

Skin Problems Related to the Occupation of Commercial Fishing in North Carolina

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Objective: Commercial fishing is one of the most dangerous professions with many of the occupational health problems related to the skin. This study elucidates the types of occupational skin disorders that occur in commercial fishermen in North Carolina.

Study Design/Settings: Booths were set up offering free skin cancer screenings at various seafood festivals, a "blessing of the fleet" event and commercial fishing shows, which were located throughout eastern North Carolina from 2002-2004. When commercial fishermen were screened, they were asked about significant skin problems that they had experienced and were related to their occupation. They were specifically asked about their history of (1) cancerous and precancerous skin lesions, (2) eczemas, (3) superficial fungal infections, (4) bacterial infections of the skin, (5) traumatic injuries related to the skin, (6) bites and stings, (7) shocks from fish, and (8) skin problems related to environmental extremes.

Results: Eighty-one North Carolina watermen were screened: seven of the fishermen (9%) had at least one basal cell carcinoma, five (6%) had at least one squamous cell carcinoma, and no melanomas were detected. Many occupationally related skin disorders were noted on the historical survey, and some of the more dangerous of these included traumatic injuries related to fishing equipment, cutaneous cancers, fish bites, infections, stingray injuries, and man-of-war stings.

Limitations: The sample population was comprised of volunteers, which limits generalizability, and some diagnoses were established retrospectively.

Conclusions: There are a wide variety of skin disorders among commercial fishermen in North Carolina and healthcare professionals should be aware of these when working with watermen.

Key Words: Fishermen, fishing industry, occupational health, skin diseases.

Introduction

North Carolina is usually ranked amongst the nation's top ten seafood producing states and has approximately 4,000-7,000 active full-time commercial fishermen harvesting catches from its 4,000 miles of marine and estuarine shoreline.¹⁻³ Situated where the cold-water Labrador Current meets the warm tropical waters of the Gulf Stream, North Carolina waters offer an especially wide and diverse variety of seafood.

Commercial fishing is well-known to be one of the most hazardous of all occupations.⁴ A significant proportion of work-related health problems in this industry affect the skin.^{5,6} The skin of fishermen is often exposed to high levels of wetness; to a variety of potential cutaneous pathogens; to estuarine and marine flora and fauna that can bite, sting, shock, or otherwise

cause contact/irritant skin reactions; to multiple types of traumatic injuries; and to extremes of heat and cold.

Currently, very little data exist related to cutaneous diseases in the workforce of watermen in our region. The commercial fisherman is usually a stoic, independent, and hard-working individual who is often distrustful of institutions such as medicine.⁷ As such, watermen often don't seek medical attention for perceived minor skin ailments. In addition, many can't afford to see a physician even for more serious problems due to a lack of personal funds as well as often having no health insurance.

The purpose of this study is to gather data about cutaneous problems related to the occupation of commercial fishing in North Carolina. In addition, an effort was made to educate the watermen and their families about some of the well-known risks of their occupation as well as some preventive measures.

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Materials and Methods

From 2002-2004, multiple seafood festivals, commercial fishing shows, skin cancer screening sessions, and a "blessing of the fleet" event, all taking place in eastern North Carolina, were attended by our faculty group at ECU (see Table 1). At these events, a booth offering free skin cancer screenings to all interested individuals (including commercial fishermen) was set up. While the vast majority of people who presented themselves for screening were not watermen, those who were fishermen (and who agreed to a short survey) were questioned about their previous history of skin problems related to their work in commercial fishing. A skin examination of their scalp, face, ears, neck, and upper

almost never burns. The research protocol was approved by the East Carolina University Brody School of Medicine Institutional Review Board.

Results

A total of 81 North Carolina commercial fishermen were screened, a sample representing approximately 1-2% of all licensed watermen in the state. All of the watermen who presented to the researchers and were asked to participate in the study consented to the survey. Background information collected on these individuals is summarized in Table 2.

These fishermen lived from as far north as Moyock

Table 1.
List of events/places where screenings and study took place.

Event Attended	Date(s)	# Fishermen Screened
North Carolina Commercial Fishing Show (New Bern, NC)	February 23-24, 2002	20
Engelhard Seafood Festival (Engelhard, NC)	May 18, 2002	6
Blessing of the Fleet (Hobucken, NC)	June 15, 2002	7
Swansboro Mullet Festival (Swansboro, NC)	October 12, 2002	0
Mill Creek Oyster Festival (Mill Creek, NC)	November 2, 2002	2
Carteret Skin Cancer Screening (Beaufort, NC)	February 18, 2003	6
North Carolina Commercial Fishing Show (New Bern, NC)	February 22, 2003	12
North Carolina Commercial Fishing Show (New Bern, NC)	February 28, 2004	19
Pitt County Memorial Hospital/ECU clinics (Greenville, NC)	various, 2002-2004	9
Total		81

extremities was performed by an experienced board-certified dermatologist. Impressions of clinical lesions were recorded, but biopsies were not done.

The survey instrument was designed by the authors and included the current skin cancer screening results as well as the historical information related to previous skin problems the dermatologist obtained through interviewing the participating fishermen. This information included previous personal histories of precancerous and cancerous skin lesions, eczematous (including allergic) conditions, superficial fungal infections, bacterial infections, traumatic injuries, bites and stings, fish shocks, and problems related to environmental extremes. In addition, questions were asked related to demographics, including zip code of the domicile, age, sex, full-/part-time work; where they fished (inshore/offshore/both); and whether they had insurance. Skin phototype⁸ (ranging from skin type I through skin type VI) was also assessed by the dermatologist. A person with skin type I has extremely fair white skin that never tans and always burns with even minimal sun exposure. In contrast, an individual with skin type VI has very dark brown skin that pigments extensively and

Table 2.
An overview of the 81 commercial fishermen in this study.

Mean Age (years)	52 (range 24-79)
Sex	N (%)
Male	81 (100)
Female	0 (0)
Time Commitment	N (%)
Full-time (currently or retired)	73 (90)
Part-time	6 (7)
Disabled (previously full time)	2 (2)
Fishing Location	N (%)
Inshore	46 (57)
Offshore	11 (14)
Both inshore and offshore	24 (30)
Health Insurance	N (%)
Yes	49 (60)*
No	32 (40)
Skin Phototype ⁸	N (%)
I	1 (1)
II	76 (94)
III	4 (5)
IV – VI	0 (0)

* includes 13% over 65 on Medicare

(Currituck County), North Carolina to as far south as Southport (Brunswick County), North Carolina (see Figure 1). A summary of the clinical data is listed in Table 3.

Cancerous/Precancerous Skin Lesions

Of the 81 fishermen screened, only one (1%) had skin type I (fair-skinned white individual who burns extensively and never tans), 76 (94%) had skin type II (fair-skinned white individuals

who usually have lighter hair and blue eyes and who burn easily and tan with difficulty), and four (5%) had skin type III (average white individual with darker hair and brown eyes who burns moderately, but tans well). Forty-nine (60%) of the fishermen had a total of 269 precancerous actinic keratoses. Individuals had between 1 and 45 actinic keratoses. Of these individuals, one had skin type I with the remainder having skin type II. Twelve watermen (15%) had actinic cheilitis (all skin type II). Seven fishermen (9%) had a total of 14 basal cell carcinomas (one with type I skin and six others with skin type II). Five fishermen (6%) had a total of seven squamous cell carcinomas (all skin type II). There were no malignant melanomas found in the limited skin screening in this group of watermen.

Twenty-seven (33%) of the fishermen reported a previous history of having been treated for actinic keratoses, and one (1%) had previously diagnosed actinic cheilitis. All of these men had skin types I and II, and their average age was 58 (range = 40-79). Fifteen (19%) reported having had a total of 28 basal cell carcinomas. The mean age of these watermen was 59 (range = 48-79) and all had skin type II. Seven (9%) of the 81 total fishermen reported having had ten squamous cell carcinomas. The mean age of those reporting a previous history of squamous cell carcinomas was 64 (range = 48-79), and all had skin type II. Three (3.7%) of the overall group gave a history of having had malignant melanoma. All of them had skin type II, and their mean age was 63 (range 59-72).

Eczemas

A total of 30 fishermen (37%) reported a history of "eczema," with hand eczema and eczema of the forearms accounting for all of these cases. It was generally reported by the fishermen

Figure 1.
Map of Eastern North Carolina Showing Hometowns (dots) of Fishermen Participating in this Study.

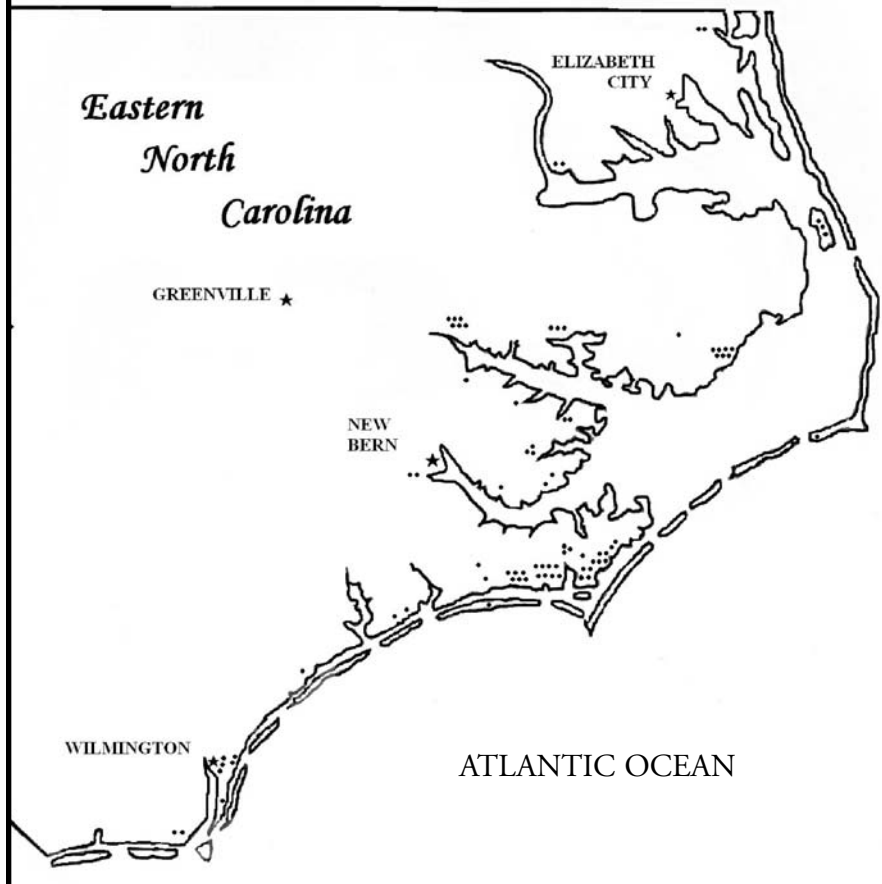


Table 3.
Clinical data on the 81 commercial fishermen in this study.

Skin Problem	# Fishermen in "Live" Screening	# with History of Problem
Actinic Keratosis	49 (60%)	27 (33%)
Actinic Cheilitis	12 (15%)	1 (1%)
Basal Cell Carcinoma	7 (9%)	15 (19%)
Squamous Cell Carcinoma	5 (6%)	7 (9%)
Malignant Melanoma	0 (0%)	3 (4%)
Eczema		30 (37%)
Superficial Fungal Infection		24 (30%)
Bacterial Infection		47 (58%)
Traumatic Injury		25 (31%)
Bites/Stings		69 (85%)
Fish Shocks		12 (15%)
Heatstroke/Frostbite		0 (0%)

that the problem was worse in the winter months. Although there may be others, three of this group reported having had rashes that suggested a history of an allergic contact dermatitis: one who was allergic to rubber/latex gloves, one who reacted only when handling shrimp, and one who reacted only after handling squid.

Superficial Fungal Infections

Of the entire group of watermen studied, 24 (30%) gave a history of having had superficial fungal infections. The majority of them gave a history of “athlete’s foot” (tinea pedis), with others giving a history of hands, legs, groin, and nails being involved (often combined with their feet). One individual gave a history of a fingerweb “fungus infection” when working in gloves, and this was likely due to *Candida* (erosio interdigitale blastomycetica).

Bacterial Infections

Commercial fishermen are exposed to many disruptions of the epidermal barrier to skin infections due to the minor cutaneous traumatic injuries in their day-to-day work in handling fish/crustaceans with spines, sharp shells, pinch injuries, and fish bites. A total of 47 fishermen (58%) described having had a bacterial infection that was serious enough to warrant seeking medical care, and many of them described multiple episodes.

The largest numbers of cases of infection were described by individuals as “fish poison,” “shrimp poison,” “crab poison,” or “scallop poison,” and were reported by 25 fishermen (31%). These are common names for the usually transient and self-limited cellulitis known as erysipeloid due to the organism, *Erysipelothrix rhusiopathiae*. True cases of erysipeloid may, however, be difficult to sort out from fish envenomations in this historical study. Many fishermen reported not seeking medical attention except for the most serious episodes of erysipeloid, and yet, *Erysipelothrix rhusiopathiae* can disseminate and cause endocarditis as well as other sequelae.⁹

The next most common infection where medical attention was sought was abscess formation in eight fishermen (10%) and cellulitis in seven fishermen (9%). These infections were often related to a puncture wound (fish/crab/shrimp spine or splinter injury) or a laceration (crab pinch, fish bite or other traumatic injury).

Three (4%) of the fishermen reported seeking medical attention for cases of *Mycobacterium marinum* infection. This slow-growing aquatic organism causes granuloma formation in tissue with a tumorous or verrucoid lesion enlarging over many weeks to months and usually following (and at the site of) a traumatic injury to the skin.

Other less common infections requiring medical attention were folliculitis (two fishermen; 2%) where the infection was occurring under or at the margins of rubber gloves, and an acute paronychia infection of a proximal nail fold (one fisherman; 1%). One fisherman (1%) also reported that he had been treated for the infestation commonly known as “creeping eruption” or “catworms” (cutaneous larva migrans).

Traumatic Injuries

Most fishermen laughed when initially asked about traumatic injuries to the skin: “It happens every day,” they answered. However, when asked about the more serious traumatic injuries to their skin where medical attention should have been sought, 31% reported in the positive. Lacerations, skin avulsions, severe puncture injuries, and crush injuries (with injury to the skin) related to boats or boat equipment occurred in eight fishermen (10%). Injuries ranged from a hatch falling, a hand crushed between two boats, a bulkhead injury, a fall on the boat, and a drill bit injury while working on the boat, to a hand caught in a boat’s steering chain with loss of digits/fingertips. Lacerations, skin avulsions, or crush injuries (with injury to the skin) due to the larger fishing equipment were reported to have occurred to nine fishermen (11%). Injuries ranged in this category from a trawl door falling on a foot, a net dropping on a foot, winch injuries, block injuries, a crab pot-pull injury, a gill-netter pulley tearing a waterman’s hand open, to lacerations from metal oyster gear equipment. Serious fishhook lacerations/injuries occurred in five fishermen (6%) with these occurring most commonly in the offshore/finfish fishermen. Serious knife laceration injuries occurred in three watermen (4%), and serious, deep lacerations from an oyster shell injury occurred in one fisherman (1%). Several of the fishermen reported more than a single serious traumatic event.

Bites and Stings

Virtually all of the commercial watermen interviewed were very familiar with the day-to-day exposure to minor fish bites, crab pinch injuries, shrimp spine injuries, minor jellyfish stings, minor shell cuts, minor fish stings, etc. Out of the 81 total fishermen interviewed, there were only 12 who reported never having had what they would consider a “significant” or “serious” bite/sting related to their occupation.

Serious or extensive exposure to jellyfish stings was the most common exposure occurring in 22 individuals (27%). Nettles falling from nets led to extensive and severe stings in some individuals. Indeed, 21 fishermen (26%) reported being stung by jellyfish in the eyes with temporary blindness, “blistering” of the eyes, severe conjunctivitis, and pain/edema causing temporary ocular closure. Nine fishermen (11%) reported at least one serious sting by a Portuguese man-of-war. One individual reported such a severe sting to his chest and face that he “went into shock.” He recovered without medical attention as he was offshore and couldn’t get to a medical facility.

Potentially one of the most severe and common sting injuries to which commercial fishermen in North Carolina are exposed is from the stingray. The injury usually occurs on the limbs, and these injuries account for many of the visits to doctors’ offices in this occupational group. Twenty-six (32%) of watermen surveyed reported at least one stingray sting (range 1-13 stings). Fifteen (19%) had suffered multiple stings. Smaller sting injuries were referred to as “pin cushion” stings whereas the larger lacerations, deep puncture injuries—injuries with retained spines or those leading to infection—were those requiring medical attention.

Serious puncture injuries necessitating extraction or causing infection from fish fins/spines/bones or crab/shrimp spines/“prongs” occurred in 16 commercial fishermen (20%). Severe fish stings (other than those due to stingrays) were reported in five individuals (6%), with the more severe stings reported due to the spiny dogfish and sea catfish.

Fish bites can also lead to severe injuries, and the more severe injuries were reported by ten watermen (12%). In North Carolina, fish reported to cause these more severe bite injuries included sharks, barracuda, mackerel, and bluefish.

Severe crab pinch injuries were more common in the inshore fishermen and were reported by nine commercial watermen (11%). These resulted in lacerations that required suturing, resulted in tendon exposure, or were crush injuries.

Fish Shocks

Some fish have specialized cells known as electrocytes, which are capable of producing an electric current strong enough to shock individuals coming in contact with them. Fish known to cause electric shocks in North Carolina waters include the stargazer (Family *Uranoscopidae*) and torpedo ray (Family *Torpedinidae*). Eleven fishermen (14%) reported shocks from stargazers and one (1%) from a torpedo ray. There were no serious sequelae, and only transient anesthesia and paraesthesias were noted.

Environmental Extremes

Fishermen often continue to work in extremes of heat, cold, and wetness. No cases of “immersion foot” were reported. There were also no cases of heat stroke although two reported “heat prostration” (with loss of consciousness in one). There were also no cases of frostbite reported, although two watermen reported frostnip injury.

Discussion

Skin cancers as well as precancerous lesions have been shown to have an increased incidence in commercial fishermen and have been found to be correlated with age and fair skin types.¹⁰ In addition, actinic cheilitis and squamous cell carcinoma of the lip have also been shown to have a high incidence in this occupational group.¹¹ Sun-protective clothing, sunscreens (PABA free, waterproof, at least SPF 15), lip balm containing sunscreens, and wide brimmed hats will all lower the potential for skin cancers in watermen. It must be emphasized that even “waterproof” sunscreens will wash off with the extremes of wetness and perspiration that occur in fishermen, and frequent reapplications are needed.

A history of eczematous rashes was commonly reported by our study group with the majority fitting into the category of irritant/xerotic/atopic with only a few having allergic contact dermatitis. Allergic dermatitis to latex/rubber products is well known,¹² as are allergic reactions to seafood.^{13,14}

Exposure to wetness, humidity, and perspiration likely explains the high incidence of superficial fungal infections in commercial fishermen. Interestingly, in a previous study of

watermen (in Germany), there was an even higher preponderance of tinea infections than that reported by the fishermen in our study.¹⁵

Fishermen are occupationally subject to infections not commonly seen in persons working in terrestrially-based occupations. In addition to the more usual Staphylococcal or Streptococcal infections, aquatic organisms such as *Vibrio* species, *Aeromonas hydrophila*, and *Pseudomonas*, need to be considered when treating infections in these individuals. Very serious and life-threatening infections due to *Vibrio vulnificus* and *Aeromonas hydrophila* need to be considered in fishermen who have liver disease, are immunosuppressed, or who have chronic diseases, such as kidney failure or diabetes.¹⁶

Traumatic injuries to the skin in commercial fishermen were often due to the vessel, fishing equipment, or knives/hooks. Deeper as well as crush injuries may need radiologic evaluation as well as consultation with a surgical sub-specialist, both of which are often hard to arrange at the time these injuries occur among watermen.

Bites and stings were a common injury to the watermen in our study, and treatment of these injuries usually depends on the type of injury incurred. If spine/foreign body retention is possible, a radiologic examination may reveal it, and a surgical consultation should be considered. Consideration of antibiotic coverage and attention to tetanus prophylaxis is also warranted.

Fishermen in our study were the recipients of shock injuries from both the stargazer and torpedo ray. These fish can deliver shocks anywhere from 14 to 220 volts depending on the species.^{17,18} No serious complications are generally noted in these injuries and no treatment is usually indicated.

Working in the hot summer heat without taking sufficient breaks, coupled with insufficient fluid intake, historically accounted for the few cases of heat prostration in our study. No cases of frostbite were recorded in this study, but prolonged exposure to cold without protective clothing/gloves accounted for the two cases of frostnip noted. It is recommended that protective survival suits be carried on commercial fishing vessels as they may be life-saving in the event of a vessel capsizing or sinking.

Conclusions

It is easy to conclude from this study that North Carolina commercial watermen are exposed to a large variety of risks to their skin including: (1) high levels of ultraviolet rays of sunlight causing development of cancerous and precancerous skin/lip lesions; (2) traumatic injuries from fishing equipment, boats, boating repairs, as well as sharp spines/shells in sea critters; (3) skin irritants and allergens, wet/dry cycles, and chapping cold exposure that all can lead to eczematous conditions; (4) wetness, humidity, and sweaty conditions leading to cutaneous fungal infections; (5) traumatic injuries to the epidermal barrier to infection as well as exposure to a variety of aquatic pathogens leading to bacterial infections, including life-threatening ones; (6) bites, stings, and shocks from marine fauna that can, at times, be severe; and (7) extremes of wetness, heat, and cold potentially leading to injury.

The most serious concerns raised by this study include the high incidence of skin cancer, especially melanoma, where 3.7% of North Carolina watermen surveyed had a history of this potentially metastatic and life-threatening form of skin cancer (as compared to a lifetime risk of 2.2% in white males in North Carolina¹⁹ or the typically accepted 1.3% in the general population in the United States²⁰). Other concerns about skin cancer relate to the high numbers of uninsured watermen, which can lead to delays in seeking medical attention.

There are several concerns when interpreting the results from this study. First, with the exception of the skin cancer screening of this group, the study is largely retrospective, relying on memories of events by the fishers themselves. The results are not proven by biopsies, microscopic tests or cultures, but rely on visual recognition and historical claims. One could make the argument that many of the accounts are embellished and magnified. However, in the opinion of our group, this is probably not a significant factor and, if anything, the stoicism and fierce independence of these individuals lends them to tend to diminish and belittle even potentially life-threatening events.

Second, some of the fishermen talked of other peers who had life-ending infections or severe disabling traumatic injuries. Obviously, the individuals who had these events were not able to present themselves for our study. Indeed, watermen coming to festivals and events likely represent the healthier and higher end of the financial spectrum of watermen. We could observe many out working in the sounds during these festivals/shows.

Finally, since the commercial fisherman in our region tends to be an independent individual, lacking in finances or insurance to pay for medical care, and at times distrustful of the healthcare system, many fishermen probably did not present to our booth for a screening. It was often the spouse of a waterman who coerced him over to our booth to get screened for concerning lesions. As the participants in this study were volunteers, it is unclear whether the data collected here can be extrapolated to the entire population of watermen.

In conclusion, we have presented a study of 81 commercial fishermen in eastern North Carolina who have had a large variety of cutaneous problems related to their occupation. While this group of watermen has had severe economic pressures in recent decades, they have unique healthcare needs. Concerning issues in this group of North Carolina workers include: (1) the need for affordable health/disability insurance; (2) first aid/emergency supplies on vessels; (3) protective gear and equipment for fishermen; and (4) better access to healthcare (including specialty access) in rural fishing communities. As the economy becomes more global with its concomitant local economic pressures on this group of watermen, a more global approach both to fishing regulations and fishing safety should be pursued. **NCMedJ**

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