and about a third provided "unconventional" information[36]. It is unknown whether this sharing and exchange of information may result in any beneficial outcomes. It can be theorized that positive, personal information from their peers can perhaps improve patient's self-efficacy by providing social support[37,38]. A randomized controlled trial compared HIV positive patients who were provided in-home access to a computerized system (CHESS) with a control group[39]. CHESS provided information, decision support, and access to experts and other patients. Users reported an improvement in quality of life, less time spent in ambulatory visits, fewer and shorter hospitalizations. Whether the benefits were related to increased information, expert access, or peer support cannot be clearly established. Patients and health care providers should also be aware that the Internet provides fertile grounds for individuals with "Munchausen" type disorders who imagine fictitious illnesses in order to gain attention and sympathy from others[40,41].

Most of the larger search engines such as AltaVista, Northern Light, Excite, and Google include a ranking of relevance or quality. Jadad, *et al* identified and reviewed rating instruments to evaluate Web sites providing health information[6]. Although a number of instruments were found, none of them provided information on their performance as measured by their reliability and validity. Many of these scales feature sites with "seals of approval," "best of the Web," etc., often with visual ordinal scales — for instance 0 to 3 stars. Consumers may place faith in these assessments but it is unclear how many of these are derived, and whether they are performed by independent third parties[6]. Many of these ratings are based on graphic quality, ease of use, and interactivity, but it is otherwise unclear how the health contents are assessed. Several methods have been proposed to improve the accuracy and quality of health information in the Net including better labeling, creation of directories, and filtering[42-44]. Since the Web allows easy posting of information by individuals, it may be impossible to monitor the quality of new sites on an ongoing basis without substantial resources. Nonprofit organizations have started to provide lists of reliable sites that can be made readily available.

Our findings suggest that most of the health information on the Web available to patients with arthritis about their disease is profit driven, and produced by companies or individuals with no clear affiliation. These findings emphasize the need for critical evaluation of health information in the Internet. We encourage physicians to openly discuss Web contents and specific sites with their patients, and to provide addresses of Web sites with reliable, evidence based data. Additional research is required to explore the effects of exposure to this information on patients' attitudes, expectations, behaviors, and outcomes.

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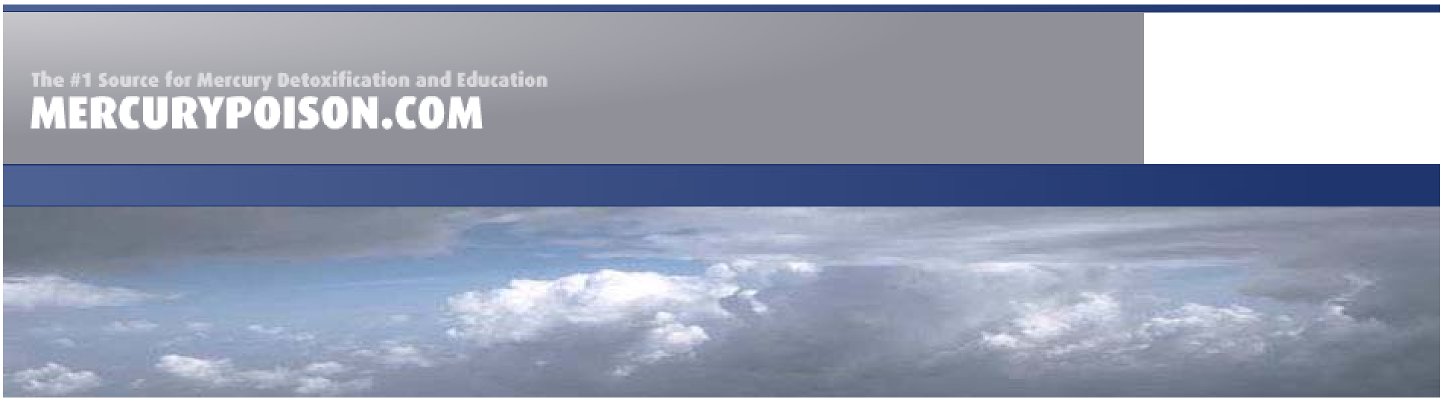
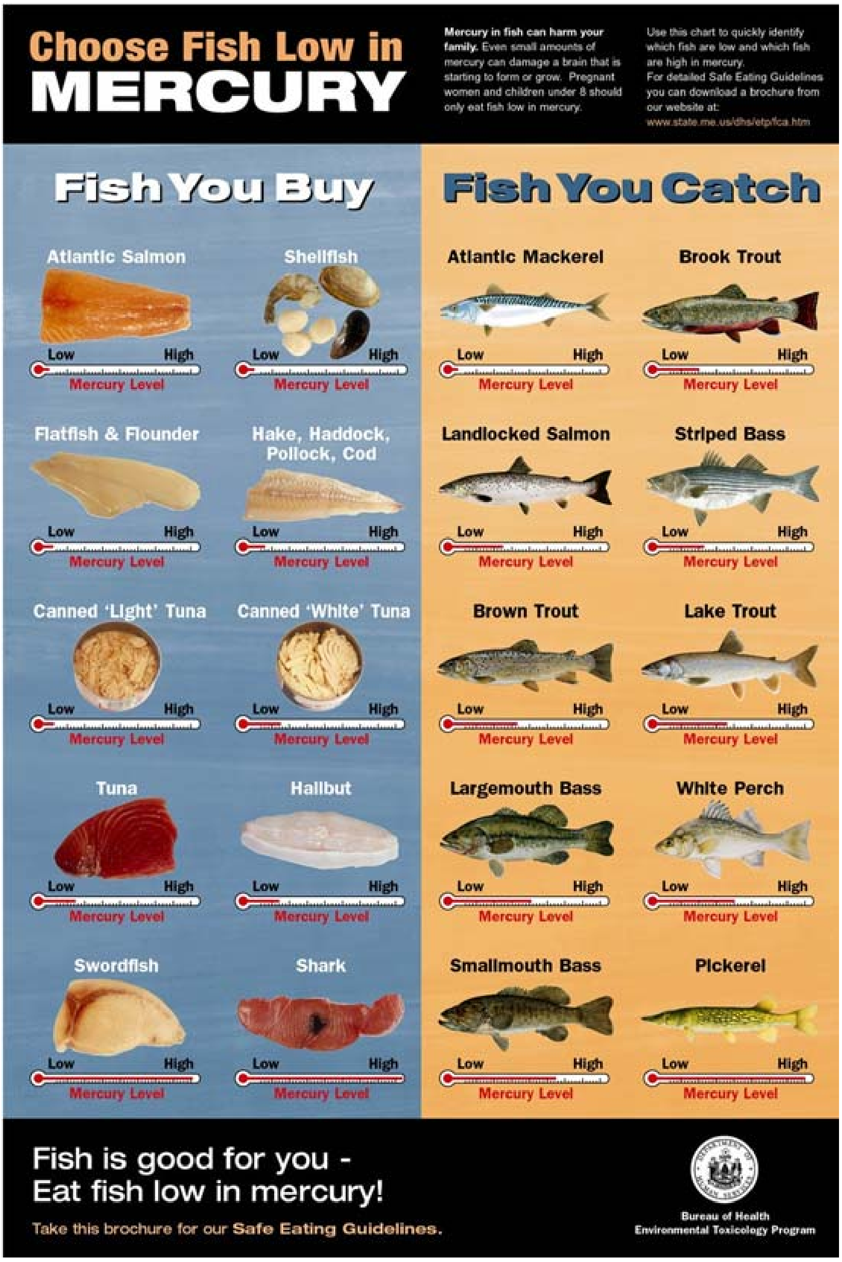


Mercury Poisoning Fish List

The following charts show the level of mercury poisoning in fish. It includes fish high in mercury like swordfish, shark, small mouth bass, pickerel, and those considered lower in mercury like shellfish, mackerel, shrimp, scallops, talapia and whitefish.

Please note that many believe that white tuna or albacore is higher in mercury poisoning than the charts show.


Choose Fish Low in
MERCURY
Mercury in fish can harm your family. Even small amounts of mercury can damage a brain that is starting to form or grow. Pregnant women and children under 8 should only eat fish low in mercury.
Use this chart to quickly identify which fish are low and which fish are high in mercury.
For detailed Safe Eating Guidelines you can download a brochure from our website at:
www.state.me.us/dhs/etp/fca.htm
Fish You Buy
Atlantic Salmon
Shellfish
Flatfish & Flounder
Hake, Haddock, Pollock, Cod
Canned 'Light' Tuna
Canned 'White' Tuna
Tuna
Halibut
Swordfish
Shark
Fish You Catch
Atlantic Mackerel
Brook Trout
Landlocked Salmon
Striped Bass
Brown Trout
Lake Trout
Largemouth Bass
White Perch
Smallmouth Bass
Pickerel
Low High
Mercury Level
Fish is good for you -
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for more information about mercury and fish.

- Learn about mercury and its effects
- Know how mercury gets into your home and food
- Sign up to take action to protect yourself and your family

Test your mercury levels on our online calculator

LEAST MERCURY

Anchovies
Butterfish
Catfish
Clam
Crab (Domestic)
Crawfish/Crayfish
Croaker (Atlantic)
Flounder*
Haddock (Atlantic)*
Hake
Herring
Mackerel (N. Atlantic, Chub)
Mullet
Oyster
Perch (Ocean)
Plaice
Pollock
Salmon (Canned)**
Salmon (Fresh)**
Sardine
Scallop*
Shad (American)
Shrimp*
Sole (Pacific)
Squid (Calamari)
Tilapia
Trout (Freshwater)
Whitefish
Whiting

MODERATE MERCURY

EAT SIX SERVINGS OR LESS PER MONTH:

Bass (Striped, Black)
Carp
Cod (Alaskan)
Croaker (White Pacific)
Halibut (Atlantic)*
Halibut (Pacific)
Jacksmelt (Silverside)
Lobster
Mahi Mahi
Monkfish*
Perch (Freshwater)
Sablefish
Skate*
Snapper*
Tuna (Canned chunk light)
Tuna (Skipjack)*
Weakfish (Sea Trout)

HIGH MERCURY

EAT THREE SERVINGS OR LESS PER MONTH:

Bluefish
Grouper*
Mackerel (Spanish, Gulf)
Sea Bass (Chilean)*
Tuna (Canned Albacore)
Tuna (Yellowfin)*

HIGHEST MERCURY

AVOID EATING:

Mackerel (King)
Marlin*
Orange Roughy*
Shark*
Swordfish*
Tilefish*
Tuna (Bigeye, Ahi)*

***Fish in Trouble!** These fish are perilously low

The following tables provide the mean and range of mercury levels in a variety of fish and shellfish.

Table 1
Fish With Highest Mercury Levels

SPECIES	MEAN (PPM)	RANGE (PPM)	NO. OF SAMPLES
Tilefish	1.45	0.65-3.73	60
*Swordfish	1.00	0.10-3.22	598
King Mackerel	0.73	0.30-1.67	213
*Shark	0.96	0.05-4.54	324

Table 2
Fish and Shellfish With Much Lower Mercury Levels

SPECIES	MEAN (PPM)	RANGE (PPM)	NO. OF SAMPLES
Grouper (Mycteroperca)	0.43	0.05-1.35	64
Tuna (fresh or frozen)	0.32	ND-1.30	191
Lobster Northern (American)	0.31	0.05-1.31	88
Grouper (Epinephelus)	0.27	0.19-0.33	48
Halibut	0.23	0.02-0.63	29
Sablefish	0.22	ND-0.70	102
Pollock	0.20	ND-0.78	107
Tuna (canned)	0.17	ND-0.75	248
Crab Blue	0.17	0.02-0.50	94
Crab Dungeness	0.18	0.02-0.48	50
Crab Tanner	0.15	ND-0.38	55
Crab King	0.09	0.02-0.24	29
Scallop	0.05	ND-0.22	66
Catfish	0.07	ND-0.31	22
Salmon (fresh, frozen or canned)	ND	ND-0.18	52
Oysters	ND	ND-0.25	33
Shrimps	ND	ND	22

Table 3
Fish With Methylmercury Levels Based on Limited Sampling

Data presented in Table 3 are based on limited sample sizes and therefore have a much greater degree of uncertainty

SPECIES	MEAN (PPM)	RANGE (PPM)	NO. OF SAMPLES
Red Snapper	0.60	0.07-1.46	10
Marlin	0.47	0.25-0.92	13
Moonfish	0.60	0.60	1
Orange Roughy	0.58	0.42-0.76	9
Bass Saltwater	0.49	0.10-0.91	9
Trout Freshwater	0.42	1.22 (max)	NA
Bluefish	0.30	0.20-0.40	2
Croaker	0.28	0.18-0.41	15
Trout Seawater	0.27	ND-1.19	4
Cod (Atlantic)	0.19	ND-0.33	11

Mahi Mahi	0.19	0.12-0.25	15
Ocean Perch	0.18	ND-0.31	10
Haddock (Atlantic)	0.17	0.07-0.37	10
Whitefish	0.16	ND-0.31	2
Herring	0.15	0.016-0.28	8
Spiny Lobster	0.13	ND-0.27	8
Perch Freshwater	0.11	0.10-0.31	4
Perch Saltwater	0.10	0.10-0.15	6
Flounder/Sole	0.04	ND-0.18	17
***Clams**	ND	ND	6
Tilapia	ND	ND	8

From Medscape Medical News > Neurology

Neurotoxin in Shark Fins: A Wider Threat?

Megan Brooks
Authors and Disclosures

March 30, 2012 — An analysis of fin clips from sharks in Florida waters found high concentrations of a neurotoxin that has been linked to neurodegenerative diseases, including Alzheimer's disease, amyotrophic lateral sclerosis (ALS), and parkinsonism dementia.

The neurotoxin, β-N-methylamino-L-alanine (BMAA), is produced by cyanobacteria, also known as blue-green algae.

Deborah C. Mash, PhD, from the University of Miami Miller School of Medicine, Florida, who worked on the study, said the concentrations of BMAA in the samples are a "cause for concern," not only in shark fin soup, considered a delicacy in Asian cuisine, but also in dietary supplements and other forms of shark cartilage ingested by humans.

Their report was published online February 21 in the journal *Marine Drugs*.

However, the risks of exposure to this neurotoxin may go beyond shark products. Commenting on these findings, Frederick L. Tyson, PhD, from the National Institute of Environmental Health Sciences (NIEHS), Research Triangle Park, North Carolina, points to "other routes of BMAA exposure that we should be concerned about."

Dr. Deborah C. Mash

"People are exposed to it in fresh water systems," Dr. Tyson, who was not involved in the shark study, said in a telephone interview with *Medscape Medical News*. "It's blue-green algae, so there certainly is dermal exposure and the possibility of ingesting it while you are in the water."

"The other concern is that it does accumulate in crop plants so if you have crops that are being irrigated by reservoirs or dam systems or whatever that have a high cyanobacterial biomass there is potential there for some human risk as well," he added.

Sharks Bioaccumulate BMAA

Dr. Mash and her colleagues sampled fin clips from 7 different species of sharks in the waters off the South Florida coast: blacknose, blacktip, bonnethead, bull, great hammerhead, lemon, and nurse sharks. They detected BMAA in the fins of all species examined, with concentrations ranging from 144 to 1836 ng/mg wet weight.

"Sharks, because they are long-lived, bioaccumulate environmental toxins over the lifespan, just like humans," Dr. Mash told *Medscape Medical News*. "Sharks have mercury levels that are elevated and our work shows a second neurotoxin — BMAA."

"It's been suggested," Dr. Tyson said, "that BMAA can bioaccumulate in nerve cells that are not going to reproduce so it doesn't get cleared."

The concentrations found in shark fins overlap with the concentrations the researchers observed previously http://www.ncbi.nlm.nih.gov/pubmed/19254284 in postmortem brain tissue from patients who died with sporadic Alzheimer's disease and ALS.

The BMAA concentrations in shark fins also mirror the BMAA levels found in fruit bats in Guam. The fruit bats accumulate BMAA from their diet of cycad seeds. Ingestion of fruit bats has been linked to severe ALS and parkinsonism dementia in indigenous people of Guam.

Association Merits Further Research

Dr. Mash told *Medscape Medical News*, "Further work is needed to determine the risk to human health."

Dr. Tyson agrees. "Research has shown an association between BMAA and neurodegenerative disease," he said, "but there is no hard data that it's causal. No one has made a mechanistic connection."

"It does merit research in terms of how much of a human risk it poses, but the jury is still out until we can show some kind of mechanistic connection at least in animal models and we have some applications (at NIEHS) that are certainly asking those questions," Dr. Tyson added.

The study was funded through a donation from the Herbert W. Hoover Foundation. The authors and Dr. Tyson have disclosed no relevant financial relationships.

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Article

Cyanobacterial Neurotoxin β-*N*-Methylamino-L-alanine (BMAA) in Shark Fins

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Abstract: Sharks are among the most threatened groups of marine species. Populations are declining globally to support the growing demand for shark fin soup. Sharks are known to bioaccumulate toxins that may pose health risks to consumers of shark products. The feeding habits of sharks are varied, including fish, mammals, crustaceans and plankton. The cyanobacterial neurotoxin β-*N*-methylamino-L-alanine (BMAA) has been detected in species of free-living marine cyanobacteria and may bioaccumulate in the marine food web. In this study, we sampled fin clips from seven different species of sharks in South Florida to survey the occurrence of BMAA using HPLC-FD and Triple Quadrupole LC/MS/MS methods. BMAA was detected in the fins of all species examined with concentrations ranging from 144 to 1836 ng/mg wet weight. Since BMAA has been linked to neurodegenerative diseases, these results may have important relevance to human health. We suggest that consumption of shark fins may increase the risk for human exposure to the cyanobacterial neurotoxin BMAA.

Keywords: β-*N*-methylamino-L-alanine; neurotoxin; neurodegenerative disease; cyanobacteria; elasmobranch; conservation

1. Introduction

Sharks are apex predators in virtually all marine environments and impact ecosystem structure and function through trophic cascades [1,2]. However, shark populations are experiencing global declines as a result of over-fishing, largely driven to support the burgeoning shark fin trade [3–5]. A minimum of 26 to 73 million sharks per year, representing a combined weight of 1.7 million tons are killed in both target and bycatch fisheries to support the high demand for fins in Asian markets [6]. High exploitation rates continue to increase annually driven by the rising demand for highly prized fins used to make shark fin soup, an Asian delicacy and one of the world's most expensive fishery products [7]. Shark fins consist of cartilage with fibrous protein collagens that add texture and consistency to the soup. The larger the fin and higher fin needle content (collagen fibers), the more expensive the soup. Sharks accumulate mercury and other heavy metals [8] that pose health risks to consumers of shark products, including shark fin soup.

The neurotoxin BMAA is produced by diverse species of free-living cyanobacteria found in terrestrial and aquatic environments [9] and cyanobacterial symbionts [10]. BMAA has been linked to the development of neurodegenerative brain diseases, such as Alzheimer's disease and Amyotrophic Lateral Sclerosis (ALS) [11,12]. Cyanobacteria are found in lakes, rivers, estuaries, and marine waters with bloom growth increased due to nutrient loading from agricultural and industrial runoff, farm animal wastes, sewage, groundwater inflow and atmospheric deposition [13]. The occurrence of BMAA has been reported in isolated cyanobacteria from waters in the Baltic Sea [14], China [15], Holland [16], South Africa [17], British Island [18], and Peru [19] as well as in laboratory cultures of free-living marine cyanobacteria [20].

BMAA has been measured in high concentration in marine fish and invertebrates collected from South Florida coastal waters [21] and the Baltic Sea [14]. Given the ubiquity of cyanobacteria in marine ecosystems, BMAA could bioaccumulate up the marine food web to sharks, potentially posing health risks to consumers of shark products.

Given the increasing exploitation of sharks and the potential health hazard associated with bioaccumulation of BMAA in marine food webs, we conducted a study to determine if BMAA could be detected in shark fins. Specifically, we sampled fins and select organs from seven common shark species found in South Florida waters (USA) for analysis and detection of BMAA using multiple analytical techniques.

2. Results and Discussion

The fins of seven shark species collected in South Florida coastal waters (Table 1) were analyzed by high performance liquid chromatography with fluorescence detection (HPLC-FD). BMAA was detected in a total acid hydrolysate using HPLC-FD and validated by triple quadrupole liquid chromatography tandem mass spectrometry (LC/MS/MS). Precolumn derivatization of the amino acids in the sample was performed using the fluorescent tag 6-aminoquinolyl-*N*-hydroxysuccinimidyl carbamate (AQC). AQC universally tags amino acids at primary and secondary nitrogens producing complex molecules that do not degrade during high pressure separation [22].

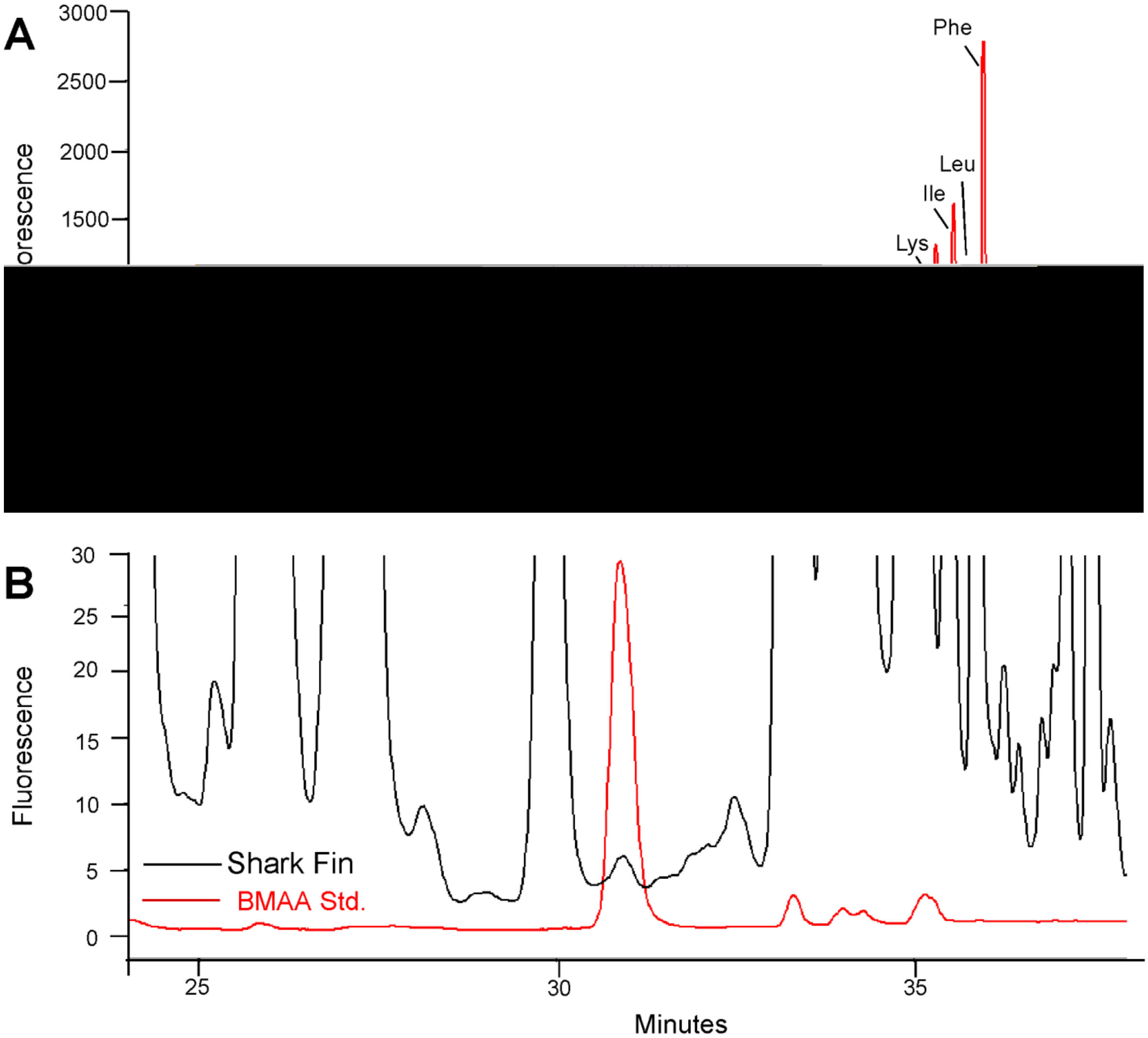
Table 1. Shark specimens and location sites with presence and absence of cyanobacteria blooms indicated.

Species	Scientific Name	Location		Month	Cyanobacterial Blooms
Blacknose [a]	*Carcharhinus acronotus*	25.62099°N	80.15602°W	August	not present
Blacktip [b]	*Carcharhinus limbatus*	25.00644°N	80.99969°W	March	present
Blacktip [b]	*Carcharhinus limbatus*	25.00644°N	80.99969°W	September	present
Blacktip [a]	*Carcharhinus limbatus*	25.59968°N	80.15205°W	July	not present
Blacktip [b]	*Carcharhinus limbatus*	25.01109°N	80.99832°W	September	present
Blacktip [b]	*Carcharhinus limbatus*	25.00644°N	80.99969°W	March	present
Blacktip [a]	*Carcharhinus limbatus*	25.62592°N	80.15442°W	October	not present
Blacktip [a]	*Carcharhinus limbatus*	25.61905°N	80.1714°W	October	not present
Blacktip [a]	*Carcharhinus limbatus*	25.64757°N	80.1881°W	April	not present
Blacktip [a]	*Carcharhinus limbatus*	25.67199°N	80.18144°W	September	not present
Blacktip [b]	*Carcharhinus limbatus*	25.01089°N	81.00419°W	September	present
Blacktip [b]	*Carcharhinus limbatus*	25.00976°N	81.00079°W	September	present
Blacktip [b]	*Carcharhinus limbatus*	25.01715°N	81.01056°W	September	present
Bonnethead [a]	*Sphyrna tiburo*	25.36711°N	80.14806°W	March	not present
Bonnethead [a]	*Sphyrna tiburo*	25.36711°N	80.14806°W	March	not present
Bonnethead [a]	*Sphyrna tiburo*	25.40807°N	80.21806°W	October	not present
Bull [b]	*Carcharhinus leucas*	25.01715°N	81.01056°W	September	present
Bull [b]	*Carcharhinus leucas*	25.01309°N	81.00129°W	September	present
Great Hammerhead [a]	*Sphyrna mokarran*	25.62138°N	80.15656°W	July	not present
Great Hammerhead [b]	*Sphyrna mokarran*	25.01715°N	81.01056°W	September	present
Lemon [b]	*Negaprion brevirostris*	25.00644°N	80.99969°W	June	present
Lemon [b]	*Negaprion brevirostris*	25.00644°N	80.99969°W	June	present
Nurse [a]	*Ginglymostoma cirratum*	25.61942°N	80.1835°W	September	not present
Nurse [b]	*Ginglymostoma cirratum*	24.88335°N	80.84475°W	April	present
Nurse [b]	*Ginglymostoma cirratum*	25.00644°N	80.99969°W	March	present
Nurse [a]	*Ginglymostoma cirratum*	25.62311°N	80.15626°W	August	not present
Nurse [a]	*Ginglymostoma cirratum*	25.60062°N	80.15214°W	August	not present
Nurse [a]	*Ginglymostoma cirratum*	25.60569°N	80.1534°W	August	not present
Nurse [a]	*Ginglymostoma cirratum*	25.62311°N	80.15626°W	August	not present

[a] Biscayne Bay; [b] Florida Bay.

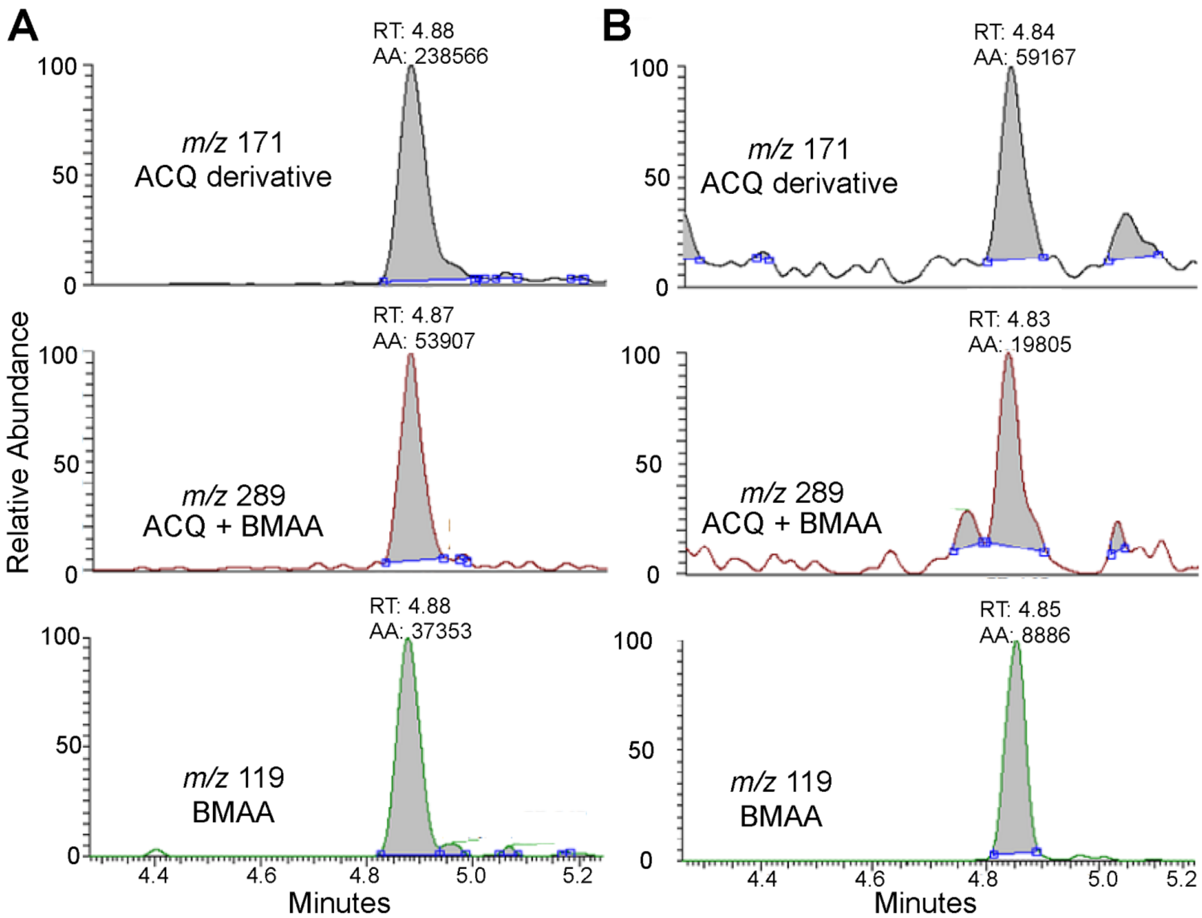
The AQC-derivatized BMAA standard elutes closest to methionine (Met). Figure 1A illustrates the HPLC-FD separation of the standard amino acids, BMAA and its isomers *N*-2(amino)ethylglycine (AEG) and 2,4-diaminosuccinic acid (2,4-DAB). The relative retention time for BMAA (30.89 min) was clearly separated from AEG (29.67 min) and 2,4-DAB (32.91 min).

Figure 1. HPLC identification of BMAA in shark fins. (**A**) HPLC-FD separation of non-hydrolyzed AQC derivatized amino and diamino acids: tyrosine (Try), valine (Val), methionine (Met), *N*-2(amino)ethylglycine (AEG), β-*N*-methylamino-L-alanine (BMAA), and 2,4-diaminosuccinic acid (2,4-DAB), lysine (Lys), isoleucine (Ile), leucine (Leu), phenylalanine (Phe); (**B**) Representative chromatogram of great hammerhead shark fin (black) overlaid with BMAA standard (red). Separation of the derivatized amino and diamino acids was optimized on a C18 column.



These results demonstrate that BMAA did not coelute with any of the natural or diamino acids contained in the shark matrix. A representative HPLC-FD chromatogram of a great hammerhead shark fin sample shown in Figure 1B illustrates the BMAA peak. BMAA in the shark sample shown in Figure 1 was confirmed using triple quadrupole LC/MS/MS (Figure 2). The mass spectrometric verification of the BMAA peak confirms HPLC detection of BMAA in the shark sample [9,16,17,23]. The product ions with masses of *m/z* 171, 289, and 119 were detected in the third quadrupole for both the sample and the BMAA standard and the ratio of the three fragmentation product ions were within normal variation as described previously [18].

Figure 2. LC/MS/MS identification and verification of BMAA in a single great hammerhead shark fin from South Florida Bay waters. (**A**) Triple quadrupole LC/MS/MS verification of BMAA standard. The chromatographic spectra of the three major ions produced from collision-induced dissociations of *m/z* 459 are: (top panel) protonated AQC derivative fragment (*m/z* 171), the quantitation ion; (center panel) protonated-BMAA AQC fragment (*m/z* 289), the first qualifier ion and (lower panel) protonated-BMAA fragment (*m/z* 119), the second qualifier ion; (**B**) Representative triple quadrupole LC/MS/MS verification of BMAA in a great hammerhead shark. Spectra are the same as in Column A.



We detected and quantified BMAA in the fins of all shark species with concentrations ranging from 144 to 1836 ng/mg wet weight (Table 2). BMAA was not detected in six out of the total number (n = 29) of individual fin clip specimens assayed. The results demonstrate high concentrations of BMAA in shark fins collected in areas with or without active cyanobacteria blooms. We observed considerable variability within the same shark species having a similar body length and taken from the same collection sites. For example, the bonnethead shark had BMAA concentrations that ranged from 320 to 1836 ng/mg over a range of only 76 to 79 cm. Of the 7 members of the elasmobranch family surveyed, both the nurse shark and the blacktip shark had fin clip samples where BMAA was not detected (Table 2). Interestingly, the two samples taken from nurse sharks sampled in Florida Bay were positive for BMAA while only one of the five sampled from Biscayne Bay had a quantifiable peak (Table 2). There was no apparent correlation of BMAA concentration with the size of the shark or lifespan at sampling.

Table 2. BMAA concentrations in shark fins from South Florida coastal waters.

Species	Size (cm)	BMAA Mean (ng/mg)	SE	BMAA (ng/100 cm shark)
Blacknose [a] (1)	120	1,663		1,386
Blacktip [b,*] (4)	61	280	84	460
Blacktip [b,*] (4)	99	144	18	210
Blacktip [a] (1)	162	ND		ND
Blacktip [b,*] (1)	165	ND		ND
Blacktip [b,*] (1)	173	286		165
Blacktip [a] (1)	174	168		97
Blacktip [a] (1)	177	247		140
Blacktip [a] (1)	148	794		537
Blacktip [a] (1)	155	811		522
Blacktip [b,*] (1)	165	303		184
Blacktip [b,*] (1)	165	745		453
Blacktip [b,*] (1)	168	252		150
Bonnethead [a] (4)	76	632	96	860
Bonnethead [a] (4)	79	320	59	408
Bonnethead [a] (4)	77	1,836	364	2,385
Bull [b,*] (4)	163	232	60	142
Bull [b,*] (4)	183	264	96	144
Great Hammerhead [a] (4)	247	1,528	212	619
Great Hammerhead [b,*] (4)	175	528	211	291
Lemon [b,*] (4)	168	556	210	332
Lemon [b,*] (4)	201	628	66	312
Nurse [a] (1)	226	223		99
Nurse [b,*] (1)	213	169		79
Nurse [b,*] (1)	168	161		96
Nurse [a] (1)	165	ND		ND
Nurse [a] (1)	235	ND		ND
Nurse [a] (1)	207	ND		ND
Nurse [a] (1)	241	ND		ND

Number in parentheses indicates sample size; SE: standard error; ND: not detected; [a] Biscayne Bay; [b] Florida Bay; * Active cyanobacterial blooms.

We measured BMAA using HPLC-FD in the organs and muscles of great hammerhead sharks killed as a result of recreational fishing activities. As shown in Table 3, BMAA was detected in kidney, liver, and muscle but was not measured in the heart tissue for this species. The highest levels were observed in the kidney, suggesting that uptake and excretion of BMAA along with other natural amino acids occurs in this organ. Although the heart sample had no detectable BMAA, further studies are needed to rule out possible accumulation of BMAA in contractile cardiac tissue.

Table 3. BMAA concentrations in different tissues of great hammerhead sharks (*Sphyrna mokarran*) collected in South Florida coastal waters.

Organ	BMAA Mean (ng/mg)	SE	BMAA (ng/100 cm of shark)
Kidney (3)	1450	687	598
Liver (4)	588	81	243
Fin (8)	1028	211	487
Muscle (3)	58	41	24
Heart (2)	ND		ND

Number in parentheses indicates sample size, SE: standard error, ND: not detected.

Cyanobacterial blooms in South Florida coastal waters occurred in the 1980s and have persisted ever since [21]. Most cyanobacteria are known to produce the neurotoxin BMAA that has been linked to development of the neurodegenerative brain diseases [10,11,24]. Brand *et al*. [21] recently reported that BMAA was detected in several species of crustaceans and fish from the same South Florida coastal waters surveyed in the present study. These marine species are part of the diet of some groups of sharks. Since sharks are at the highest trophic level, they may bioaccumulate BMAA from active exposure to cyanobacterial bloom sites. All seven shark species analyzed in this study had BMAA detected in high amounts in their fins. Interestingly, high concentrations of BMAA were detected in the fins of some sharks collected in areas that had no active cyanobacteria blooms. Sharks are highly migratory, making it likely that they pass in and out of areas where cyanoblooms may have occurred over time [21,25]. While planktonic cyanobacteria are abundant, benthic and cyanobacteria epiphytic on seagrass and macroalgal blades are also present, providing a source of BMAA from the lowest trophic levels to higher animals within the same marine ecosystem.

The bonnethead shark that had the highest levels of BMAA in this study are known to primarily feed on members of the benthic zone, including blue crabs and pink shrimps which reportedly have very high concentrations of BMAA (mean concentration of 2505 μg/g and 2080 μg/g, respectively [21]). Sharks as long-lived apex predators may concentrate protein-associated BMAA over time in certain tissues. This pattern of bioaccumulation is what has been observed for mercury and other heavy metal toxins in sharks across the lifespan [8]. The range of BMAA concentrations measured in the different sharks surveyed most likely reflect their ecological niches, different foraging patterns, and their size and age differences.

BMAA was measured in select organ tissues including the kidney, liver, and muscle of the great hammerhead shark (*Sphyrna mokarran*). The tissue uptake of BMAA has been previously reported in the brain and muscle of bottom-dwelling fishes in the Baltic Sea [14], muscle and tissues from fish and crustaceans in South Florida coastal waters [21], and in brain, muscle, skin, intestine, kidney and fur in flying foxes from Guam [23]. Taken together, these studies suggest that BMAA may be misincorporated into proteins where it bioaccumulates with repeat exposures.

Shark fins consist of cartilage with fibrous protein collagens. Shark fin cartilage powder or capsules are marketed as dietary supplements and claimed to combat and/or prevent a variety of illnesses. However, the benefits of this supplement have not been significantly proven, nor has shark cartilage been reviewed by the US Food and Drug Administration (FDA). Recently Field *et al*. [26] hypothesized that collagen abnormality in the skin of sporadic ALS patients may be caused by the misincorporation of BMAA leading to misfolding of the collagen proteins. In keeping with this hypothesis, the highest levels of BMAA found in the Guam flying fox were detected in skin tissue known to contain collagen as a major component [23].

The elevated level of BMAA in shark fins provides additional support that marine cyanobacteria may represent a route for human exposure to BMAA. Further studies are needed to confirm this finding and to demonstrate that widespread BMAA detections in sharks may occur outside of South Florida coastal waters. The recent finding that BMAA co-occurs with other cyanotoxins in contaminated water supplies raises the possibility that low-level human exposure to BMAA exists in many parts of the world [17]. The possible link between BMAA and gene/environment interactions in progressive neurodegenerative diseases [9] warrants concern for exposure to BMAA in human diets. In Asia, shark fin soup is considered a delicacy, which drives a high consumer demand for this product. Our report suggests that human consumption of shark fins may pose a health risk for BMAA exposure especially if it occurs with mercury or other toxins.

3. Experimental Section

3.1. Sample Collection

Archived shark fins were collected in South Florida (USA) from various areas with or without documented cyanobacterial blooms as described previously [21]. Fin clips were sampled during coastal shark surveys in Florida Bay and Biscayne Bay (Table 1). Sharks were temporarily caught using circle-hook drumlines (a modified fishing apparatus). Drumline units are composed of a base weight that is anchored to the sea floor, outfitted with 75 feet of 700 pound test monofilament, attached by a swivel to a 4-strand 900 pound test circle hook gangion, which permits captured sharks to swim in large circles around the stationary base weight. Sharks were brought alongside the vessel for non-lethal tissue collection, whereby a 2 × 2 cm clip was removed from the trailing edge of the first dorsal fin and a 4 mm muscle biopsy sampled from the hepaxial muscle on the shark's left flank, after which the animal was released. Specimens were immediately frozen and archived. An opportunistic sample of fin, muscle, liver, heart, and kidney were obtained from dead animals killed as a result of recreational fishing activities. Tissue specimens from nurse (*Ginglymostoma cirratum*), blacktip (*Carcharhinus limbatus*), great hammerhead (*Sphyrna mokarran*), bull (*Carcharhinus leucas*), blacknose (*Carcharhinus acronotus*), lemon (*Negaprion brevirostris*) and bonnethead (*Sphyrna tiburo*) sharks were included in this survey (Table 1).

3.2. Fluorescence HPLC Methods for Analysis of Protein-Associated BMAA

BMAA was detected and quantified using a previously validated HPLC method with minor modifications [20,27]. Shark fin clips and tissues were hydrolyzed for 18 h in 6 N HCl (1:8 wt/v) at 110 °C. Hydrolysates were filtered at 15,800 × g for 3 min and concentrated in a speed-vac (Thermo-Savant SC250DDA Speed Vac Plus with a Savant refrigerator trap RVT 4104). The dried extract was resuspended in 0.1 M trichloroacetic acid then washed with chloroform for removal of any residual lipids. The washed extract and standards were derivatized with 6-aninoquinolyl-*N*-

hydroxysuccinimidyl carbamate (AQC) using the AccQ-Fluor reagent (Waters Crop, Millford, MA) and BMAA was separated from the protein amino acids by reverse-phase high pressure chromatography (Waters Nova-Pak C18 column, 3.9 mm × 300 mm) eluted in a gradient of 140 mM sodium acetate, 5.6 mM triethylamine, pH 5.2 (mobile phase A), and 52% (v/v) acetonitrile in water (mobile phase B) at 37 °C using a flow rate of 1.0 mL/min, and 10 μL sample injection volume. The samples were eluted using a 60 min gradient: 0.0 min = 100% A; 2 min = 90% A curve 11; 5 min = 86% A curve 11; 10 min = 86% A curve 6; 18 min = 73% A curve 6; 30 min = 57% A curve 10; 35 min = 40% A curve 6; 37.5 min = 100% B curve 6; 47.5 min = 100% B curve 6; 50 min = 100% A curve 6; 60 min = 100% A curve 6. Detection of the AQC fluorescent tag was achieved using a Waters 2475 Multi λ-Fluorescence Detector with excitation at 250 nm and emission at 395 nm. Experimental shark samples were compared with standard spiked shark fin matrix negative for endogenous BMAA containing a commercial BMAA reference standard (Sigma B-107; >95% purity, St. Louis, MO, USA). The limits of detection (LOD) and limits of quantification (LOQ) were 2.7 and 7.0 ng, respectively. The percentage of recovery of BMAA was 88%.

3.3. Triple Quadrupole LC/MS/MS

Identification of a BMAA peak detected by reverse-phase HPLC was verified by liquid chromatography/mass spectrometry/mass spectrometry (LC/MS/MS) using product ion mode in a triple quadrupole system. The frozen shark fin tissues were hydrolyzed for 18 h in 6 N HCl at 110 °C and then dried in a Thermo-Savant SC250DDA Speed Vac Plus (Waltham, MA, USA). The sample was reconstituted in dilute HCl (20 mM) and derivatized with AQC, which increased the molecular weight of the BMAA analyte from 118 to 458. The derivatized sample was separated using gradient elution at 0.65 mL/min in aqueous 0.1% (v/v) formic acid (Eluent A) and 0.1% (v/v) formic acid in acetonitrile (Eluent B): 0.0 min = 99.1% A; 0.5 min = 99.1% A curve 6; 2 min = 95% A curve 6; 3 min = 95% A curve 6; 5.5 min = 90% curve 8; 6 min = 15% A curve 6; 6.5 min = 15% A curve 6; 6.6 min = 99.1% A curve 6; 8 min = 99.1% A curve 6. Nitrogen gas was supplied to the heated electrospray ionization (H-ESI) probe with a nebulization pressure of 40 psi and a vaporizer temperature of 400 °C. The mass spectrometer was operated under the following conditions: the capillary temperature was set at 270 °C, capillary offset of 35, tube lens offset of 110, auxiliary gas pressure of 35, spray voltage 3500, source collision energy of 0, and multiplier voltage of −1719. A divert valve was used during the clean-up and equilibration parts of the gradient. The second quadrupole was pressurized to 1.0 Torr with 100% argon. Product-ion analysis of BMAA used *m/z* 459 as the precursor ion for collision induced dissociation (CID) and thereby all other ions were excluded in the first quadrupole. Further two-step mass filtering was performed during selective reaction monitoring (SRM) of BMAA after CID in the second quadrupole, monitoring the following transitions: *m/z* 459 to 119, CE 21 eV; *m/z* 459 to 289 CE 17 eV; *m/z* 459 to 171 CE 38 eV. The resultant three product ions originating from derivatized BMAA (*m/z* 119, 289, 171) were detected after passing the third quadrupole and their relative abundances were quantified.

4. Conclusions

BMAA can be transferred from cyanobacteria in the lower trophic levels (teleosts and crustaceans) to marine apex predators. Sharks are among the most threatened marine vertebrates [28] due in part to the high demand of their fins for dietary and medicinal purposes. The consumption of shark products that contain the cyanotoxin BMAA could increase risk for development of neurodegenerative diseases, including Alzheimer's disease and ALS [11,24]. The worldwide prevalence of Alzheimer's disease is estimated to quadruple in 2050 by which time 1 in 85 persons worldwide will be living with the disease [29]. Until more is known about the possible link of BMAA to Alzheimer's disease and other neurodegenerative diseases, it may be prudent to limit exposure of BMAA in the human diet. Our report suggests that consumption of shark fins increases the risk for human exposure to BMAA, a neurotoxic amino acid that accumulates in biological tissues.

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Shark fin trading in Costa Rica

From Wikipedia, the free encyclopedia

Confiscated shark fins

Shark fin trading in Costa Rica, or shark finning, is an illegal practice in the country. It poses a serious problem with shark populations and organized crime within Costa Rica. The trade in Costa Rica is vigorously controlled by the Taiwanese mafia because of the high value of shark fins in restaurants in the Pacific Rim countries such as Taiwan, Hong Kong and China where Shark fin soup can cost up to $100 a serving in top restaurants.[1] Some 95% of shark fin trading activity in Costa Rica culminates in the docks of Puntarenas on the western coast, notably Inversiones Cruz Dock and Harezan Dock,[2] which are often privately run by the Taiwanese.[3] The industry in Costa Rica took off from the 1970s as a result of the growth in demand from the emerging wealthy Tiger economies of the Asia-Pacific for shark fin as a delicacy. By the 1990s, the shark fin industry in Costa Rica had become one of the world's most important in shark finning, especially as a major cargo-unloading point for international fleets because of lax laws and government corruption in cracking down on the trade.[3]

However, there is environmental awareness of the consequences of fin trade exploitation which could result in shark extinction. Prompted by WildAid’s campaigns, in East Asia, high profile politicians and their kin, film personalities, industrial establishments and committed individuals took voluntary “No shark fin” pledge. In January 2011, it was reported that British chef Gordon Ramsay and his TV crew were held at gunpoint and soaked with petrol when filming a documentary about the illegal trade in Costa Rica.[4]

Contents

Practice

According to Ramsay, shark finning in Costa Rica is "A multi-billion dollar industry, completely unregulated. We traced some of the biggest culprits to Costa Rica. These gangs operate from places like forts, with barbed wire and gun towers."[4] In response to poor incomes and pressure, local fisherman are forced into harvesting shark fins, despite only getting about one dollar per pound on an average, less than a third of its total retail value.[5] Corrupt politicians are silenced with a fee to ignore government regulations.[6] The practice involves sharks being caught by a horizontal drag line with many baited hooks, known as longline fishing. According to biologist Jorge Ballestero of the Costa Rican Sea Turtle Restoration Project (Pretoma) “Costa Rica has become intricately linked to this trade for two reasons: It has the biggest longliner fleet in the hemisphere, and it allows international vessels dedicated to the exploitation and trade of shark fins to land here.”[3]

The Taiwanese mafia dominate the shark finning industry in Costa Rica, although Indonesian gangs also have a foothold in the market.[3] The Taiwanese and Indonesian mafia operate private docks in the Puntarenas area, notably Inversiones Cruz Dock and Harezan Dock and several others where some 95% of all catches are brought in, transported by truck to San José and flown mostly to Hong Kong.[3] According to the Costa Rican customs adviser Omar Jiminez, at least three boats full of shark fins enter the ports in Puntarenas every week.[7]Kaohsiung in Taiwan is one of the biggest ports in the world for importing shark fins. They are brought in from overseas and are placed out to dry in the sun on residential rooftops near the port.

However, it should be noted that various shark cartilage industries in the country exist, depending on the import of cartilages from other countries.[8][9] Costa Rica is mentioned as one such country where a leading processing plant is said to be purchasing raw cartilages from any source in the world to carry out semi or primary processing before exporting it, particularly to the USA.[9] The USA then markets it worldwide in the processed shark cartilage powder form, in four or five brand names.[9]

History

In the 1970s, mass local and reef fishing off the Central America coasts had a profound effect on coastal shark populations throughout the Americas. FAO initiated action in 1999 to introduce a “Voluntary Plan of Action for sharks.”

In 1982, the National Learning Institute of Costa Rica received technical support and financing from the Taiwanese government to modernize its fishing fleet according to Pretoma.[3] This had a major impact on the finning industry in Costa Rica, which subsequently took off in the 1980s (especially after 1986[8]). Due to low shark populations on the coasts, the updated vessels could now venture further out to sea and use longline technology to greatly increase their catches. Meeting the increasing demand in the Tiger economies of the Pacific Rim countries for shark fins brought about their economic growth and increased wealth in the 1980s and 1990s. By the late 1990s, Costa Rica had become established as a major cargo-unloading point for international fleets and thus became a key component in the global finning industry.[3]

In May 2003, a young Costa Rican Coast Guard official, Manuel Silva, reported the landing of a Taiwanese fishing vessel with 30 tons of shark fins on board. Not only were the Taiwanese vessels ignored by the four agencies charged with checking incoming cargos but the Costa Rican Fishing Institute (Incopesca) also failed to take action following his report.[3]

In 2006/2007, Canadian director Rob Stewart went to Costa Rica and the Galapagos to shoot what he thought would be an innocent documentary after sharklife underwater in the film *Sharkwater*. However, shortly into filming, they stumbled across the Taiwanese mafia, the illegal shark fin trade and, feared for their lives when chased by gunboats.[10] They managed to secretly capture footage of the traders in the film.

Today, Costa Rica is one of the world's most important participants in the shark-fin trade.[3]

Demand

In Hong Kong restaurants, where the market has traditionally been strong, Shark fin soup can fetch up to $100 a serving in the top restaurants. However, the demand from Hong Kong natives has reportedly dropped, but this has been more than balanced by an increase in demand from the Chinese mainland, fueled by its growing economy and increased wealth,[11] as the economic growth of China has put this expensive delicacy within the reach of a growing middle class.[12][13] This increase in demand, combined with the importance of this top predator in the ocean, has the potential to significantly alter oceanic ecosystems.[14] The high price of the soup means that is

Left: Shark fin in a Japanese health store. Right: Shark fin soup often used as a way to impress guests or at celebrations.[11] Shark fin is also incorrectly perceived by some as having high nutritional value, as well as cancer and osteoarthritis fighting abilities.[15][16] Based on information gathered from the Hong Kong trade in fins, the market is estimated to be growing by 5% a year.[17] In 1998, China imported a reported 4,240 tonnes of shark fins worth US$24.7 million, but Costa Rica competed with Japan, Spain, Singapore, Indonesia, Hong Kong, Vietnam, Norway, Ecuador, Peru and Fiji in providing for the Chinese market.[18] In China, shark fins are increasingly being used in less extravagant items such as cakes, cookies, bread and even cat food.[3]

In the South Asian region, use of shark cartilage in preparing soups is considered a health tonic. Hong Kong imports it from North and South American countries, particularly for use in either a cooked format or to prepare boiled soup, as a health fad, by mixing it with herbals supplements.[18]

Another large demand for shark cartilage is for manufacture of "Shark Cartilage Powder" or pills as a cure for cancer. The anti cancer claims of such powders marketed in many parts of the world has been discounted by the US Food and Drug Administration and Federal Trade Commissions. In spite of such injunctions, the trade in this powder continues and the shark cartilage powder is still widely marketed as a cancer cure, stated to be selling at US$145 per gram.[19] It is also stated that in Costa Rica, one single firm alone processed 235,000 sharks every month to manufacture cartilage pills.[19]

Environmental concerns

Hammerhead shark off Cocos Island, Costa Rica where illegal shark activities are difficult to deter because of limited manpower.[20]

Since the late 1980s populations of northwest Atlantic coastal and oceanic shark have dropped by an average of 70%, and in 2003 the World Conservation Union (IUCN) estimated that tens of millions of sharks are finned and discarded at sea every year.[3] However, estimates are muddy given the fact that the sharks and their fins cross-cut different fishing markets (not to mention that the vast majority of sharks are exploited in the Pacific coast of Costa Rica as opposed to the Atlantic coast).[3] The major environmental problem facing Costa Rican waters by mass shark finning is that the fishermen involved in the practice of killing sharks for their fins pay no attention to the age, gender, size, or even the species of shark. Young shark may be killed off, drastically affecting the ability to breed.[3] A further biological complication is that sharks are naturally slow to breed and mature, which makes the possibility of extinction for many shark species in Costa Rican waters becoming increasingly ominous.[3]

As far back as 1999, FAO initiated action to introduce a "Voluntary Plan of Action for sharks." The response, though not spontaneous, received support from 15 countries including Costa Rica. Even in the early 2000s, the fin trade market's influence on over exploitation of fins was realized, with many countries imposing ban on fishing of these species. Goaded by WildAid's campaigns in East Asia, high profile politicians and their kin, film personalities, industrial establishments and committed individuals took voluntary "No shark fin" pledge and many personalities hosted banquets with "shark free" announcements. There is now constant publicity in the media in this regard in eastern Asia.[21]

Crackdown

Former Costa Rican president Abel Pacheco, a noted environmentalist, and his Taiwanese counterpart, Chen Shui-Bian began a crackdown on shark finning in the early 2000s. However, enforcement is nearly impossible because of corrupt politicians and the terror created by the Taiwanese mafia preventing officials from making a stand against the trading.[3] A reform bill has been proposed in Congress since the late 1990s in which a law would be passed entailing a prison term of up to two years for any perpetrator involved in the trafficking of fins that have been cut from sharks' bodies before the catch has reached the dock. In this context, Pretoma has obtained a petition of over 20,000 signatures calling for the suspension of landing permits for foreign fishing vessels. Although the opposition to the trading is high and indeed illegal, effectively cracking down on the industry will be difficult as long as law enforcement and monitoring of fishing vessels is slack and corruption and poverty remain. The Taiwanese and Indonesian mafia even run their own private docks in Puntarenas which are known to the government and the Costa Rican police but incoming vessels are rarely inspected in a climate of fear.[3] The port of Puntarenas, as of 2003, only had three inspectors allocated to the inspection of hundreds of vessels and generally only examines about 20% of them.[3] As of 2003, no full-scale government investigation has been instituted into the port of Puntarenas, widely known to be the linch-pin of the illegal Costa Rican shark fin trading industry.[3] In 2007, Costa Rica was again internationally criticized for its handling of sharkfinning.[22]

Chen Shui-Bian, together with Abel Pacheco, launched a crackdown on shark finning, with little success.

Gordon Ramsay incident

In early January, 2011, British chef Gordon Ramsay and his TV crew were threatened at gunpoint and with petrol while filming for his episode of the new Channel 4 show, *Big Fish Fight*.[23] Ramsay said of the incident, "Back at the wharf, there were people pointing rifles at us to stop us filming. A van pulled up and these seedy characters made us stand against a wall. The police came and advised us to leave the country. They said, 'If you set one foot in there, they'll shoot you.' At one point, I managed to shake off the people keeping us away, ran up some stairs to a rooftop and looked down to see thousands of fins, drying on rooftops as far as the eye could see. When I got back downstairs, they tipped a barrel of petrol over me."[4]

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External links

- Further reading (http://www.pretoma.org/downloads/pdf/ecoamericasnov03.pdf)
- Video footage of an illegal private dock in Costa Rica (http://www.youtube.com/watch?v=R952jNyU4z8)
- Interview with Rob Stewart on his film *Sharkwater* about the shark problem in Costa Rica (http://ecopreservationsociety.wordpress.com/2009/01/26/sharkwater-the-explosive-documentary-film-on-the-costa-rica-shark-fin-trade/)

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Part of complete coverage on
Eco Solutions

Shark catching drives species to extinction

By **Dean Irvine**, CNN
February 1, 2011 -- Updated 0230 GMT (1030 HKT)

STORY HIGHLIGHTS

- A third of shark species are threatened with extinction, according to conservation group
- Around 73 million sharks caught each year, mainly for their fins

(CNN) -- Last year six people were killed by sharks worldwide. Multiply that number by more than 12 million and you get close to the number of sharks killed for human consumption each year.

Top shark catching countries failed to effectively manage shark stock, says new report

Value of shark sanctuaries and tourism being promoted among some countries

The annual mass slaughter of sharks, estimated to be around 73 million each year, has left one third of all shark species on the brink of extinction.

"It's a grave situation that sharks are now faced with," say Matt Rand, director of the Pew Environment Group's Global Shark Conservation Campaign.

"If serious action is not taken soon, the fate of shark species playing a viable role in the marine ecosystem -- one they've played for 400 million years -- is in jeopardy. Some say we've past the turning point; I hope that is not the case."

Gallery: Shark species feeling the bite

It's in everyone's interest to curb the massive overfishing of sharks

--Scott Henderson, Conservation International

On Monday a U.N. Food and Agriculture Organization summit began in Rome to discuss the problems facing global fish stocks. Some estimate that around 70% of fishing areas are fished out or fully exploited.

A recent report from the Pew Environment Group and TRAFFIC suggests sharks fishing, particularly the practices of finning, needs to be at the top of the agenda as regulations on shark catching have failed to stop an alarming decline in their numbers.

Shark fins are increasingly sought after in Asia, particularly China, as they are used in soups and other products. Finning -- where a shark's fins are removed and the body dumped -- is outlawed by the U.S. and EU, but loopholes and lack of regulation and enforcement elsewhere have meant it remains a major problem.

An international action plan for sharks has been in place for ten years, but it leaves the responsibility of sustainably managing and recording catches to each country.

While a few had made "excellent progress," the majority of countries had not, according to the U.N.'s Food and Agriculture Organization (FAO) in 2005.

"It's a good plan; it's very well thought out," says Rand. "If it was implemented we'd be seeing healthy populations. Unfortunately that's not the case."

Of the top four shark catchers -- Indonesia, India, Spain and Taiwan -- only Spain provides a breakdown on what species it is catching.

Rand hopes that the summit in Rome will provide some time for the FAO to reflect on the global dynamics of sharks, and that they will "recommit to take this international plan of action seriously and implement it."

We're pointing out to the shark catchers that they can make the change

--Matt Rand, Pew Environment Group

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"We're pointing out to the shark catchers that they can make the change. We hope it's not just the NGOs just looking at what's happening. Now is the opportunity to recommit to the international plan to save sharks," he says.

Away from international regulations there are some bright spots in shark conservation efforts.

Palau, Honduras and the Maldives have all declared that no sharks can be caught in their waters.

"They realize that it's very hard to have a sustainable fishery of a species that doesn't reach sexual maturity until in its teens and then only produces a few pups every time they give birth," says Rand.

Shark tourism is also being increasingly valued by coastal communities across the world.

Scott Henderson of Conservation International has lived in the Galapagos Islands for 20 years and witnessed the rise in diving tours in the area, the main attraction being the chance of seeing sharks.

But even the world's most protected marine eco-system has not been immune to shark catching. Illegal shark fishing around the Galapagos does occur, says Henderson, although he believes it is under control and becoming less frequent.

"There is nothing inherently wrong with fishing, and cultural traditions must be respected. However, as the elephant ivory trade, mountain gorilla exterminations and rhinoceros horn trade tragedies all prove, both suppliers and markets need to be responsible in curbing their activities when extinctions are imminent."

Rand describes the uncontrolled catching of sharks as a "massive experiment on the world's oceans."

"There's a big question mark as to how far they will decline," he says.

The impact of declining shark numbers on marine eco-systems and the knock-on effect on fishing industries has already been felt in regions around the world.

The rapid decline of black tip sharks in the west Atlantic Ocean since the early 1990s led to a rise in cow-nosed rays and decline in the North Carolina bay scallop industry.

"Whether you care about sharks, themselves, or the oceans they regulate, it's in everyone's interest to curb the massive overfishing of sharks that is putting oceans at risk," says Henderson.

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Over 50 Percent Of Oceanic Shark Species Threatened With Extinction

Date: May 25, 2008

Source: Wiley-Blackwell

Summary: The first study to determine the global threat status of 21 species of wide-ranging oceanic pelagic sharks and rays reveals serious overfishing and recommends key steps that governments can take to safeguard populations. Sharks and rays are particularly vulnerable to overfishing due to their tendency to take many years to become sexually mature and have relatively few offspring. These findings are published in Aquatic Conservation: Marine and Freshwater Ecosystems.

FULL STORY

Researchers have found that 16 out of the 21 oceanic shark and ray species that are caught in high seas fisheries are at heightened risk of extinction, due primarily to targeted fishing for valuable fins and meat as well as indirect take in other fisheries.

Credit: iStockphoto

The first study to determine the global threat status of 21 species of wide-ranging oceanic pelagic sharks and rays reveals serious overfishing and recommends key steps that governments can take to safeguard populations. These findings and recommendations for action are published in the latest edition of Aquatic Conservation: Marine and Freshwater Ecosystems.

This international study, organised by the IUCN Shark Specialist Group (SSG), was conducted by 15 scientists from 13 different research institutes around the world, with additional contributions from scores of other SSG members.

The experts determined that 16 out of the 21 oceanic shark and ray species that are caught in high seas fisheries are at heightened risk of extinction due primarily to targeted fishing for valuable fins and meat as well as indirect take in other fisheries. In most cases, these catches are unregulated and unsustainable. The increasing demand for the delicacy 'shark fin soup', driven by rapidly growing Asian economies, means that often the valuable shark fins are retained and the carcasses discarded. Frequently, discarded sharks and rays are not even recorded.

Sharks and rays are particularly vulnerable to overfishing due to their tendency to take many years to become sexually mature and have relatively few offspring.

"Fishery managers and regional, national and international officials have the opportunity and the obligation to halt and reverse the rate of loss of biodiversity and ensure sharks and rays are exploited sustainably." says lead author Nicholas Dulvy from the Centre for Environment, Fishers and Aquaculture Science, Lowestoft Laboratory in Lowestoft, UK.

"The current rate of biodiversity loss is ten to a hundred times greater than historic extinction rates, and as humans make increasing use of ocean resources it is possible that many more aquatic species, particularly sharks, are coming under threat," says Dulvy, now based at Simon Fraser University, Vancouver. "This does not have to be an inevitability. With sufficient public support and resulting political will, we can turn the tide."

The group's specific recommendations for governments address the need to:

- Establish and enforce science-based catch limits for sharks and rays
- Ensure an end to shark finning (removing fins and discarding bodies at sea)
- Improve the monitoring of fisheries taking sharks and rays
- Invest in shark and ray research and population assessment
- Minimize incidental catch ('bycatch') of sharks and rays
- Cooperate with other countries to conserve shared populations.

"The traditional view of oceanic sharks and rays as fast and powerful too often leads to a misperception that they are resilient to fishing pressure," said Sonja Fordham, co-author of the paper and Deputy Chair, IUCN Shark Specialist Group and Policy Director, Shark Alliance. "Despite mounting evidence of decline and increasing threats to these species, there are no international catch limits for oceanic sharks. Our research shows that action is urgently needed on a global level if these fisheries are to be sustainable."

Story Source:

Materials provided by **Wiley-Blackwell**. *Note: Content may be edited for style and length.*

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Dramatische afname zee-roofdieren

Door: redactie

6-12-11 - 10:17 Haaienlijken ontdaan van de vinnen in Taiwan. © reuters.

Overbevissing heeft een enorm effect op roofdieren als haaien, tonijn en zwaardvissen. Hun aantal is de afgelopen decennia tot wel negentig procent verminderd.

Tonijn op een vismarkt in de Filipijnen. © getty.

Dat blijkt uit onderzoek van de University of British Columbia, dat gisteren werd gepresenteerd in het blad Marine Ecology Progress Series.

De studie bekeek hoeveel roofdieren er tussen 1950 en 2006 in de oceanen rondzwommen. Hieruit blijkt een dramatische afname. Dat komt, doordat roofdieren extra gevoelig zijn voor overbevissing. Ze worden namelijk zelf volop geconsumeerd en ze eten zelf andere vissen. De vissen worden tegenwoordig voornamelijk in zuidelijke wateren gevangen, om in het noorden te worden geconsumeerd.

Laatste voedsel

'Dit is heel belangrijk, omdat vis het laatste voedsel is dat we op grote schaal in het wild oogsten', aldus onderzoeker Laura Tremblay-Boyer. 'Wanneer je vis eet is het meestal een roofdier. Of het nu een visstick is of een vis in een restaurant. Het komt meestal uit een ander land.'

Omdat het niet mogelijk is om lukraak vissen te tellen in de oceanen, ontwikkelden Tremblay-Boyer en haar mede-onderzoekers een speciaal model waarin ze gegevens als de temperatuur van de oceaan, de aanwezigheid van algen, en de afstand in de voedselketen tussen roofdieren en die algen gebruikten. Ook hanteerden ze een wereldwijde database waarin de visopbrengsten tussen 1950 en 2006 werden bijgehouden.

Zelf noemde Tremblay-Boyer haar methode 'het checken van een bankrekening, in dit geval één met een slecht resultaat. Het gaat naar beneden.' Volgens haar is overbevissing de drijvende kracht achter de achteruitgang van onderwater-ecosystemen. Tremblay-Boyer vergelijkt het verwijderen van vis uit de oceanen met het kappen van tropisch regenwoud.

Nergens meer naar toe

In een persverklaring zeggen de onderzoekers dat 'na het leegvissen van de noordelijke oceanen, de visindustrie liever zuidwaarts ging dan strikte regels in te voeren. Wat gebeurt er als we nergens meer naartoe kunnen?'

Want de onderzoekers vrezen dat uiteindelijk alle oceanen zullen zijn leeggevist. Tremblay-Boyar: 'Wij hebben de keuze of we biefstuk, vis of tofu eten. Maar sommige mensen kunnen alleen maar vis eten, omdat ze aan de kust wonen. Wanneer we vis uit de zuidelijke oceanen blijven eten, heeft dat effect op die mensen'.

Een grote witte haai toont in False Bay (Zuid-Afrika) zijn indrukwekkende natuurlijke kracht tijdens de jacht op zeehonden.

Haaienvinnensoep drijft haaienpopulaties wereldwijd de soep in

Hoewel heel wat duikers ze fascinerend vinden, roepen haaien bij de meeste mensen toch nog altijd voornamelijk angst op. Zelfs 35 jaar na de film Jaws staat het beeld van het vraatzuchtige monster nog steeds in hun geheugen gegrift en dat is onterecht.

Dat geschonden imago zou haaien wel eens fataal kunnen worden, want terwijl overal ter wereld acties worden georganiseerd om walvissen, dolfijnen en ander zeeleven te beschermen, blijkt het erg moeilijk mensen te bewegen hetzelfde te doen voor haaien. Nochtans hebben ze die bescherming dringend nodig.

De mythe ontkracht

Terwijl de mens (Homo sapiens) slechts 200.000 jaar op de aarde bestaat, zwemmen haaien reeds meer dan 400 miljoen jaar in onze oceanen. De eerste dinosauriërs verschenen pas 200 miljoen jaar later. Haaien hebben dan ook al vijf uitroeiingsperiodes overleefd. Ondertussen zijn ze geëvolueerd tot bijna 500 verschillende soorten. Enkele daarvan worden niet groter dan een paar tientallen centimeter terwijl de walvishaai, de grootste vissoort in zee, tot 15 meter lang kan worden. Slechts van een zevental soorten werd gedocumenteerd dat ze ooit een mens gebeten hebben.

Filmmakers en tv-producenten schetsen graag het beeld van de bloeddorstige, mensenetende haai, waardoor er nog steeds geloof wordt gehecht aan deze mythe. Om te overleven hebben haaien de dikke vetlaag van zeehonden en het hoge eiwitgehalte van schildpadden en vissen nodig. Een mens daarentegen bestaat voornamelijk uit huid en beenderen en is daarom niet geschikt als prooi. Haaien bijten ons dan ook bijna nooit opzettelijk, maar vermits ze geen handen of armen hebben, kunnen ze wat ze tegenkomen enkel met hun mond onderzoeken. De meeste mensen worden dan ook slechts een enkele keer gebeten waarna de haai zijn interesse verliest. Het silhouet van een persoon die op een surfplank door het water peddelt, kan voor een haai – die zijn prooi altijd van onderaf besluipt – echter lijken op dat van een grote schildpad. Zwemmende mensen geven bovendien dezelfde vibraties door in het water als een gewonde vis.

Er sterven ook veel minder mensen aan de gevolgen van een haaienbeet dan de media willen laten geloven. Gemiddeld zijn dat er jaarlijks zeven. Wanneer we dat vergelijken met andere doodsoorzaken, blijkt dat er elk jaar gemiddeld 40 mensen sterven na getroffen te zijn door de bliksem en meer dan 150 omdat er een kokosnoot op hun hoofd valt. In de Verenigde Staten (VS) alleen al stierven er in 2009 niet minder dan 130 mensen aan verwondingen veroorzaakt door een hert en 198 door een hondenbeet.

Noodzakelijke hoeksteen van het ecosysteem

Haaien lijken wat hun voortplanting betreft veel meer op zoogdieren dan op andere vissen. Terwijl

***Links:** Een recente studie toonde aan dat in de Bahama's, een levende rifhaai 73 USD per dag genereert voor het ecotoerisme, terwijl diezelfde haai slechts éénmalig 50 USD waard is in handen van de haaienvinnenmarkt.*
***Rechts:** In de Kesennuma fabriek in Japan alleen al verwerkt men jaarlijks 1 miljoen haaien, maar ook in de EU vindt men fabrieken van deze omvang.*

de meeste vissoorten reeds na een drietal jaar volwassen zijn en daarna duizenden of zelfs miljoenen eieren leggen, hebben haaien vaak 10 jaar nodig en sommige soorten zelfs 25 tot 30 jaar om geslachtsrijp te worden. Ze produceren vervolgens ook slechts een beperkt aantal nakomelingen. Daarom zijn haaien erg kwetsbaar voor overbevissing en duurt het letterlijk tientallen jaren alvorens hun aantallen opnieuw kunnen aangroeien.

De aanwezigheid van een voldoende aantal haaien is bovendien erg belangrijk voor het ecosysteem in de zee. Als roofdieren aan de top van de voedselketen regelen zij immers de aantallen van de soorten onder hen. Wanneer men in een bepaald gebied de haaien gaat wegvissen, worden hun prooien daarna ongemoeid gelaten. Vermits deze zich snel voortplanten, gaan hun aantallen op korte tijd sterk toenemen. Vervolgens gaan ze daardoor hun eigen prooien uitputten, waarna ze zelf gedoemd zijn. Haaien jagen ook voornamelijk op zieke en oude dieren die trager zijn dan de andere vissen en zorgen zo dat de genenpool van hun prooien gezond blijft. Als aaseters houden ze bovendien riffen schoon en vrij van ziekten en parasieten.

Op verschillende plaatsen in de wereld ondervindt men nu reeds de gevolgen van het wegvissen van de haaien in dat gebied. In het zuidoosten van Australië heeft het verdwijnen van de haaien een vermeerdering van het aantal octopussen veroorzaakt, die vervolgens de meeste kreeften opgegeten hebben. De eens zo welvarende kreeftenindustrie is hierdoor ingestort. Ook aan de Atlantische kust van de VS heeft een tekort aan haaien grote scholen koeneusroggen veroorzaakt en deze hebben de velden van de kostbare sint-jacobsvruchten gedecimeerd.

Massale slachting

Toch worden er jaarlijks naar schatting tientallen miljoenen haaien uit de zee opgevist. In deze schatting wordt de bijvangst van haaien (niet-intentionele vangsten wanneer men vist op andere soorten), niet gerapporteerde vangsten en de mondiaal aanzienlijke illegale haaienvangst echter niet opgenomen. Wetenschappers bevestigen dat in de laatste 30 jaar, 65 tot 80% van verschillende haaiensoorten werden weggevist uit grote delen van de oceanen; van de commercieel meest interessante soorten zelfs tot 95%.Plaatselijk is de situatie nog schrijnender, zoals in de Middellandse Zee en de Zuid-Chinese Zee, waar vele haaiensoorten nu reeds volledig verdwenen zijn. Daarnaast vinden vissers in verschillende landen, waaronder Thailand, enkel nog kleine onvolwassen haaien die zich nog niet hebben kunnen voortplanten.

Algemeen wordt aangenomen dat een derde van alle haaiensoorten nu reeds met uitsterven wordt bedreigd; van de open oceaansoorten zelfs de helft. Nooit werd een diersoort zo fel bejaagd en massaal afgeslacht als dit de afgelopen decennia met haaien gebeurt. In tegenstelling tot wat vaak wordt gedacht, is dit echter zeker niet de schuld van vissers in verre landen alleen. De Europese Unie (EU) is immers verantwoordelijk voor niet minder dan een derde van de globale haaienvangst. Dankzij de welvaart in Europa bevaren grote, snelle en zeer efficiënte Europese vissersvloten alle wereldzeeën, zelfs de Stille Oceaan. Tot voor kort was Spanje de grootste leverancier van haaienvinnen voor Hong Kong, maar ook Portugal, Italië, Frankrijk, het Verenigd Koninkrijk, Nederland en zelfs België bezitten vloten die specifiek op haai vissen.

De methode die wordt gebruikt om haaien te vangen noemt men de langelijnvisserij. Deze 'longlines' bestaan uit vislijnen tot 100 km lang. Elke 2 à 3 meter hangt aan een zijlijn een haak met aas. Elke dag hangen er wereldwijd zoveel 'longlines' in de zeeën, dat hun samengetelde lengte een afstand van 550 keer de omtrek van de aarde beloopt. Deze vismethode wordt specifiek gebruikt voor het vissen op 'groot wild', maar het

De EU is verantwoordelijk voor een derde van de globale haaienvangst

Deze blauwe haai werd na het nemen van de foto levend van zijn vinnen ontdaan

is ook een erg destructieve manier van vissen, vermits naast haaien ook veel dolfijnen, zeeschildpadden en zelfs albatrossen komen vast te hangen aan die lijnen.

Legale bescherming tegen overbevissing en finning blijft in gebreke

Alsof dat nog niet voldoende verspilling is, wordt het merendeel van de haaien enkel gevangen voor hun vinnen, omdat de waarde van de vinnen op de markt veel hoger is dan die van haaienvlees. Om zoveel mogelijk kostbare vinnen op de boot te kunnen bewaren, trekken vissers de haai aan boord, snijden ze zijn vinnen af en gooien ze daarna het dier terug in de zee. Heel vaak leven die dieren dan nog. Sommige haaiensoorten kunnen enkel ademen wanneer ze blijven zwemmen, zonder hun vinnen sterven ze door verstikking. Andere soorten bezwijken pas veel later aan bloedverlies of worden levend opgegeten door andere dieren.

Deze praktijk noemt men 'finning'. Officieel is 'finning' in de EU verboden, maar de huidige wetgeving bevat verschillende achterpoortjes. Het is ondermeer toegestaan de vinnen en karkassen in verschillende havens te verkopen, waardoor controle onmogelijk wordt. Er kan niet meer worden nagegaan of er voldoende karkassen aan boord zijn in verhouding met de aanwezige hoeveelheid vinnen, of de vissers de vangstquota hebben gerespecteerd en of ze geen beschermde haaiensoorten gevangen hebben. Daardoor passen sommige landen in de EU deze praktijk hoogstwaarschijnlijk nog steeds toe. Shark Alliance, een overkoepelend orgaan van meer dan 100 verschillende organisaties die zich inzetten voor de bescherming van haaien, waaronder Sea First Foundation, voert daarom al enkele jaren campagne. Ze lobbyen om de wetgeving zo aan te passen dat haaien enkel nog met vinnen intact in de havens aan land mogen worden gebracht.

Ook in de rest van de wereld is de wetgeving om overbevissing en 'finning' te voorkomen over het algemeen ontoereikend of zelfs onbestaande. Gelukkig hebben over de laatste paar jaar de landen Palau, Honduras, de Malediven, de Bahamas, Tokelau en de Marshalleilanden hun kustwateren uitgeroepen tot haaienreservaat en in 2010 werd de Indonesische eilandengroep Raja Ampat uitgeroepen tot beschermd gebied voor zeeleven. Ook in de VS komt haaienbescherming stilaan in een stroomversnelling. Over de laatste paar maanden hebben de Amerikaanse staten Hawaï, Washington, Oregon en Californië en de overzeese gebieden Guam en de Noordelijke Mariana Eilanden zowel de handel in als het bezit van haaienvinnen verboden. Daardoor is het op die plaatsen nu zelfs illegaal om haaienvinnensoep te eten.

Haaienvinnensoep

Ondanks het feit dat er stilaan meer bewustwording ontstaat rond het probleem, gaat de haaienvinnenhandel in de rest van de wereld in een razend tempo verder. Vanaf duizenden kustplaatsen worden haaienvinnen na het drogen verscheept naar Hong Kong en van hieruit naar restaurants over de hele wereld, om er haaienvinnensoep van te bereiden. De vinnen hebben nochtans geen nutritionele waarde en zelfs geen smaak. Ze worden uitsluitend voor hun textuur toegevoegd aan de soep die smaakt naar de gebruikte kip- of visbouillon. Desondanks wordt een kommetje haaienvinnensoep in restaurants verkocht voor 70 tot 100 euro omdat het volgens traditie een keizerlijk gerecht is. Honderden jaren geleden was het erg moeilijk om een haaienvin te bemachtigen en de soep gaf dan te kennen aan de keizer dat hij machtiger was dan het machtigste dier in de zee.

De laatste 30 jaar is de welvaart in China echter sterk gestegen waardoor de middenklasse zich het gerecht als luxeproduct heeft toegeëigend en haaienvinnensoep inmiddels onmisbaar is geworden op feestelijke gelegenheden als huwelijken, verjaardagen en bedrijfsfeestjes. Haaienvinnensoep staat voor Aziaten ook symbool voor gezondheid en vruchtbaarheid. De waarheid is echter dat haaienvinnen en haaienvlees grote hoeveelheden van het giftige neurotoxine methylk-

De vinnen van een haai maken samen slechts 3-4% uit van zijn lichaam. Door de grote vraag naar en hoge waarde van de vinnen wordt de rest van het dier zelfs in derdewereldlanden gewoon weggegooid

In Azië vindt men overal winkels en magazijnen vol haaienvinnen. Een waardig feestje zonder haaienvinnensoep is ondenkbaar

wik bevatten. De mens heeft zijn afvalstoffen waaronder die van zware industrie, steeds in de zee gedumpt, waardoor er nu veel van dit zware metaal in zee aanwezig is. Methylkwik heeft de eigenschap dat het makkelijk wordt opgenomen in weefsels en spieren van levende wezens. Het belandt eerst in week- en schelpdieren die worden opgegeten door vissen en telkens wanneer een prooi wordt opgegeten, wordt de methylkwik van het slachtoffer overgenomen in het eigen lichaam. Dit proces heet bio-accumulatie. Haaien, die aan de top van de voedselketen staan, verzamelen hierdoor veel meer giftige stoffen in hun lichaam dan andere vissen. Bovendien bevatten haaienvinnen en haaienvlees ook pcb's, andere zware metalen zoals arseen en zelfs brandvertragers. De Amerikaanse en Europese voedselagentschappen raden het consumeren van haai dan ook ten stelligste af!

Haaienbescherming gaat ook jou aan

Dierenrechtenorganisaties wereldwijd zetten zich in – vaak met beperkte middelen – om de haaienproblematiek onder de aandacht te brengen, maar ook ieder van ons kan zijn of haar steentje bijdragen om de vraag naar haai en afgeleide producten te verminderen. Terwijl haaienvinnensoep niet vaak wordt gegeten in Europa, bestaat er wel een aanzienlijke markt voor haaienvlees. De meeste Europeanen beseffen echter niet dat ze reeds haai aten, omdat het onder verdoken namen wordt verkocht. Zo wordt hondshaai in België aangeboden met de benaming zeepaling en in het Verenigd Koninkrijk als 'fish & chips'. Maar ook 'flake', 'rock salmon' of 'cape steak' en in Zuidelijk-Europa 'tintorera', 'roussette' en 'saumonette', zijn alternatieve namen voor haaienvlees.

Koop geen pillen of poeders van haaienkraakbeen voor de behandeling van allerlei ziekten. In 1992 schreef Dr. William Lane het boek 'Haaien krijgen geen kanker' en het werd onmiddellijk een bestseller. Ondertussen hebben studies uitgewezen dat haaien wel degelijk kanker ontwikkelen, zelfs in het kraakbeen waarvan de pillen

In verschillende landen vindt men enkel nog onvolwassen haaien die zich nog nooit hebben kunnen voortplanten. Ook zij worden gedood voor haaienvinnensoep

geproduceerd worden. Bovendien is het wetenschappelijk bewezen dat haaienkraakbeenpillen geen enkele positieve invloed uitoefenen op menselijke kankers. Toch worden de pillen nog steeds wereldwijd verkocht als alternatief geneesmiddel voor kanker. Daarnaast wordt ook beweerd dat haaienkraakbeen geneeskrachtige eigenschappen zou bezitten voor de behandeling van ondermeer osteoporose, diabetes, aids, herpes, bloedsomloopproblemen en rheuma, maar er is geen enkel bewijs voor deze gezondheidsclaims. In de Verenigde Staten werden enkele producenten zelfs veroordeeld voor het op de labels vermelden van genezende eigenschappen die totaal uit de lucht gegrepen waren.

Squalene is een component van haaienleverolie, maar kan ook worden gewonnen uit plantaardige oliën zoals olijfolie. Het wordt gebruikt in make up- en toiletartikelen zoals zeep, zonnecrème en lotions waarbij ze de opname van het product in de huid bevordert. Gelukkig stappen steeds meer bedrijven over op plantaardige squalene (zoals Beiersdorf die Nivea en La Mer verkoopt, Unilever met de producten Dove en Ponds en ook Estée Lauder en L'Oreal). Squalene van haaien wordt wel nog vaak gebruikt in de samenstelling van vaccins. De spuit voor de Mexicaanse griep bijvoorbeeld bevatte squalene van haaien. GlaxoSmithKline gaf toe dat zij 440 miljoen vaccindosissen bestelden voor de Mexicaanse griep, wat overeenkomt met 4,4 ton squalene uit haaienlevers. Bovendien gebruiken ook de meeste andere farmaceutische bedrijven squalene van haaien.

Reageer nu

Een ware mentaliteitswijziging kan echter pas realiteit worden wanneer de bevolking op de hoogte is van de situatie en hierbij een duidelijk standpunt inneemt. Het bewustmaken van je omgeving omtrent dit probleem is daarom de eerste stap naar een betere haaienbescherming. Geef de boodschap door, vertel je omgeving wat er gebeurt met haaien. Reageer en geef je mening op bijvoorbeeld krantenartikels, zeker wanneer haaien afgeschilderd worden als monsters. Teken petities en neem deel aan acties of evenementen die worden georganiseerd om aandacht te vragen voor haaien. Steun organisaties die het opnemen voor haaien en blijf op de hoogte van de actualiteit, want dit najaar neemt de Europese Commissie belangrijke beslissingen in verband met een wetsvoorstel om de achterpoortjes in de EU ontvinningswet eindelijk voorgoed te sluiten.

KATRIEN VANDEVELDE
SEA FIRST FOUNDATION

Boven: *In Europa wordt veel haaienvlees gegeten, maar bijna altijd onder verdoken namen verkocht*

Midden: *Studies hebben uitgewezen dat haaienkraakbeen niet geschikt is voor de behandeling van kanker en andere ziekten*

Onder: *Hun ondergang kan maar afgewend worden wanneer men op de hoogte is van hun situatie en een standpunt inneemt. Spoor de Nationale ministers later dit jaar aan te stemmen voor een strenger haaienbeleid*

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Alarming Scale of Global Shark Fin Trade Revealed in New Photos

Jaymi Heimbuch
Science / Ocean Conservation
October 21, 2011

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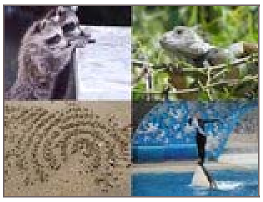

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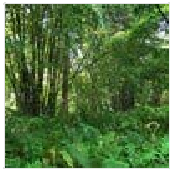

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Bags of shark fins. In 2009 the Taiwanese-flagged fishing trawler, Chien Jiu 102, was seized at Cape Town harbor, South Africa with 1.6 tons of dried shark fins.

According to Pew, the images captured depict "fins and body parts of biologically vulnerable shark species, such as scalloped hammerhead and oceanic whitetip, being readied for market."

And it isn't hard to determine that this is just a snapshot of the larger picture of shark finning.

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An assortment of shark fins. From 1985 to 1998, shark fin imports to Hong Kong and Taiwan increased by more than 214 percent and 42 percent, respectively; and between 1991 and 2000, trade in shark fins in the Chinese market grew by six percent a year.

“These images present a snapshot of the immense scale of shark-fishing operations and show the devastation resulting from the lack of science-based management of sharks, “said Matt Rand, director of global shark conservation at the Pew Environment Group. “Unfortunately, since there are no limits on the number of these animals that can be killed in the open ocean, this activity can continue unabated.”

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Taiwan has the fourth largest number of reported shark catches. It, along with Indonesia, India and Spain account for 35% of total global catches. Taiwan is reportedly instituting a [ban on shark finning to go into effect next year](); however, it is hard to say how that will be enforced if it is such a large industry right now.

As Mike noted earlier this year, "Since a whole shark takes a lot more space than just a shark fin, this means that the fishing boats should be able to catch fewer sharks before coming back to shore, and that shark fishing should be less profitable. But this will depend heavily on whether there are inspectors looking at catches and enforcing the law, and if the boats don't just bypass Taiwan and go dock at other ports to drop their fins."

It will take a serious investment in enforcement to have the ban really mean anything at all.

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Many of these fins come from pelagic shark species. According to the IUCN, over 50 percent of pelagic sharks are Threatened or Near Threatened with extinction.

Pew Environment Group states, "The demand for shark fins, meat, liver oil, and other products has driven some populations of these animals to the brink of extinction. Up to 73 million sharks are killed annually to support the global trade in their fins. The International Union for Conservation of Nature assessed in its Red List of Threatened Species that 30 percent of shark populations around the world are Threatened or Near Threatened with extinction. Since sharks are top predators, their depletion also has risks for the health of entire ocean ecosystems."

Studies have shown that sharks can be worth far more alive than dead to a coastal community.

Australian Institute of Marine Science (AIMS) and the University of Western Australia found that a single reef shark can contribute as much as $2 million over its lifetime to the economy of Palau because it is an attraction to shark divers and tourists, and it helps keep reefs healthy which is a benefit for both tourism and fishing.

However, sharks are not safe -- even in sanctuaries.

We have heard of so many wonderful strides in countries across the globe declaring waters safe for sharks. The world's first shark sanctuary was declared in Palau in 2009, followed by the Maldives in early 2010. Then Indonesia set aside the waters around an entire island, and this year Cocos Island dedicated waters to a sanctuary bigger than Yellowstone, Honduras coughed up over 92,000 square miles, followed by the Bahamas with 250,000 square miles. And finally, Micronesia has declared plans to create the world's largest sanctuary to date.

But it means nothing without enforcement, which we have seen first hand recently. Illegal boats were caught with over 350 dead sharks in the Galapagos where shark fishing is banned, and an estimated 2,000 sharks were slaughtered in the Malpelo wildlife sanctuary in Columbian waters.

© *Shawn Heinrichs for the Pew Environment Group*
This picture of over 3,500 shark fins provides a snapshot of a tiny percentage of the estimated 30 to 73 million sharks killed every year to supply the global shark fin industry.
Photo Credit: Shawn Heinrichs for the Pew Environment Group

To address the overfishing of sharks, the Pew Environment Group recommends that governments should immediately establish shark sanctuaries; end fishing of sharks for which management plans are not in place or that are endangered; devise national plans of action for conservation of sharks; and eliminate shark bycatch in fisheries.

These are goals that would go a long way to help shark numbers recover, and bring these important apex predators back from the edge of extinction. However, in reality we have a long way to go before we could get many governments to not only agree to these goals but also enforce them. Indeed, first we need to diminish the demand for shark fins and other shark products in the first place.

If there is demand, and money to be made, it will be an uphill battle. Some US states have already implemented bans on the shark fin trade, including Oregon, Hawaii, Washington and California. Toronto, Canada also has a ban in the works. More bans worldwide on possessing or selling shark fins, as well as significant education efforts about the importance of sharks are as important as any changes in fishing practices.

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Shark carcasses, also known in the fishing industr

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Ruth Owen

Horrific and Disgusting!! Something MUST be done to stop this.

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