

## SESSION TWELVE: MIXED CATCH



*Small vessels and big waves in the Bay of Bengal (Photo courtesy of Yugraj Yadava)*



# TAMING *MAL DE MER*: A REVIEW OF CURRENT KNOWLEDGE ON THE PREVENTION AND TREATMENT OF SEASICKNESS

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## Introduction

The English words *nautical* and *nausea* both derive from the old Greek word for “ship,” and a close association between the two continues to this day.

Seasickness is a debilitating condition that can afflict almost anyone, sometimes even in relatively mild sea conditions. Its direct effects are temporary and nonfatal, but it may lead to potentially dangerous dehydration and can create a hazardous situation by robbing crew members of the ability—and sometimes the will—to care for self and ship. Some individuals appear to be relatively immune while others, including many commercial fishermen and professional mariners, suffer from it intensely and repeatedly. Aversion to seasickness is a major deterrent to recreational boating, sport fishing, and cruise vacationing.

Although fear may be a contributing factor, the condition itself is neither psychological nor “all in the head.” It is a very real physiological response to disturbance of the normal sense of balance, as perceived via the visual, vestibular (inner ear), proprioceptor (peripheral body sensory), and somatosensory (overall body sensory) systems.

Seasickness is largely preventable and is treatable once in progress. Many people with motion sickness susceptibility function comfortably at sea by using good information to apply appropriate behavior and effective medication.

## **Purpose**

The maritime popular press and dock-talk frequently address seasickness prevention and treatment, and both present anecdotal evidence to support the effectiveness of various pharmaceuticals, devices, and folk remedies. Some discussions are enlightening, others downright silly, but few are based on empirically derived information. At the same time, government agencies, including the National Aeronautics and Space Administration (NASA), universities, research hospitals, and navies have conducted controlled experiments pertinent to motion sickness suppression, but their results have not been widely disseminated. Many marine, water sports, and medical writers have offered seasickness advice based on lengthy experience on the water. Some of that advice is confirmed by the research results, while much appears intuitively valid but not clinically tested.

Individual mariners, vessel owners, and passengers need the best available information on controlling seasickness. The purpose of this study is to review the current state of knowledge, help the industry sort out valid from unsubstantiated information, and suggest approaches that may help mariners minimize the effects of this malady.

## **Methods**

The author reviewed 179 published sources on seasickness prevention, control, and treatment. The categories of sources are as follows: medical or scientific journal articles (15); medical journal article abstracts (23); drug information sheets from the American Society of Health-Systems Pharmacists (ASHSP) and other on-line pharmacy sites (12); drug manufacturer information sheets (7); alternative remedy information sheets (9); Web postings from physicians, medical schools, consultants, drug companies, and letters from physicians (20); comments gleaned from chat room postings (40); articles in newspapers, popular magazines, maritime recreation and trade publications, and marine recreation and industry-related Web sites (53). Additional input was obtained through personal communications with a number of researchers, drug company representatives, physicians, and individual seasickness sufferers.

Journal articles and abstracts reported on research conducted in the United States, Canada, United Kingdom, Switzerland, the Netherlands, Germany,

Denmark, and Israel. Nearly all of the other materials came from sources in the United States.

Medical and scientific journal articles and abstracts are believed to be based on legitimate, peer-reviewed research. Drug manufacturer information sheets and drug information sheets from ASHSP are believed to be factual descriptions of the contents, effects, and side effects of drugs. Postings by physicians, medical schools, and consultants are believed to be legitimate analyses by qualified medical professionals, but are not peer-reviewed nor research-based. Comments from chat rooms are just that—accounts based on personal anecdotal experience. Articles in newspapers, magazines, and on industry-related Web sites run the gamut from well-researched journalistic endeavors, to humor pieces, to thoughtful essays, all summarizing decades of personal experience.

Sources addressed causes of seasickness, behavioral prevention and treatment, pharmaceuticals for prevention and treatment, alternative therapies, and comparisons among competing drugs and devices. No attempt was made to ascertain or score the legitimacy of the sources, nor was there any sort of statistical analysis of the messages they contain. Rather, the author endeavored to find verification of results through multiple references and corroboration between science-based and experience-based sources.

The author also attempted to correlate results obtained through this review with the experiences of passengers aboard his own wildlife charter boat, which operates on the frequently tempestuous waters on Bristol Bay, Alaska, during the summer. The number of clients observed annually is too small to create a statistically significant sample, but casual observation has been sufficient to cast doubt on some published claims and to corroborate others.

What follows is a synthesis of the current state of knowledge on the control of seasickness.

## Results

### *What it is*

Seasickness is a physiological condition characterized by dizziness, lethargy, nausea, vomiting, and a host of other unpleasant and often debilitating symptoms. It can result from a variety of sensory inputs and manifests itself

differently in different people. It is similar to other forms of motion sickness, and it strikes somewhat randomly. Some people are affected only in violent storm seas, while others succumb in the gentle roll of a ground swell.

It normally results from repeated rhythmic motion at the frequency range of sea waves. It is now clear that seasickness usually occurs when the vestibular and proprioceptor systems detect motion out of harmony with normal visceral activity. The emetic center of the brain interprets this input as evidence of poisoning and triggers the stomach's normal defensive action—to purge. In other words, seasickness is an inappropriate physiological response to certain physical stimuli (Money, James et al. 1996).

Much research on motion sickness has focused on the role of the vestibular system (inner ear), which plays a role in maintaining body orientation and balance. Persons with disease-damaged vestibular systems and animals whose inner ears have been surgically removed are virtually immune to motion sickness. They also don't exhibit normal nausea response to poisoning. Many of the anti-emetic (nausea preventing) drugs work by desensitizing the vestibular system.

Many sources state that seasickness is the result of dissonance between the vestibular and vision systems that often occurs when persons go below deck or focus their vision on objects inside the cabin. However, if it were caused simply by the difference between what the eye sees and the inner ear experiences, it could be prevented or cured simply by keeping the sufferer's vision focused on the sea outside the boat. Usually this is not the case.

Seasickness in most people has two components. One is distress—the sensation of malaise, dizziness, and nausea—that results from sensory inputs to the brain. The other is the stomach's reaction to it, which can be churning, acid overload, and vomiting. People may experience one without the other, but distress in the motion center of the brain seems to trigger a reaction in the stomach. Antacids and stomach folk remedies may ease the unpleasant gastric effects of seasickness, but will not attack the cause.

While the genesis of most seasickness is repeated rhythmic motion, especially up and down motion), it is exacerbated by odors, lack of ventilation, fear or apprehension, a sense of lack of control, and substances ingested by the sufferer, including alcohol, acidic drinks such as coffee and cola, and spicy or fatty foods. Even the sight of a vomiting shipmate can trigger nausea.

### *How to predict it*

Nearly all people can become seasick in one situation or another. Nearly everyone gets over it (“gets their sea legs”) after a period of anywhere from a few hours to a few days if they remain at sea that long. Some career mariners get it the first day out on every voyage (see note a). The literature suggests that susceptibility varies with age: kids 5 to 12 are most susceptible and adults over 50 are slightly less susceptible than others. People with good aerobic fitness are slightly more susceptible than those who are out of shape (Cheung, Money et al. 1990). People who get migraine headaches (most of whom are female) are more susceptible. Females apparently experience seasickness more frequently than males, but while women are more likely to report feeling seasick, they often cope better with nausea, complain less, and are less likely than males to attempt to curtail a voyage due to seasickness (see note b).

Anyone who has experienced other forms of motion sickness is a candidate for seasickness, but many who have not still get sick on the water, even after previous seasickness-free voyages. A good self-test for seasickness susceptibility is to read while riding as a passenger in a car on a winding road and in stop-and-go traffic.

### *Behaviors to prevent seasickness*

It is more effective to prevent seasickness than to treat it. Following are some behaviors that can combine to reduce the likelihood of an onset of seasickness:

- The night before, eat and drink moderately and get plenty of sleep; take a first dose of prophylaxis (see “Drugs” below).
- The morning of embarkation, eat a small breakfast, avoiding rich or fatty foods, dairy products, or high-protein foods; avoid coffee or drink a minimal amount; take second dose of preventive medicine.
- On the boat, take a position with a good outside view of water and horizon; stay low and near the center of the boat, if possible; avoid smells of the head, galley, fuel, and exhaust; avoid reading or doing work that requires close-range eye focus; move around and get fresh air; avoid alcoholic beverages and tobacco smoke; if possible, remain standing, move about, and “ride the waves” in a manner such that the head remains relatively stationary as the body moves with the boat; avoid abrupt or rapid head movements; try to take slow, rhythmic deep breaths to decrease symptoms of motion sickness.

If seasickness starts, acknowledge the condition and act on it. Take additional medicine (again see below), maintain a view of the horizon, and avoid going below.

If vomiting feels imminent, don't fight it. Some people feel much better after vomiting, but be sure to vomit over the side or in a location that causes minimal distress to others aboard.

Treat seasick crew members or passengers as sick people: Protect them from injury or loss overboard during vomiting; help them avoid dehydration by offering water or light fluids; and offer nutrients and electrolytes with light snacks or moderate meals of bland foods. Children, in particular, should be made to take plenty of fluids to avoid dehydration.

### *Alternative, folk, or "natural" remedies*

Many nonpharmaceutical substances or applications have been recommended, including honey, peppermint, Vitamin B6, citrus fruits, mango, saltine crackers, biofeedback, "artificial horizon" glasses (Tassier 2003), rubbing alcohol, herbal drinks and salves, a half-cup of seawater, immersing feet in ice water, and holding a can of cold beer behind the ear (Drouin 2001). Most probably are harmless, and some sufferers claim to experience a measure of relief. However, these remedies have not been proven in research, and relatively few people report success using any of them.

Ginger, in the form of candied root, ginger ale, ginger cookies, tea, or powdered root in capsules, has many advocates, although its effect mainly is to settle the stomach rather than to suppress the nausea center in the brain (Holtmann, Clark et al. 2002). Many anecdotal reports support its effectiveness. However, the available published studies on the effects of ginger on nausea have produced contradictory results, and most that focused on seasickness have not shown a statistical difference between ginger and a placebo (see note c).

TravelWell, a British product, uses music, tones, and pulses to quell the vestibular system. It is an audiotape played on a personal cassette player with headphones. It has earned testimonials from Australia and around the UK. However, the vestibular and cochlear (hearing organ) systems function separately so there is no physiological reason that music or tones would ease distress originating in the vestibular system (Cheung 2003).



Acupressure, applied to the precordial channel 6, or *nei kuan* position on the inside of the wrist, produces relief in some people from several kinds of nausea, including seasickness. Products such as Sea-Band, Travelband, Queaz Away Bands, and BioBand, which have small plastic buttons or studs embedded in an elastic wrist band so that they press on the *nei kuan* position, are sold for seasickness prevention. They are inexpensive and have no side effects, so they are commonly carried aboard vessels. Clinical proof of effectiveness is sparse (see note d), although nonclinical tests and some field experience suggests that they work for some people (see note e).

A variation on the acupressure band is the Relief Band, an electronic device similar in appearance to a wristwatch that contains a battery and two electrodes that rest on or near the *nei kuan*. The device sends a user-variable transcutaneous electric current into the wrist, which in some people apparently desensitizes the vestibular system. It should not be worn by individuals with cardiac pacemakers. The manufacturer claims the device can both prevent and alleviate seasickness and provides testimonials. Limited field experience indicates that it works for some users (see note f).

As noted, clinical proof is lacking for most of the nonpharmaceutical remedies. Scientists believe that a combination of the placebo effect and habituation to the environment contribute to the beneficial affects attributed those alternatives (Cheung 2003).

## Drug effectiveness

Most people rely on any of several popular pharmaceutical products to prevent or suppress seasickness. Most are taken as pills, capsules, or chewable tablets; some as suppositories; syrups or injections; or as a gel or a transdermal "patch." Most have proven in both laboratory testing and field experience to be at least somewhat effective for most users. Comparative tests have produced contradictory results; that is, in some tests one drug performed better than another and in other tests did not perform as well.

Overall effectiveness of drugs is highly variable. One often quoted figure is that proper application of drugs reduces the incidence of seasickness by 50% and another is that occurrence among persons predisposed to seasickness is reduced from 80% to 20% (see note g). All induce side effects, some mild and some severe. The less potent drugs tend to produce drowsiness and dry mouth, while more powerful compounds may produce prostatic hypertrophy,

confusion, muscle twitching, rash, headaches, and other symptoms that may include lack of ability to concentrate on tasks and loss of muscle control.

### ***Over-the-counter drugs***

Most over-the-counter (OTC) drugs sold specifically for motion sickness prevention are based on one of three chemical compounds. Dimenhydrinate (original Dramamine, TripTone, Gravol), cyclizine (Marezine), and meclizine (Bonine, Antivert, Dramamine II) are all antihistamines, a class of drugs commonly used to treat the symptoms of allergies, but also are central depressants. They work by blocking the histamine receptors in the brain's emetic or vomiting center. They are moderately effective and have minimal side effects, usually drowsiness and dry mouth. The old standard dimenhydrinate (Dramamine) generally is considered to cause more drowsiness than other antihistamines (AHFS 2001); hence, the popularity of "nondrowsy" formulations, such as Dramamine II (meclizine).

Diphenhydramine (such as Benadryl) is an antihistamine that is marketed as an allergy remedy and an OTC sleeping pill, but it has characteristics similar to those listed above and is sometimes taken for seasickness when nothing else is available.

The key to success with OTC antihistamines is to begin treatment at least 2 hours prior to boarding the vessel and, preferably, taking an initial dose the night before. It may be necessary to maintain the level of the drug in the body by taking additional pills during a long voyage, as effectiveness may last as little as 4 to 6 hours. (The manufacturer recommends taking no more than two meclizine tablets in 24 hours.) Small or drug-sensitive individuals have the option of taking only one tablet.

Because the drugs can cause drowsiness, users should avoid alcohol, which would increase the sedative effect. Most of the antihistamines have not been proven to harm human fetuses, but manufacturers advise pregnant women to consult with their doctors before use. Some have been shown to cause birth abnormalities when given in very high dosages to laboratory animals. Manufacturers also warn that they can cause undesirable side effects when combined with other medications and may not be recommended for patients with certain medical conditions.

### ***Prescription drugs***

Other drugs are used to treat seasickness, some with different pharmacologi-

cal bases. Following is a list of some of the more familiar anti-emetic drugs. Most are available in the United States only by prescription, if at all.

Scopolamine, marketed as Transderm-Scop and commonly referred to as “the patch,” has achieved wide popularity and is considered by some researchers to be the best single anti-motion sickness drug available. Numerous clinical and field tests have been detailed in published reports and most, but not all, find it more effective than OTC antihistamines at preventing (not curing) seasickness. Introduced into the bloodstream via a small adhesive patch worn behind the ear, it remains potent for 48 to 72 hours. Since most people acclimate to sea motion with less than 3 days of continuous exposure, re-application normally is not required. However, effectiveness diminishes during that time. It is a belladonna alkaloid, and side effects include pupil dilation, blurred vision, and dry mucous membranes. In a few people, side effects are more severe and potentially dangerous, including hallucinations and temporary psychosis in some elderly patients. Users must wash their hands after handling the patch and before touching their eyes. After prolonged use, some people experience withdrawal symptoms (Gahlinger 1999). The patch is supposed to be applied at least 4 hours prior to exposure to sea conditions, but peak serum levels are reached after 24 hours so an earlier application may be preferable. Although not recommended by the maker, some drug-sensitive individuals cut the patch in two and wear only one half at a time.

Scopolamine also is sold as a gel to be rubbed into the skin and in tablet form as Scopace. The manufacturer claims research shows that the tablet is twice as effective as the patch. It also claims that in the digestive system the tablet dissolves in minutes, and each dose is effective up to 8 hours. A prescription is required to purchase any form of scopolamine.

Promethazine (Phenergan), an antihistamine-based prescription drug, is reported to be very effective at stopping vomiting and may be indicated for severe seasickness. It emerged as the best anti-space-motion-sickness drug in a study conducted by NASA, with 80% effectiveness (Putcha, Berens et al. 2002). It works for both prevention and treatment, is available as a syrup, suppository, or injection (options that can make it useful to people who are too sick to take a pill) and is recommended for children as young as 2 years old.

Cinnarizine (Stugeron, Antimet) may be the most popular remedy in Europe and is considered more effective than OTC antihistamines while causing less

sedation. It has proven effective in clinical trials. It is not FDA-approved for sale in the United States. Some users have expressed concern over its safety (Bohl and Anonymous 1999), and potential users should be aware that it comes in several dose levels that may produce different side effects.

Prochlorperazine (Compazine) is an anti-emetic normally used to treat nausea caused by radiation and chemotherapy, but sometimes prescribed for severe seasickness. Like Phenergan, it comes as a capsule, oral liquid, injection, or suppository. Some transoceanic cruising sailors carry suppositories in anticipation of encountering severe storms while underway.

Ondansetron (Zofran) is a relatively new and powerful anti-emetic intended for use by patients in chemotherapy. It doesn't cause drowsiness like Compazine and others (Hummel) (see note h). It is available as an orally dissolving tablet, which makes swallowing unnecessary. It is quite expensive, but few seasick individuals would balk at a \$60 per pill price if it brought relief. As an aside, Dextroamphetamine (Dexedrine) is an amphetamine or stimulant that has been prescribed for seasickness, particularly in situations where alertness was essential. However, it is a controlled substance, has profound and sometimes dangerous side effects (Long 2003), and may be habit forming.

The armed forces reportedly supply specially concocted anti-motion sickness drugs to military pilots, astronauts, and some vessel crew members. One said to be highly effective is the "Navy cocktail," a blend of 25 mg each of Phenergan and ephedrine. Ephedrine is a powerful alkaloid stimulant included to counter drowsiness. A possibly safer blend has been suggested (Boniface 2003) that substitutes 60 mg of pseudoephedrine (Sudafed) for the ephedrine. Some fishermen use this combination, calling it the "Coast Guard cocktail."

Because drowsiness is a common side effect of many drugs, especially those based on antihistamines (in fact, similar antihistamines are packaged and sold as sleeping pills), some sources recommend taking a nonprescription caffeine-based stimulant, such as NoDoz, to counter the soporific effect.

### *Using drugs effectively*

Research and field experience both show that there are two essential components to seasickness drug effectiveness. The first is to get a sufficient amount of the drug into the blood stream, and the other is to believe in it.

Just as individual physical size and personality varies from person to person, so does responsiveness to drugs. For some it may be necessary to use the manufacturer's recommended maximum dose, while others can cut it in half. When an already sick person takes a drug, it is difficult to determine how much of it has actually reached the system so it may be necessary to take more to reach the proper level. In most cases, if a drug isn't providing the expected relief, it is because an insufficient amount of it is getting into the system (see note i).

It is often said that OTC drugs such as dimenhydrinate and meclizine only prevent seasickness and do not stop it once it starts. This is not necessarily so. The problem is that once a person is sick, the pyloric valve (between stomach and small intestine) may close, preventing a swallowed pill from reaching the intestine where it can be absorbed into the blood stream. It probably will be expelled with the next bout of vomiting, and even if not, there is a delay of at least 2 hours while it works its way through and is absorbed so that it can do any good. That's why pills or capsules should be taken at least 2 hours prior to embarkation.

One charter boat captain has claimed great success with the following approach: at the first sign of queasiness, the sufferer takes chewable dimenhydrinate or meclizine tablets and chews but does not swallow. Instead the person holds the crushed tablets under the tongue or next to the cheek where it can be absorbed directly into the blood stream through the lining of the mouth (Maurice 2003). This captain reports that nearly everyone who takes these drugs by this *buccal* or *sublingual* route enjoys rapid relief. These drugs can irritate the mouth lining, and this method should be used only when really necessary. (Some researchers claim that this class of drugs cannot be absorbed through the lining of the mouth, but results of at least one clinical test show that dimenhydrinate can enter the bloodstream this way [Scavone et al. 1990]. Oddly, neither of the two primary manufacturers of chewable seasickness pills has tested this method of delivery.)

The other component of success is faith in the drug. Research shows that the placebo effect alone will alleviate symptoms in 40% of seasickness cases (Thornton 2002). When combined with the proven effects of selected drugs, this faith factor assures that most patients can be helped.

## Conclusions

1. Mariners and passengers benefit from accurate information about seasickness causes, prevention, and treatments. Misinformation and unproven folk wisdom is in circulation.
2. There is no magic bullet. What works for some people does not work for others.
3. For many people, good preventative behavior can obviate the need for medication.
4. OTC motion sickness drugs tend to produce fewer and less intense side effects than prescription drugs, but also less of the desired result.
5. Among the OTC drugs, those based on meclizine are likely to cause less drowsiness than those based on dimenhydrinate.
6. The transdermal scopolamine “patch” appears to be the single most effective pharmaceutical solution for the broadest range of persons, especially in cases in which exposure to sea conditions is expected to continue for more than a few hours. Prospective users should be aware of potential side effects.
7. Mariners and passengers should assess their own susceptibility and plan ahead to prevent seasickness. Potential sufferers should “test drive” medications to check for side effects before going to sea.
8. Strategies for beating seasickness on day trips or short voyages may be different from those appropriate to longer voyages. For example, a strong dose of one of the common prescription anti-emetics would help an individual make it through a day trip, but it might interfere with the body’s natural adaptation to motion, required for successful performance on an extended voyage.
9. Individuals who are drug-intolerant (and pregnant or nursing women) may prefer to try alternative remedies, such as powdered ginger and the acupressure or electronic acupressure devices.
10. For most people, the surest short-term prevention is to select one of the proven OTC drugs or the patch, take it early and correctly, and practice good preventative behavior.
11. Persons who have extreme susceptibility or anticipate extreme conditions should consider getting a prescription for one of the more powerful anti-emetics to be carried on board for use only in case of emergency.
12. Nonprescription chewable medications can be carried on board all vessels and offered to needy individuals who may wish to apply the sublingual/buccal absorption method.
13. Faith in a remedy is powerful medicine.

14. Seasick persons are sick and must be treated as such. They should be secured while vomiting and during rough weather to ensure that they don't fall overboard or become injured. Dehydration can be a serious consequence of seasickness in the short term (particularly in children), and nutrient depletion can be a consequence on longer voyages.

## Suggestions for further research

Since most people embarking on voyages don't expect to get seasick, they don't take preventive measures. Future research should focus on measures to suppress seasickness after it has begun. Controlled studies on the effectiveness of taking chewables through the mouth lining, rather than swallowing, are warranted.

It would be useful to have further study of the effectiveness of combining measures, such as using acupuncture bands in conjunction with drugs, and with combinations of drugs. Desperately seasick people often pile on the potential remedies, and it would be helpful to know if some advantage can be gained or if the potential risks are greater.

More controlled experiments in actual field conditions, such as aboard naval, research, fish processing, or work vessels, may produce more useful results than laboratory research, much of which is conducted in revolving chairs.

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## Notes

- a. During his commercial fishing days, the author had a crew member who got desperately ill in the first storm of each season, and then was fine the rest of the year. That former crew member recently told the author that since he became a vessel skipper, he has had no further seasickness.
- b. This subjective observation is based on the author's seven summers of taking tourists offshore on his small motor boat. When women get seasick they usually just deal with it; when men do they are more likely to articulate their condition, insist on curtailing the voyage, or even cancel altogether.
- c. See, for example, Pitler and Ernst, "Efficacy of ginger for nausea and vomiting: A systematic review of randomized clinical trials," *British Journal of Anaesthesia* 84(3): 367-71. Found at [www.jr2.ox.ac.uk/bandolier/booth/alternat/AT128.html](http://www.jr2.ox.ac.uk/bandolier/booth/alternat/AT128.html). Also, J.J. Stewart., M.J. Wood, C.D. Wood and M.E. Mims, "Effects of ginger on motion sickness susceptibility and gastric function," Louisiana State University Medical Center, Shreveport; and A. Grontved, T. Brask, J. Kambskard and E. Hentze, "Ginger Root against seasickness: A controlled trial on the open sea," Dept. of Oto-Rhino-Laryngology, Svendborg Hospital, Denmark. Both abstracts are in *Medical Papers* and found at [http://seasickness.co.uk/html/body\\_medical\\_papers.html](http://seasickness.co.uk/html/body_medical_papers.html).
- d. The makers of Sea-Band claim "clinical trials" but do not provide traceable references. A company spokesman told the author that the company has difficulty demonstrating effectiveness on motion sickness because a great many variables come into play, unlike nausea related to surgery and other conditions that can be tested in the controlled environment of a hospital.
- e. Lee Beall, a "volunteer seasick remedy tester," tried several devices for *Powerboat Reports*, an independent subscription-supported journal for boaters. Trials were conducted over a period of 6 days in a moving automobile to assure more consistent conditions than could be expected in a boat. In the October 2001 issue, in an article titled "Motion sickness remedies: Wrist bands worth a try," he is quoted as reporting that the two acupressure bands tested, Sea-Band and BioBand, both worked as advertised and prevented onset of motion sickness. In the same test he found dramamine very effective, while bonine and ginger tablets were ineffective.
- f. Beall, referenced above, reported in the same *Powerboat Reports* article that the Relief Band was highly effective in the automobile test, but

- was less so in an on-water test, and caused minor irritation to the wrist. John E. Phillips, writing in advertising-supported *Saltwater Sportsman*, reported successful results when he tested it on three charter boat anglers who were already experiencing some level of seasickness (found at [www.saltwatersportsman.com/new\\_gear/sea\\_sick\\_cure.html](http://www.saltwatersportsman.com/new_gear/sea_sick_cure.html)). The author has observed aboard his own boat that about half of the people already feeling ill who tried Relief Band have enjoyed noticeable improvement. No-one aboard the author's boat has applied Relief Band as a prophylaxis.
- g. For example, Robert Hoyt, MD, writing in the July 2000 issue of *Southwinds—Local News for Southern Sailor*, in an article called "Seasickness ad nauseum," states, "I did find one relevant study that monitored about 1,400 patients on the open ocean, during which several common drugs were studied (cinnarizine, cyclizine, meclizine, dimenhydrinate, scopolamine and ginger). Their results showed that all the compounds studied had a similar effect in reducing the likelihood of seasickness from about 80% on no meds to 20%." He did not provide a citation for the study.
  - h. Dr. Hummel tested several medications on himself while on the author's boat and wrote a detailed letter describing his experience with effectiveness and side-effects.
  - i. This page describes how one skipper has adjusted doses offered to his passengers and crew members. Found at [www.yachtsdelivered.com/sea-sick/dosage.htm](http://www.yachtsdelivered.com/sea-sick/dosage.htm).

# DROWNINGS— NO NEW CAUSES: COOPERATIVE APPROACH NEEDED

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## Introduction

People have gone to sea to harvest fish and other seafood since the beginning of time. Many did not return, perishing due to some misfortune related to their venture. More often than not, the cause of death was drowning. Men and women now go to sea to catch fish with modern vessels, advanced navigation equipment, and first-class life-saving equipment. Regardless of these improvements to vessels and equipment, drowning continues to be the major cause of deaths. For example, in British Columbia, on average one work-related death is recorded for every 26 workers' compensation claims in the commercial fishing industry. Eighty-six percent of these were drownings. The sad thing is, the same types of incidents occur over and over again. There are no new causes. Change is needed, but change will not happen by itself. All parties involved in, or with, the industry must focus and sustain their effort to reduce the number of drownings in the British Columbia commercial fishing industry. This has begun to happen with formation of the Marine Action Group in 2002.

This paper identifies and discusses—

- ✦ The factors contributing to drowning.
- ✦ The types of controls needed to prevent drownings.
- ✦ Who has direct and indirect responsibility in the industry.
- ✦ New cooperative initiatives being undertaken, including the emergence of the Marine Action Group.

## The problem/issue

Between 1991 and 2002, 63 work-related deaths were recorded, 86% of which were drownings. This is despite the fact that the number of fishermen and women and vessels participating in the industry declined significantly. Drowning and other deaths occurred in all fisheries and gear types. Table 1 provides a breakdown by gear type.

*Table 1: Drowning and other deaths by gear type*

Gear	Drowning	Other	Total
Trap fishing	14	0	14
Dive fishing	9	1	10
Longlining	8	1	9
Gill-netting	7	3	10
Seining	6	1	7
Trawling	5	1	6
Trolling	4	1	5
Barnacle harvesting	2	0	2
TOTALS	55	8	63

### *Causes of drowning*

The general causes of the various types of fatalities were determined by reviewing employer injury reports to the British Columbia Worker Compensation Board (WCB) for the period 1991–2001 and through contact with the WCB officers that investigated specific accidents. This information is summarized in Figure 1. It reaffirms that drowning is a very significant issue in the British Columbia fishing industry and that drowning results from two main causes: vessels capsizing or foundering, or crew members being dragged or knocked overboard and jumping or falling overboard.

A more in-depth look at contributing factors is necessary to prevent drownings. Reviews of accident investigations, incident reports, inquests, and other reports show that factors contributing to drowning generally fall into three main categories: structural, cultural, and insufficient information. These three categories are described below.

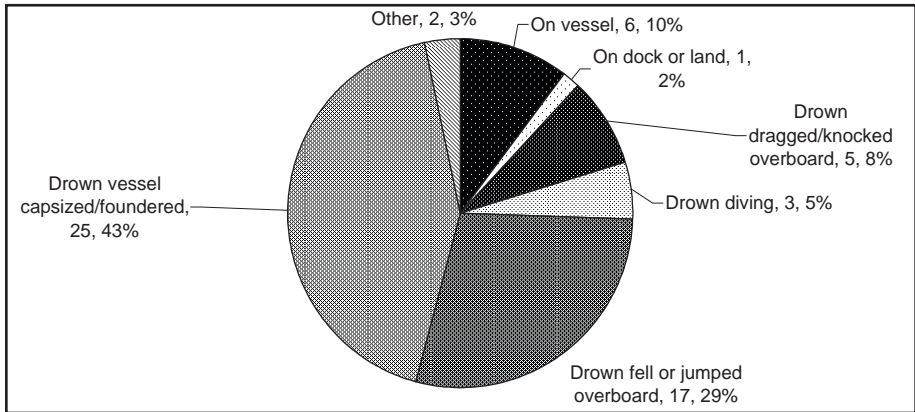


Figure 1: General causes of fishing deaths, 1991-2001

### Structural factors

Structural factors include time pressures, lengths of seasons or openings, and quotas that must be filled within a specific timeframe. Vessel length and power restrictions may also be included. Such factors tend to increase economic or financial pressure such that vessel skippers and crew take chances they might not otherwise take. Frequently, situations arise from the need of a level of government to juggle and balance resource conservation and allowable catch with economic needs of the industry. A byproduct of increasingly reduced fishing time is that both skippers and crew members get less sea time and experience than they would have several decades ago.

### Cultural factors

Cultural factors are often based on long-standing beliefs of people in the industry that they won't be victims of tragedies. They believe it won't happen to them because (in their words)—

- ✦ This boat has fished in these conditions for years with no problems.
- ✦ Working on deck with a PFD, harness, and lanyard would be more dangerous than not wearing the protective equipment.
- ✦ The feel of the boat provides all the stability information I need.
- ✦ I can travel safely after working round the clock because I have alarm systems and a good automatic pilot.
- ✦ This is the way that it has always been done in this industry.
- ✦ We have good boats and seamanship in this fishery, not like those guys in some other fisheries.
- ✦ Experienced fishermen and women are tough and have what it takes.

### *Insufficient information factors*

Many incident reports reveal either a lack of information or a failure to consider, use, or obtain information needed to make sound decisions relative to the situation and conditions. Examples include—

#### *Lack of information:*

- ✦ Local knowledge of the impact of specific wind-opposing current conditions.
- ✦ Impact on stability from vessel modifications and changing gear type or fisheries.
- ✦ Design and special stability characteristics of the vessel under light and heavy loads.

#### *Failure to use information:*

- ✦ Proceeding because it should only take a few minutes to get through this hazardous situation.
- ✦ Continuing to catch and pack as much as possible because “There will never be another chance to catch this many fish.”
- ✦ Proceeding through hazardous conditions because “We have to be at the dock unloading in 7 hours regardless of conditions.”
- ✦ Believing that because a crew member has been in the industry for years, he or she is a competent watch-keeper.
- ✦ Believing that skippers and crew members who have been in the industry for years know what to do in the case of emergencies, such as fire on board or abandoning ship.

Cultural factors integrated with insufficient information can result in failure to analyze effectively probable and actual conditions and circumstances prior to making decisions that affect the safety of vessel and crew.

## **Controls to prevent drowning**

Based on incident reports, four types of controls are needed to reduce the number of drownings. They are—

- ✦ Up-to-date, understandable, quickly read stability information for each vessel.
- ✦ Watch-keeping practices that include periodic monitoring by the skipper or a competent hand.

- ✦ Effective deck layout and work practices to prevent involuntary entry into the water and effective means of staying afloat if in the water.
- ✦ Periodic emergency drills for crew member overboard, fire, flooding, abandoning ship, and calling for help.

It is imperative that skippers and crew members be able to recognize the risks and minimize them quickly and effectively. To do this, they must understand the need for and fundamentals of each type of control identified above. The reasons why these controls are needed are as follows:

1. Fishing vessel stability has been a major concern for years in British Columbia as is evident from reviewing Transportation Safety Board reports. Between 1975 and 2001, 154 British Columbia fishing vessels capsized with 149 persons confirmed drowned or listed as missing. While these statistics do not distinguish between smaller open boats or skiffs and larger vessels, the fact remains that lack of sufficient stability has been a major factor leading to capsizing and drownings.
2. Inadequate watch-keeping has contributed to numerous vessels coming to grief through taking on water and foundering. In some cases, foundering resulted from serious leaks that developed in the hull. In other cases, flush deck fittings or hatch covers were not properly secured. Sometimes flooding occurred while in transit; at other times, it occurred after the vessel struck a submerged object or the shore. The fact is that in most cases, effective watch-keeping could prevent a flooding situation, provide time to control flooding, or provide time for a skipper and crew to prepare to abandon ship.
3. Staying out of the water sounds like an issue that wouldn't require discussion. However, WCB statistics show that a significant number of crew members drowned after they were dragged, knocked, or fell overboard. Typically, crew members do not wear personal flotation devices (PFDs) when working on deck. Even the light, self-inflating, low-profile types that don't impede work are seldom worn. Additionally, there are times when it is necessary to rig lifelines, and, in the case of trap fishing, wear a harness and retractable lanyard during some specific operation. All too often protective equipment is not rigged or worn because skippers and crew members assume or believe that it is too restrictive and they are likely to get caught in the gear. These cultural factors discourage searching for safer ways to work, contributing to inadequate protection and potentially increasing the risk of crew members going overboard.

4. Periodic emergency drills are a must. Generally, skippers and crew on larger vessels are much more attuned to conducting emergency drills than they were a decade ago. However, investigations have revealed a tendency on many vessels for both skippers and crew members to assume that individual skippers and crew members know how to respond effectively to all common types of emergencies based on their length of time in the industry.

## **Responsibilities for safety**

Typically, when fatal accidents occur, there was a lack of understanding of and/or a failure to carry out responsibilities. Responsibility for safety in the fishing industry falls into two main categories, direct and indirect. These are described below.

*Direct responsibilities* include those of the vessel owner, skipper, and crew members. For example, the owner is responsible for maintaining the vessel in a mechanically sound and seaworthy condition. This would include documenting the impact on stability from vessel modifications and shifting to other gear types. The skipper is responsible for setting the operational standard for vessel seaworthiness and crew safety. Seaworthiness includes factors such as loading, tanking, and trim. Examples related to crew safety include watch-keeping, safe work practices, emergency preparedness, etc. Crew members have a responsibility to maintain themselves in fit condition and follow safe operating procedures, including wearing protective equipment and applying safe work practices.

Government or government agencies have *secondary or indirect responsibilities* for safety. A number of jurisdictions are involved. Transport Canada has marine responsibilities under the Canada Shipping Act. In practice their focal areas include vessel structure and the maintenance and operation of vessels according to international and specific conventions. The WCB sets and enforces minimum safe work standards and may investigate accidents. The Department of Fisheries and Oceans licenses vessels and crew, and administers the opening and closing of fisheries and areas relative to sustainability of stocks. The Canadian Coast Guard has responsibility for search and rescue. The Transportation Safety Board investigates marine occurrences.



Many of the factors discussed earlier in this paper, to varying degrees, have singly or in combination with responsibility issues contributed to drownings in each gear and fishery type throughout the years. To prevent these drownings, both those with direct and indirect responsibilities for safety in the industry must take progressive, focused action. The fundamental steps in the process are to—

- ✦ Identify priority risk areas, specific causes, and contributing factors.
- ✦ Build awareness of specific risks, causes, and contributing factors that frequently result in drowning.
- ✦ Build on awareness to generate timely recognition of when and how to apply preventive measures.
- ✦ Ensure compliance with applicable crew and vessel safety regulations.

## **What is being done?**

Many individuals and organizations with safety responsibilities within the industry have recognized causes and contributing factors that increase the risk of drowning and have taken steps to reduce the risk. For example, some vessel and fleet owners put their skippers and crews through Marine Emergency Duty (MED) training and hold preseason safety meetings. Some marine insurance companies have raised their safety standards for insured vessels and hold periodic safety forums. The Transportation Safety Board investigates some serious fishing vessel accidents and publishes detailed reports of these accidents. Transport Canada inspects vessels over 15 tons every 4 years. The Department of Fisheries and Oceans has begun to factor weather and other conditions into openings and length of time to fill quotas. The Coast Guard engages in search and rescue may provide inspection and education services. The WCB inspects conditions covered under its regulations, investigates accidents, and provides consultation, education and various publications.

## **What else needs to be done?**

Given the geographically dispersed, highly mobile, and multicultural nature of the British Columbia fishing industry, a catalyst was and is needed to encourage and promote a greater degree of collaboration on issues, initiatives, and information sharing.

Clearly, numerous individual initiatives are aimed at both crew and vessel safety. However, to achieve a sustainable reduction in drownings, a broader sharing of information and services is needed through sustained collaborative efforts that focus on causes and contributing factors.

As described above, a more cooperative spirit between industry organizations, individuals, and government has begun to emerge. There is now some room for optimism that partnering and sharing information, services, and publications will generate sufficient synergy for a semi-formal fishing industry safety program to continue to evolve.

## **The emergence of the Marine Action Group**

The Marine Action Group (MAG) emerged through meetings between the WCB and the four federal government marine agencies in 2002. MAG was formed to share information about priority issues, initiatives, and educational materials. By late 2002, it became apparent that industry organizations should also be invited to participate. The BC Seafood Alliance was the first industry organization to become involved. Early in 2003, the Council of Professional Fish Harvesters began to participate. The United Fishermen and Allied Workers Union and the Pacific Coast Fishermen's Mutual Marine Insurance Company, the largest insurer of fishing vessels, have received invitations and are expected to participate.

MAG's aim is to provide an opportunity for organizations to broaden distribution of their educational safety materials to all segments of the industry. Some initiatives will remain the domain of the individual organization, and others may be developed through joint agency/industry organization working groups. The common purpose is to create a broad awareness of priority safety issues, such as drowning, and necessary behavior change within fishing communities and on board vessels. The process includes generating—

- ✦ Awareness of individual and collective responsibilities for preventive action and activities.
- ✦ Awareness through promotions, posters, presentations, industry leader testimonials, discussion groups, and enforcement.
- ✦ Increased use of naval architects when vessels are modified or rigged for a different gear type.
- ✦ Increased numbers of vessel masters ensuring their crews complete MED training.

- ✦ Application of effective means to recover a person overboard on every vessel.
- ✦ Improved deck layout and application of other means on board to reduce incidents of crew members being dragged, knocked, or falling overboard.

Activities, services and publications include, but are not limited, to—

- ✦ Fish Harvesting Alert (fatality poster).
- ✦ Hazard Alerts.
- ✦ Fishing vessel stability poster (*new*—illustrating the impact of modifications and changing gear types on vessel stability).
- ✦ Funding an industry safety coordinator position.
- ✦ Monthly articles in fishing journals.
- ✦ Funding (partial) the May Day fishing safety project for exhibit in coastal museums.
- ✦ “Gearing Up for Safety” manual and other manuals.
- ✦ Presentations, inspections, consultations, and enforcement by the WCB and other organizations.
- ✦ Investigation of the *Cap Rouge II* capsizing by the Transport Safety Board and WCB.
- ✦ Use of laser technology by a naval architect to capture the lines and calculate stability of the *Cap Rouge II* under various assumptions and conditions.

Agencies and organizations participate in MAG because they believe collaboration and partnerships provide an opportunity to achieve greater results. While the WCB and others would like to see no drownings within 5 years or less, a 75% sustained reduction within the same period would be considered a successful beginning. The WCB would also like to see the death-to-compensation claims ratio improve from its current position of the worst ratio among all industries in British Columbia. Perhaps the greatest challenge for MAG and participating agencies and organizations will be to maintain focus on generating results and resist becoming a forum for meeting goers.

## Evaluation

As previously mentioned, formation of the MAG and related activities are emerging as a semi-formal program that focuses preventive activity on reducing drownings and other serious incidents in the fishing industry. At

this time, a formal evaluation process has not been discussed. However, it is anticipated that an evaluation process will be developed in which levels of preventive activity, behavior change, and results are measured. Activities such as promotions, presentations, educational forums, consultations, and publications will be discussed in MAG meetings along with recipient numbers. MAG working groups will also develop and deliver presentations and materials.

Activity effectiveness will typically be evaluated by the organization providing the service or publications and communicated to other MAG members for discussion where pertinent. Routine inspections and accident investigations by participating organizations will indicate whether or not behavior change is occurring in the industry. Surveys on awareness of causes and application of preventive practices on board vessels may also be considered. Transportation Safety Board statistics, WCB accident statistics, and WCB compensation claims statistics will be reviewed periodically to determine progress toward reducing the average number of drownings and the need to focus on new fishery groups, causes, or contributing factors.

## **Summary and conclusions**

There is no reason for the unacceptable number of drownings in the British Columbia fishing industry to continue. The causes and factors that contribute to the majority of drownings are known. Many organizations and individuals in the industry have risen to the challenge and taken the initiative to reduce or eliminate drowning. A much higher level of cooperation and collaboration now between the WCB, government marine agencies and industry organizations to increase awareness of causes, contributing factors and means of prevention. The evolution of a semi-formal industry safety program to engage fishermen and women and fishing communities is gaining momentum. Through collective, progressive action that continues to engage all stakeholders, the goal of zero drownings will be realized. Return to the status quo is simply not an option.



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**DHHS (NIOSH) Publication No. 2006-114**