

## DRIFTING OBJECTS

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### 1. INTRODUCTION

Objects floating on the sea surface come from many human activities. Some have had significant impact on human history, yet little is known concerning the origin, drift and fate of many objects found on the sea shore. Edwin Arlington Robinson (1923) stated in *Roman Bartholow*:

"An ocean is forever asking questions  
And writing them aloud along the shore."

We ask your help in reporting recoveries of drifting objects, particularly ones that might be traceable to their origin, so that reports similar to these might be published in scientific journals. Information as to how and where your reports may be directed is provided at the end of this article.

To begin, we tell two brief stories about drifting objects, one concerning the influence of a drifting derelict Japanese vessel on Perry's expedition to Japan, and a second of the influence of a drifting corpse on the outcome of World War II. Following these are two detailed stories about spills from container vessels, i.e., the shoe spill and the toy spill.

### 2. IMPACT OF DRIFTING OBJECTS ON HUMAN HISTORY

Among the many examples that might be cited, two serve to illustrate the continuing impact of drifting objects on human history.

#### Perry's Expedition to Japan

Derelict vessels disabled by storms off Japan probably have been transported to the Americas by prevailing winds and ocean currents since at least 5,000 years ago, based on the comparison of ceramic pottery in Ecuador and Kyushu, Japan. After whaling begun off Japan in the early 1800's, many derelict vessels were reported throughout the North Pacific Ocean. Approximately 20% of the vessels landed in North America, a few with survivors of the typical 15 month drift. Survivors from one such drift vessel initiated a chain of events that significantly influenced the outcome of the Perry Expedition to Japan.

In October 1832, the *Hojun Maru* with a crew of 14 was disabled off Japan during a severe storm. After drifting 15 months, the vessel grounded in January 1834 near Cape Flattery. Three survivors were captured by local natives, and after a few months were rescued and brought to Fort Vancouver on the Columbia River. While at the fort, a young Chinook Indian, Ranald MacDonald, heard of the incident and theorized that by shipwrecking himself in Japan he might aid in the opening of Japan, which had been closed to foreigners for the previous two centuries.

Fourteen years later in June 1848, he carried out his plan. Because of his likable personality, he was not immediately executed for entering Japan but was held in prison for nine months until being deported in April 1849. While in prison, MacDonald instructed a number of Japanese scholars, thus becoming the first teacher of English in Japan. When Commodore Perry arrived five years later in 1854, knowledgeable interpreters were available to assist with the delicate negotiations associated with the formal opening of Japan.

#### WORLD WAR II: Invasion of Sicily

During the early morning hours on 30 April 1943, a British submarine surfaced a mile off Spain and discharged one of the strangest counterespionage devices destined to have a major effect on the outcome of World War II. It was a corpse released so as to drift to the shore with the wind and the tide so it would be found and reported to the German Intelligence Service. In the attaché case chained to the corpse were personal papers of the highest ranking Allied commanders, forged convincingly so that Adolf Hitler and his highest officials would believe their authenticity. The corpse was

recovered a little offshore by a Spanish fisherman. Spanish officials reported the matter to the German Intelligence Service and the papers eventually reached Hitler.

Summarizing the results of this operation code named Mincemeat, based on files of the German Intelligence Service recovered after the war, Montagu reported: "As regards the eastern Mediterranean, we caused immense (German) effort to be put into the defense of Greece (the decoy target), with the creation of mine fields, shore batteries, etc.; we caused a concentration of (German) troops in Greece which justified the appointment by Hitler of Rommel to command them; these troops included a Panzer Division which had to be sent across Europe; all this was completely wasted effort from the German point of view and diminished the potential defense of Sicily and of Italy."

"As regards the Western Mediterranean: we caused an increase in the fortification and reinforcement of Corsica and Sardinia (decoy targets) at the expense of that of Sicily; we caused the defensive preparations in Sicily to be largely diverted from those coasts of the island where the Allies in fact landed, to the coasts where they did not land; we caused the Germans to send R-boats (torpedo boats) away from Sicily to the Aegean, thus opening a gap in their defenses which 'prejudiced the defense of Sicily' as well as creating a shortage of escort vessels."

As a result of the operation's success, Ewen Montagu was awarded the Military O.B.E. The movie "The Man Who Never Was" was based on Montagu's book about the operation.

### 3. NORTH PACIFIC GYRE

Most of the North Pacific Ocean lies within a great gyre, (Fig. 1) connecting the coastal waters off Japan, Canada, mainland U.S., Hawaii, and the Philippine Islands. Despite many oceanographic studies of the gyre's component currents (Kuroshio, Subarctic, California, North Equatorial), much is yet to be learned about the circulation of water within the gyre from drifting objects. For example, satellite-tracked drifters have been monitored only along portions of the gyre's circumference because 4-6 years is required for a hypothetical drifting object to be transported once around the gyre, whereas batteries within satellite-tracked drifters last only 2 or 3 years. Reports of drift bottles released near Hawaii and found in North America are particularly valuable because they will have transited around three-quarters of the great gyre.

In this brief article, we focus on this gyre's sub-current flowing from Japan to North America because: 1) many drifting objects are released to the gyre along coastal Japan as a result of frequent natural disasters (typhoons, earthquakes, tsunamis); 2) debris from vessels damaged by storms is spilled into the Subarctic Current because shipping routes from Asian ports to North America follow great circle routes that intersect the intercontinental current.

To simulate the drift of various floating objects around the gyre, we used the computer program known as the Ocean Surface Current Simulations (OSCURS) numerical model.

### 4. SOURCE REGION: OBJECTS FLOATING OFF JAPAN

At the Defense Mapping Agency Hydrographic/Topographic Center (DMAHTC) in Bethesda, Maryland, reports of objects floating on the sea surface are received from all around the world. Particular objects of concern to international shipping are broadcast daily and published in the weekly *Notice to Mariners*. Due to its international obligations to worldwide shipping, DMAHTC does not release radio messages on many smaller drifting objects that are of interest to oceanographers.

Because beachcombers report numerous objects that are traceable upstream in the Subarctic Current to the vicinity of Japan, and because the Japanese are meticulous in reporting materials adrift, the reports obtained over an interval of time were examined. In the Defense Mapping Agency's watch room where messages are received and reviewed for dangerous floating objects, we transcribed the objects reported for a four month period (15 July - 14 November 1993) in the Japanese reporting area that might have been transported to North America. The 101 reports included: a number of different derelict vessels (25 reports), logs (60 reports), cargo containers (4 reports), a collapsed house, pontoon, fishing net, steel buoy, and a crewman overboard. While we could not eliminate duplicate sightings, this sample indicates that a considerable number of floating objects originate from Japanese coastal waters.

As floating objects are transported eastward, they are sorted by winds, currents, flotation, and biological processes. The time required to drift directly from Japan to North America varies from eleven months to 2-3 years, depending on windage, but many objects sink as they become water-logged and as biological growth decreases their buoyancy. For example, the vessel *Ryo Yei Maru*, disabled on 11 December



# DRIFTING OBJECTS ON THE OCEAN

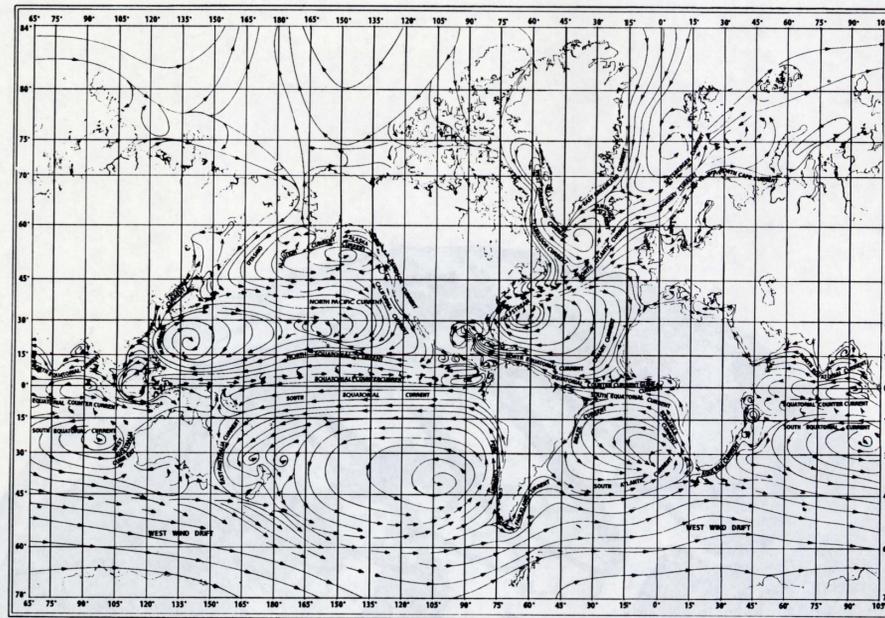


Fig. 1. Major surface currents of the world (northern hemisphere winter).

1926 off Japan, was discovered on 31 October 1927 off the coast of Washington, having drifted for 11 months without capsizing, thus exposing the vessel to considerable windage. From our collection of twenty or so messages found in drift bottles, with less windage most of them required 2-3 years to follow the path of the *Ryo Yei Maru*.

### 5. THE NORTH PACIFIC SHOE SPILL

Approximately 80,000 athletic shoes were lost overboard on 27 May, 1990 in the North Pacific Ocean in the vicinity of 48-00N 161-00W. Six months to a year later, thousands of shoes washed ashore in North America from southern Oregon to the Queen Charlotte Islands. We gathered beachcomber reports and compared the inferred shoe drift with OSCURS and historical drift bottle returns (Fig. 2). This spill, like that of children's toys described later, may provide new data for ocean current pathways because both spills were far larger than typical instantaneous releases of 500-1000 drift bottles. The drift pattern here is documented with a much larger sample than in the typical oceanographic drift experiment that usually has about a 2% drift bottle recovery rate.

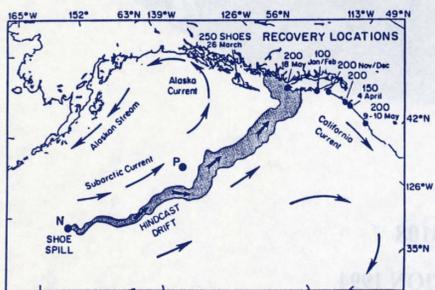


Fig. 2. Chart showing where 80,000 athletic shoes washed overboard on 27 May 1990 (N; shoe spill), and dates and locations where 1300 shoes were discovered by beachcombers (dots along coast). Drift of the shoes (in tint) simulated with a computer model, is thought to have passed close to Ocean Station Papa (P), where 33,869 drift bottles were released. (Reprinted from *Transactions of the American Geophysical Union*, EOS; Ebbesmeyer and Ingraham, 1992)

As the container vessel *Hansa Carrier* was enroute from Korea to the U.S. Pacific Northwest, it encountered a severe storm causing 21 of its 40-foot containers to be lost overboard. Five of the lost containers held approximately 80,000 shoes. From beachcomber reports, a variety of shoes were spilled, from children's sizes to men's large hiking shoes. Unfortunately, the shoes were not tied together, so that matching pairs did not come ashore; however, beachcombers held swapmeets in Oregon to find matching shoes. Despite a year in the ocean, many of the shoes were wearable after cleaning.

It was clear from preliminary reports that thousands of shoes had washed ashore. Later, after an Oregon newspaper reported our oceanographic interest in the shoes' drift, the Associated Press picked up the story and national media focused on our project. The media were quite helpful by relaying our interest in having the public write to us describing additional finds of shoes.

To obtain quantitative information, three lines of inquiry were pursued. First, examination of container load plans detailing the contents of each container enabled the comparison of serial numbers of many of the recovered shoes with those listed for each container. This revealed that four of the five containers opened, releasing up to 61,280 individual shoes. Second, we telephoned beachcombers, resulting in reports of approximately 1300 shoes. Third, one avid beachcomber, Steve McLeod, had kept a detailed list totaling 1600 shoes that could be exchanged to obtain matching pairs. Therefore, we estimated that at least 2.6% (1,600) of the released shoes were recovered. From beachcombers' stories it became evident that other beachcombers had found large numbers of shoes, but we were unable to contact some of them. Considering that some sank to the sea floor, and that many shoes washed ashore went unreported, the actual percentage of shoes reaching shore is underestimated, perhaps by a substantial amount.

OSCURS was used to hindcast the shoes' oceanic drift. The first sizable reports documented about two hundred shoes found during Thanksgiving to Christmas, 1990, and about a hundred shoes found on Vancouver Island during January and February, 1991. These recovery dates were 174-211 days after the spill (in Washington) and 218-278 days after the spill (on Vancouver Island). This gave the shoes an average recovery time of 220 days. The simulation of the shoes' trajectories indicated first landing on Vancouver Island 249 days after the spill, in approximate agreement with the first reports of shoe beachings. Therefore, after the spill it appears that the shoes drifted approximately due east.

Reports of shoe recoveries in large quantities were from as far north as the Queen

Charlotte Islands and as far south as southern Oregon. Assuming that the shoes were released at one location, considerable dispersion occurred in the latitudinal direction.

At the present time, OSCURS does not resolve the coastal currents close to the shores in the eastern Pacific Ocean. As the shoes first reached the near shore waters in winter, the northward flowing Davidson Current may explain the shoes found in the Queen Charlotte Islands. Many shoes were found along the Oregon coast through June when the local coastal currents are southerly. Apparently, during winter and spring, coastal currents dispersed the shoes over a distance greater than estimated from available observations of oceanic dispersion.

At the northern end of the Big Island of Hawaii three shoes were found from January to March, 1992. These shoes appear to have followed the California Current southward, and then traveled westward. Additional computer runs indicate that some of the shoes should arrive in Japan during 1994.

### 6. THE NORTH PACIFIC TOY SPILL

Approximately 29,000 floatable bathtub toy animals (6-12 cm) were lost overboard on 10 January 1992 from a container vessel in the mid-North Pacific Ocean in the vicinity of 44-42N 178-06E. During its voyage from Hong Kong to Tacoma, Washington, the container vessel encountered severe storm conditions. In approximately 44-42N 178-06E, twelve of its 40-foot containers were washed overboard. One of these steel containers held 7,200 packages of toy animals, with each package containing four different toy animals. The container was torn open either by the ship's stays as it went overboard or by collisions with the other containers. Ten months later, some of the plastic toys began showing up on beaches near Sitka, Alaska. According to computer simulations (Fig. 3), the toys' drift proceeded past the 1990 athletic shoe spill site on their way to the southeast Alaska coast.

To obtain reports of toys found on beaches, advertisements were placed in a local newspaper (*Sitka Sentinel*) near the toys' first landfall. From responding beachcombers, we learned that approximately 400 toys fitting our descriptions were found between November, 1992 and August, 1993 along approximately 800 km of shore between Kayak and Coronation Islands bordering the eastern Gulf of Alaska. The first known landfall of the toys was reported by two beachcombers near 57-06N 135-42W on 16 November (6 toys) and near 57-48N 136-24W during 28-29 November 1992 (20 toys).

To account for the windage of these floatable toys, during numerous runs of OSCURS, the empirical functions for current speed and angle of deflection were systematically adjusted to find a match between the model's trajectories and the toys' first landfall.

Our best estimate for the toys' trajectory passed close to the site where the athletic shoes were previously spilled in May, 1990 (about 48-00N 161-00W) and Ocean Station Papa (50-00N 145-00W), where many drift bottles have been released. Therefore, it is interesting to compare the number of toys recovered with recoveries of shoes and bottles.

The total number of toys reported (about 400) equals approximately 1.4% of those lost overboard (29,000). Historical drift bottle releases made near the toy spill totaled 16 bottles recovered from 663 releases for a recovery rate of 2.4%.

Anecdotal evidence suggests that many additional toys were recovered, but not reported. Therefore, it is not unreasonable to say that the recovery rate of toys, shoes and bottles is approximately the same.

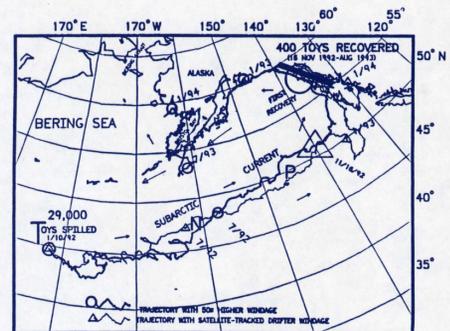


Fig. 3. Chart showing where 29,000 bathtub toys washed overboard on 10 January 1992 (T; toy spill), and dates and locations where about 400 toys were discovered by beachcombers. Drift of the toys, simulated with the OSCURS computer model, passed near the site (N), where athletic shoes were spilled, and near Ocean Station Papa (P), where 33,869 drift bottles were released.

To determine the long-term fate of the toys, the computer simulation was continued beyond first landfall, showing that the toys traveled counterclockwise around the Gulf of Alaska, and then through passes west of the Alaska Peninsula into the Bering Sea. By January, 1994 the toys had arrived in Bristol Bay and were presumably trapped in the seasonal sea ice. The following spring during breakup, given the prevailing currents, it is reasonable that the toys eventually will have been transported through the Bering Strait into the Arctic Ocean in the vicinity of Point Barrow, and from there will have been carried with Arctic pack ice north of Siberia, eventually reaching the North Atlantic Ocean.

Previously, drifts starting north of the Bering Strait have arrived at several different locations in the North Atlantic: (1) wreckage from the *Jeannette* frozen in the pack ice in the Chuchchi Sea (near Herald Island) in November 1879 was found five years later on the southwestern coast of Greenland; (2) a barrel containing a message released near Point Barrow in September 1899 was recovered on the north coast of Iceland, about six years later; (3) several bottles released in the vicinity of Nome, Alaska were found approximately ten years later in Iceland, Ireland, and Norway; and (4) a drift bottle, released 26 June, 1979 in the Bering Strait, was found in western Scotland seven years later on 6 July, 1986. Given the release of 29,000 toy animals, we anticipate that by 1999-2003 a few will have been transported to similar locations in the North Atlantic Ocean.

### 7. SUMMARY

This brief history of some objects drifting in the ocean indicates that some have had significant impact on human history, and have contributed to the scientific understanding of ocean currents. We continue to learn from drifting objects about the variability of the great ocean currents, and believe that ocean debris will continue to influence human history.

The size of some container spills dwarfs comparable oceanographic studies. For a perspective on the relative size of spilled drifting objects, consider the drift bottles released during three major oceanographic programs: (1) 33,869 bottles in the northeast Pacific Ocean during 1956-1959 for Project NORPAC; (2) 21,615 bottles released off Oregon by Oregon State University during 1961-1970; and (3) 148,384 bottles off California and Mexico by Scripps Institution of Oceanography during 1955-1971 as part of the California Cooperative Oceanic Fisheries Investigation. Spills of 61,000 shoes and 29,000 toys released instantaneously are thus relatively large numbers.

Many types of man-made objects drift on the surface of the North Pacific Ocean. Frequently, they have organisms attached to them. Depending on the associated windage, the objects and organisms will be transported to various locations in the north Pacific Ocean and adjoining water bodies. Some animals, such as *Velella Velella*, have adapted wind-sailing life strategies and are profoundly effected by winds. Early spring of some years leaves great numbers stranded in windrows along the beaches of the northwest Pacific Coast. Our calculations suggest that the fate of long-term drifting objects is not only sensitive to the great interannual variations, but also that this variation increases with the amount of their surface area subject to windage.

In our correspondence with beachcombers of North American shores, we learned that a number of bottles containing Asian notes have been uncovered. Unfortunately, most are never translated.

We are aware that many bottles containing messages are thrown from vessels all over the world. For example, Captain Basil S. Biggs released at least 500 message bottles during the 1960's and 1970's and received replies to approximately 5% of his short messages. He collected a number of the more interesting drifts into a scrapbook entitled "Epic Voyages of Messages in Bottles". A number of the drifts span the North and South Atlantic, as well as the North Pacific Ocean, and provide valuable scientific information. We hope other mariners will follow Captain Biggs' example and carefully record the release times and locations, as well as the recovery dates and locations.

Regarding containers, detailed accounts on the sea state conditions that occur at the time of spills and how the contents escape from the containers soon after a spill are lacking. Letters detailing any incident observed by a mariner would be appreciated. Information regarding containers, spills, drift bottles, and other interesting drifting objects should be sent to:

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Letters of acknowledgment and interesting accounts will be returned. Stories providing new scientific insight will be developed into scientific accounts.