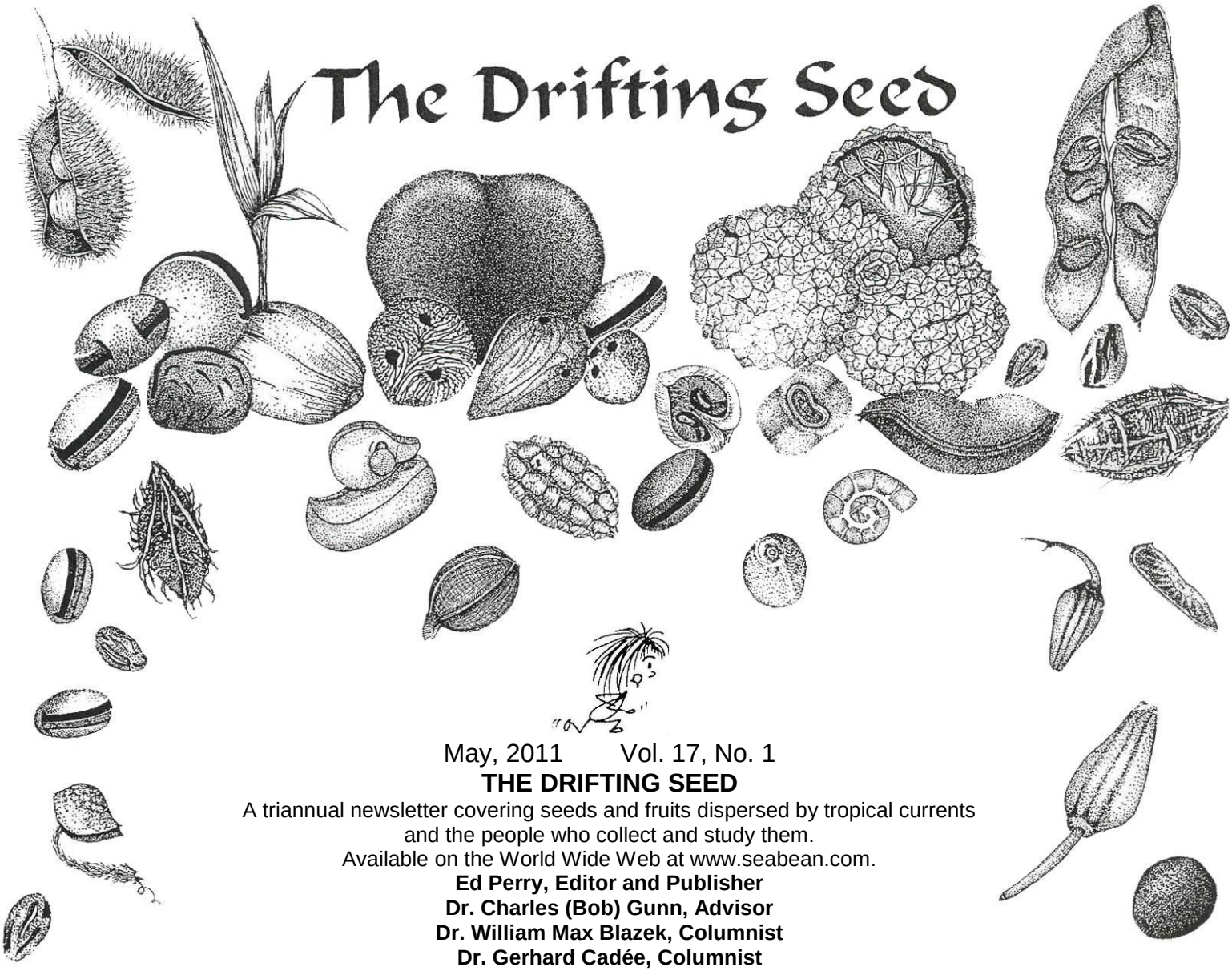

May, 2011 Vol. 17, No. 1

THE DRIFTING SEED

A triannual newsletter covering seeds and fruits dispersed by tropical currents and the people who collect and study them.
Available on the World Wide Web at www.seabean.com.

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Dr. Charles (Bob) Gunn, Advisor
Dr. William Max Blazek, Columnist
Dr. Gerhard Cadée, Columnist
Dr. Curtis Ebbesmeyer, Columnist
Dr. R. A. Hewitt, Columnist
Dr. Gerald Sullivan, Columnist
Mr. Jade Sullivan, Columnist
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The 16th Annual International Sea Bean Symposium will be held at the Cocoa Beach Public Library, October 21st-22nd, 2011.

For Newsletter Submissions, Donations, or Seed Identification:
contact: **Ed Perry,** Seaheart88@aol.com
P.O. Box 510366 Melbourne Beach, FL 32951—USA
Or e-mail: seabean@seabean.com, or visit: www.seabean.com

Has The First *Entada* Drift Seed Stranded On The Pacific Coastline of North America?

YOU BE THE JUDGE

by Seatrader Jader Sullivan & Seabeader Sully Sullivan
Jadesullivanjadesullivan@yahoo.com & geraldsully@yahoo.com

In Dec, 2007, I received a phone call from my son Jade, a new resident of the state of Washington, who claimed that on his first visit to Ocean Shores, Washington (USA), he discovered a seaheart in the wrack. A seaheart on a Pacific Northwest ocean beach? Give me a break! Not!! My response, "Sure you did, son" This is the same joker who claimed he had kukui nuts floating down the San Lorenzo River in California which were stranding on local beaches. Editor Ed set him straight by identifying this phenomena as an invasion of pignuts (*Carya glabra*).

Following receipt and examination of four e-mail pictures of said seaheart, it was concluded that he had found a wonderful "glob of tar" which resembled a fairly large "glob of tar". But upon examination of the actual drift item, it was concluded that it indeed was a drift disseminule. Wow! Seatrader Jader, drifter extraordinaire, initially guessed it was a seaheart; my wife, Carol, an *Entada* seed; ex-professor Sullivan an *E.* species, possibly *phaseoloides* or *rheedei,* since it was found on a Pacific Ocean beach; and Tim Flynn, an associate of the National Tropical Botanical Garden in Kauai, who practically has a stand of *E. phaseoloides* in his backyard, confirmed it as *Entada phaseoloides.* It should be noted that seaheart is the generally recognized common name for *E. gigas*, which is considered of New World origin, whereas, snuffbox seabean, matchbox bean and less often, St. Thomas bean are commonly used for *E. phaseoloides* and considered of Old World origin.

A short article was hastily tossed together announcing this amazing find on an American beach facing the Pacific Ocean, submitted to the *newsletter,* and was promptly rejected. Editor Ed responded: "I don't think the seed your son found was an *Entada,* and I am not even sure it was a seed. It just doesn't look like one from what I can see in the photos. Sorry." Whereupon, Jade mailed the item with a note, "Contents: 1 very eroded seaheart or maybe some tar. You make the call." Ed responded: "Hi Jade—I'm sorry to say this is plastic. Keep trying—it is possible for you to find a seaheart, though rare." Ed also relayed to me: "I received Jade's package yesterday and had a chance to look at it today. I'm sorry to say that the "seaheart" in question is in fact a piece of black plastic. Ugghh!"

So there you have it – none of us were really sure what the item truly was. Since it was not about to be published, I simply shelved this "happening" with the intent to pursue it at a later date. Later is now, and considerable information concerning this item has been assembled and is now presented for your evaluation. YOU BE THE JUDGE—is this item a glob of tar, a chunk of ugly plastic, a seed, an *Entada* seed or possibly even an *Entada phaseoloides* drift seed? So here goes—I'll try my best to be as biased as humanly possible.

The overall size, shape, thickness, color and hilum were in reasonable agreement with those of *Entada* species; although its exterior surface had lost its glossy sheen. Smith (1) stated: "*Entada phaseoloides*…..are glossy chestnut brown becoming duller and darker with age and exposure to the elements." The item measured 2 ½" in height, 2" in width with ½" thickness, which is about the average size of seahearts around here and elsewhere. The item's consistency approached that of a very hard rock or plastic. It is extremely solid almost as if it were petrified. Even when gently clattered on a hard surface, it sounds identical to rock-on-rock. This seed may well be in an early stage of fossilization known as permineralization; in which deposits of minerals into the spaces, cells and cavities have occurred. The continuing replacement of organic matter within the seed with minerals and pigments can lead to petrification. Sernander, in 1901, reported that seahearts were found in Swedish post-glacial peat bogs in a semi-fossil state (2).

Apparently the former owner of this magnificent seed decided that it would be more appealing if it were strung as a necklace. Because of the hardness of the seed, the first three attempts to drill a ¼" channel across the seed failed. Examine photo. With the fourth effort, the channel was started and halfway home there was an "oops" resulting in a massive gouge in the face of the seed. At this point, the item was probably discarded. "Been there, done that!"

How did this item reach the beach at Ocean Shores? Let the speculations begin! My preferred one is that an inarticulate Asian artisan discarded the damaged item back into the Sea of Japan, which floated into the Kuroshio Current: transferred into the Arctic Convergence (bypassing Alaska and Canada); then breaking away from the California Current and miraculously washing ashore on the Washington coastline at Ocean Shores. What an unbelievably magnificent find.

A battery of chemical and physical tests were performed on the item and at the same time the same tests were applied to an *Entada gigas* seed collected from a Mustang Island beach:

(a) Both were bathed with a rag saturated with GOO GONE, a commercial product containing petroleum distillates which would begin dissolving the item if it were tar. No effect was noted.

(b) A razor blade was employed in an attempt to slice a small sliver from the surface since a number of plastics will slice depending on their hardness. None were obtained.

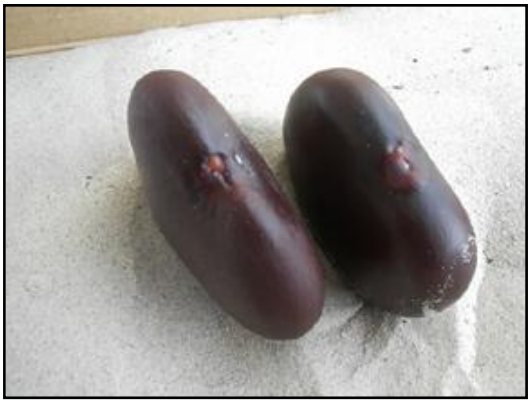
(c) Scraping the surfaces of both with the tip of a razor blade resulted in identical brown colored powder which was then subjected to intense heat. Both samples charred, smoked and burnt the same; both emitting the same characteristic odor. Nearly all plastics would have softened and/or melted. This did not occur.

(d) Both powdered scrapings were viewed microscopically under low power and high power oil emersion magnification. Both were cellular and appeared identical.

(e) Drilling the testa, seed coat, with a high speed Dremel also resulted in a fine brown powder. Drilling into plastic generally causes melting or coiled tailings. This did not happen.

(f) Drilling into the inner chamber of the item resulted in the same brown powder as with the surface cells. These internal cells were probably stone cells which would be compatible with early fossilization. Whereas nice, damp, cream-colored healthy tissue, which was probably viable, resulted when the *E.gigas* seed was drilled.

(g) Unique hilum – A rather unique anatomical feature of an *Entada* seed is its characteristic hilum. Close examination reveals that it resembles either a western or English horse saddle or somewhere in between. For those readers unfamiliar with the shape and parts of these saddles, please rein in the Wikipedia of western and English saddles on google.com. Examination of your own *Entada* seed's hilum will range somewhere in between the two saddles; exhibiting a pommel, seat, cantle and in some instances, a very conspicuous horn, whereas, other hila must be viewed with a magnifying glass to determine the presence of a rudimentary horn.



Approximately 10% of the Mustang Island *Entadas* exhibited a conspicuous horn as shown in the photo. Please refer to Hanno's article (3) which has an excellent illustration of the hila of *E. gigas, E. phaseoloides* and *E. rheedei*. Comparison of these revealed little or no differences among the three hila.

OK, so where is the photo of the item's hilum? Well, in the haste to immortalize the first *Entada* stranded on a U.S. Pacific Ocean shore, a trophy, which was christened "The Hanging *Entada*", (see picture) was erected, resulting in the near destruction of the hilum by drilling right thru the seat of the saddle.

I've been fortunate to have examined the hilum of two other seeds which had been identified as *E. phaseoloides* by Editor Ed. One was the ultimate winner of the largest *Entada*, found by Ms. Ava Shinosaki of Japan(4). The other by Ms. Billi Wagner of Florida for the smallest (5). As best as I can recall, their hila were identical to one another and indistinguishable from the pre-destroyed hilum of the item.

Please review the photo of the "after the fact" hilum of the item. Not a great amount of insight can be gleaned from this picture but a definite pommel, seat and cantle are still in evidence.

Unfortunately, from my extensive handling of seahearts over the years, I've developed an allergic response to the smoke emitted by drilling these seeds. Sneezing, nasal discharge and lacrimating eyes occur but respond nicely to a mild antihistamine. For what it is worth, the three separate occasions the item was drilled and the two times the *E. gigas*, all elicited the same allergic response with me.

So there you have it! Your call, YOU BE THE JUDGE—is the item a glob of tar, a piece of black plastic, a seed, an *Entada* seed or even possibly a seed of *E. phaseoloides?*

Bibliography

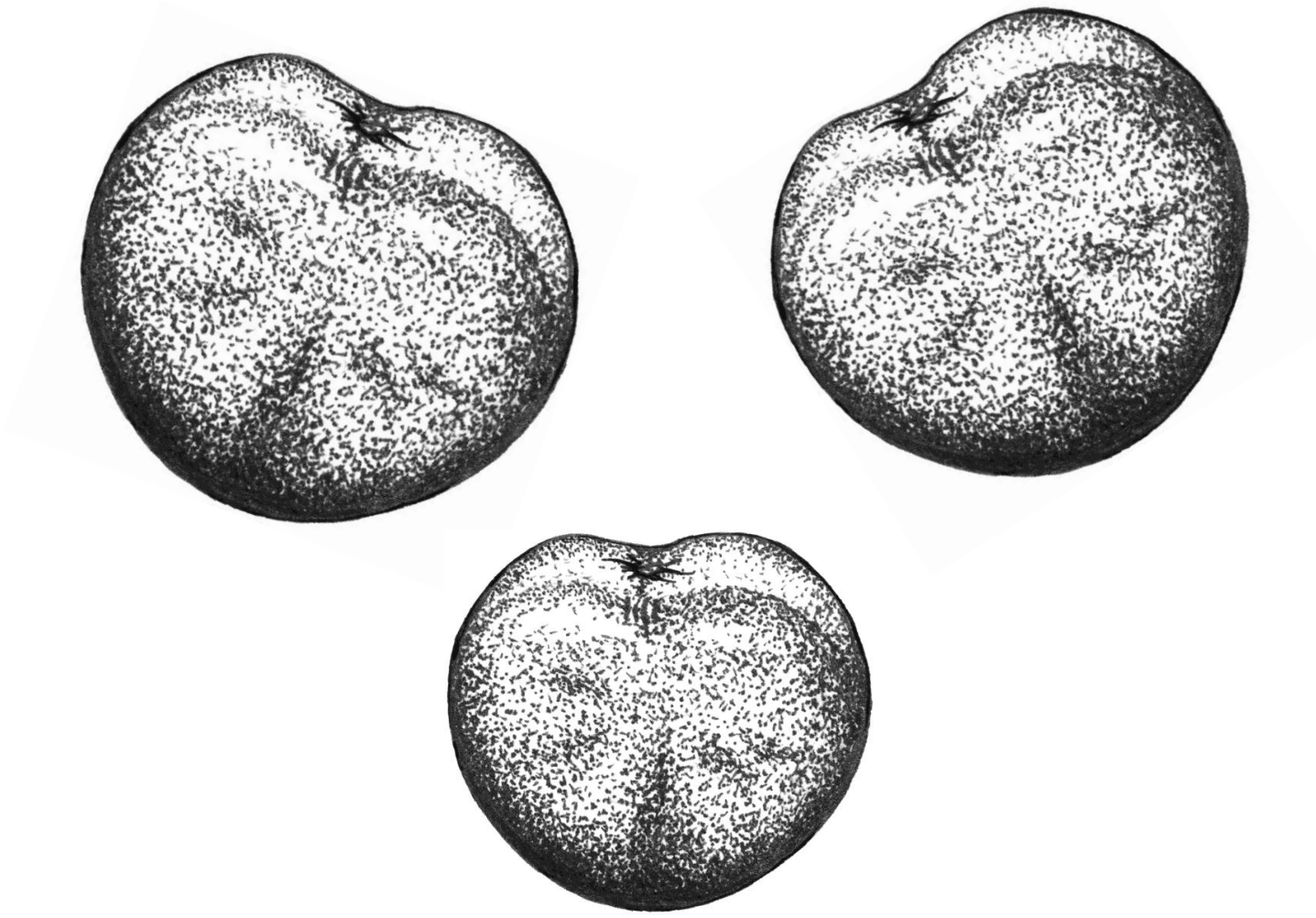
1. Smith, J.M.B. 1990. *Australian Driftseeds.* School of Human and Environmental Studies, University of New England. Armidale, NewSouthWales, Australia.

2. Sernander, R. 1901. *Den skandinaviska vegetations spridningsbidogi*.
459 pp. Friedlander, Berlin; Lundequistska, Uppsala.

3. Hanno, I. 2003. The mystery of *Entada* seeds. *The Drifting Seed* 9(1):2-4.

4. Sullivan, G. 2005. The Godzilla *Entada*. AKA the Big Bean. *The Drifting Seed* 11(1):10-11

5. Sullivan, G. 2005. The Diminutive *Entada. The Drifting Seed* 11(3):12.



Too Many Sea-Beans?
Beneath Max's Madness

by Dr. Curtis Ebbesmeyer and William Blazek
CurtisEbbesmeyer@comcast.net;

On the Monday following the annual Sea Bean Symposium, Bill and I like to go for beers in Cocoa Beach at the *Beach Shack* where Minuteman Ave. hits the sandy shore. It's a seedy place across the street from the upscale *Coconuts*. After six beers or more, we get down to brass tacks. What is it, I wondered, behind Bill's collecting 40,000 sea beans? Many sea beaners wondered, too? It seemed to lie on the edge of genius and insanity. We let the beer bring clarity.

Come with us, if you will, on our musings into the future beneath Bill's supposed madness. A future in which the most dire of ecological predictions have come to pass. Global warming has long since become global heating. All major ice masses have melted away. Sea level has consistently risen (300 or so feet upon Antarctica's complete melt and another 10 feet with the loss of the Greenland Ice Cap). The associated encroachments caused the submergence of all tropic atolls, most of Florida and much of Texas, places sea beaners love. The cities that once were New Orleans and Houston have long since been inundated.

The global thermal conveyer belt has ceased to function. Long ago, it transported heat from equatorial latitudes to the colder Arctic Ocean and Subarctic climes, thereby helping to maintain the earth's climate homeostasis. The world is now far, far different from that of today. Science and space technologies still exist, but are "hanging on by a thread." Few things are the same.

Populations numbering billions have relocated. The resulting nuclear wars have ceased, and the few remaining humans are wondering how to pick up the pieces. The fauna and flora we used to know are almost nonexistent. The tundras are now swampy morasses. The tropical and temperate rain forests are no longer. How could the world begin to return to a healthy ecosystem?

In addition to re-growing of food plants, people thought also to recreate tropic jungles, but they wondered where to obtain starter seeds. A few individuals foresaw the impending disasters, and created various seed banks. Tragically, most of these banks had been destroyed by war and environmental catastrophes.

Fortunately, with amazing foresight a few centuries back, there was a "Jonny Appleseed." He came to be known as "Billy Sea Bean," (some even called him "Mad Max") because he had this crazy idea of collecting unheard of numbers of sea beans. Many thought of him simply as an incredible hoarder, but Mad Max saw this distant time horizon. He reasoned that most of the seed repositories would be wiped out. (One, the Doomsday Bank in then Norway, defied all odds and retained a portion of its seeds).

Billy and other prescient individuals realized that not only would food crop seeds need to be preserved, but also, if the earth were to be re-greened, it would be vital that many other seed species would also have to be preserved. With a goal of 100,000 seeds, Billy roamed the beaches of Florida, the Great Bend of Texas and the Yucatan Peninsula, collecting almost 50,000 seeds over an initial ten-year period. (While he never quite reached his ultimate goal, he never stopped trying).

The earth would need help from a previous age, if a semblance of the majestic tropical rain forests were to be recreated. Billy and his colleagues therefore identified a score of the earth's highest mountains. They thought these locations might remain high enough and dry enough to successfully harbor and maintain repositories that would eventually be able to replenish many tropical seed

species. It was hoped that, say, 100 harbored species might ultimately result in at least twenty regenerated species from long-term viable seeds. After all, there had been documented cases of viable seeds from thousands of years past recovered from the tombs of Egyptian pharaohs and even ancient, preserved animal dens in the Arctic.

Toward this end, and as civilization verged on collapse, a few farsighted Tibetan Monks allowed some of Billy's seeds to be deposited deep within ancient religious caves. Additionally, after insistent efforts by ecologists and extensive lobbying from "enlightened" congress persons, a wide variety of crop, temperate and tropical seeds were delivered to, and stored, on Mars during one of the last of NASA's earlier interplanetary excursions. Tropical seed selection was based on viability information reported in the 20th and 21st century on by researchers Dennis, Gunn, and Perry.

In a last ditch effort toward re-greening the earth, technological resources were summoned, the seeds were retrieved from Mars and the Monks. The re-greening of the planet thus began.

And lo and behold! There was, indeed, a method beneath Max's madness **. . .**

Flotation Experiments with Sea Kale Fruits (*Crambe maritima* L.)

by Gerhard C. Cadée
Royal Neth. Inst. Sea Research (NIOZ); gerhard.cadee@NIOZ.nl

On my desk on July 2010 are two bottles with floating sea kale fruits. They belong to an experiment I started in November 2004 and who knows how long I will have to wait till the last has sunken to the bottom? Flotation experiments with tropical drift seeds may take long times. John Dennis started his experiments in August 1971. Many seeds floated for 15 years, some still floated after 30 years and could float for even longer periods (Perry & Dennis, 2003:23-26).

Sea kale *Crambe maritima* L.

Sea kale is a beautifully flowering temperate coastal plant (Fig. 1). It disperses by spherical drifting fruits of 5-10 mm diameter (Fig. 2). Sometimes even whole branches with fruits arrive on the Dutch coast (Fig. 3 and Cadée, 2005). Sea kale is usually not mentioned in drift seed literature, which tends

to deal mainly with the larger and tropical species. *C. maritima* occurs in three populations along European coasts: along the Black Sea, the Baltic and on Atlantic shores of France and the UK (Scott & Randall, 1976). In 1935 the first sea kale plant was observed on the Dutch coast, however, it did not flower. It is a perennial that flowers not before its second year. In 1959 it was observed again on our southern coast, of province of Zeeland in the southern part of the Netherlands but still not flowering. The first report of a flowering plant in that area dates from 1967 (Visser, 1968). Since that time it has been reported several times and appeared more to the North as well. It is now well established on several places along the Dutch coast with a preference for our artificial rocky shores: the sea dikes. The richest population now grows on our most famous dike the 'Afsluitdijk,' which closes since 1932 the former Zuiderzee (now lake IJssel) from the Wadden Sea.

Figure 1

Flotation times

It is generally thought that the usually smaller drift seeds and fruits of temperate plants float for shorter periods than the better known tropical *Entada, Mucuna* and other species. The few data that exist on flotation times of *C. maritima* seem to confirm this. Cadée (2005) cites older literature data ranging from 13 days (Sernander, 1901); 1-4 weeks (Guppy, 1906); 4 weeks as a maximum (Straka, 1959) to more than 45 days (Martins, 1845). Scott & Randall (1976) give no maximum values, but mention that in their experiments 50% had sunken after 14 days. The rest remained afloat but for how long? Apparently the experiment was not continued.

Figure 2

My own experiments, started on 8 November 2004, give both higher values for maximum flotation time and higher 50% values. I started with 100 fruits divided over two bottles with seawater, one with 60 the other with 40 fruits. The fruits stem from one of the drifting branches collected in October 2004 along the Wadden Sea dike of the Island of Texel. These bottles were kept at room temperature and checked regularly. Maximum flotation times I can still not give but they are more than 5 years. Still 10 of the 100 fruits float at this moment (July 2010). The two bottles give for unknown reasons differences in the 50% values: after 6 months half of the fruits were found on the bottom of the bottle with 60 fruits, and it lasted 32 months (!) before this was the case in the other bottle.

Viability of fruits

Such maximum flotation periods are of course only of interest for drift seed collectors. Seeds and fruits kept for so long in seawater will have lost their viability. Charles Darwin, more interested in drifting seeds as dispersal mechanisms for plants, studied viability after keeping seeds and fruits of

many species immersed in seawater. He also did one experiment with *C. maritima* which he kept for 37 days in seawater and noted that after this period they showed good viability (Darwin, 1857). It is a pity that Scott & Randall (1976) in their nice review on *C. maritima* did cite Darwin wrongly. Darwin did not do flotation but immersion experiments and did not state that 37% showed viability after 37 days immersion in seawater (as Scott & Randall, 1976 mention), but "*Crambe maritima*: after 37 days germinated well." In contrast to Darwin, Martins (1845) found that after 45 days none of his floating fruits showed viability.

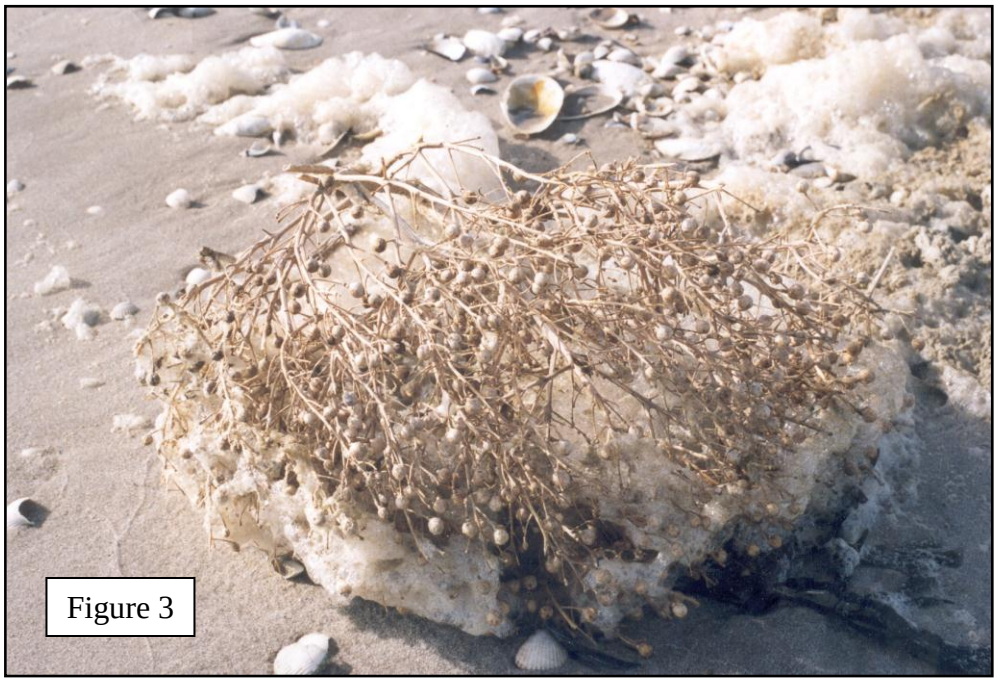


Figure 3

Explanation for the differences?

It is of course tempting to try to give an explanation for these much higher flotation figures in my experiments as compared with the published data. There is no standard method for flotation experiments. However, already Darwin has mentioned that it makes an enormous difference if you start with fruits or seeds fresh from the plant or those that were dried for some time. He gives as an example hazelnuts: "ripe hazel-nuts sank immediately, but when dried, they floated for 90 days and afterwards when planted they germinated" (Darwin, 1859 *Origin* p. 359). Experimenters rarely tell us how they collected their material and how they performed their experiments. If earlier experimenters used fresher material than I did, this might explain that my material (collected form branches of sea kale drifted ashore and kept dry for over 1 month) gave higher figures. To test this explanation I recently (22 July 2010) collected 5 still green fruits directly from the plant to start a new experiment. They did all sink in seawater within one day; one immediately the last after 16 hours. I will now dry them and start a new experiment as Darwin did with his hazelnuts. So this story will be continued.

Literature

Cadée, G.C. 2005 Drifting branches of *Crambe maritima* L. with fruits. Cah. Biol. Mar. 46: 217-219.

Darwin, C., 1857. On the action of sea-water on the germination of seeds. J. Proc. Linnean Soc. (Botany) 1: 130-140.

Perry, E.L. & J.V. Dennis, 2003. *Sea-beans from the Tropics.* Krieger, Melbourne, Fl. 232 pp.

Scott, G.A.M., & R.E. Randall, 1976. *Crambe maritima* L. Biological Flora of the British Isles. J. Ecology, 64: 1077-1091.

Visser, A. de, 1968. Over *Crambe maritima* L. in Nederland. Gorteria 4(1): 1-2.

Figures

1. Flowering sea kale on the coast of Texel, 2009
2. Fruits of sea kale from drift on the coast of Texel, 1992. Size variation 5-11 mm diameter.
3. Branch with ripe fruits in drift on the coast of Texel, 2004.

My 100-Year Old Sea-Beaning Friend; Is She our First?

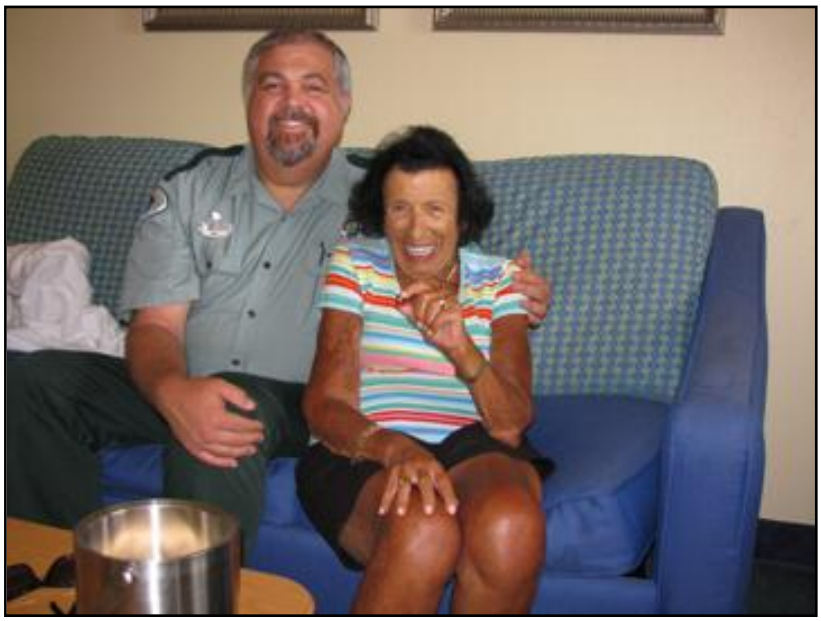
by Ed Perry, Seaheart88@aol.com

At a time in my life when I work three different jobs and jointly participate in daily responsibilities of raising my wonderful daughter, "free time" has become a thing of the past. Walks on the beach are now rarely taken and when they do happen they're a cherished treat. During this time of hectic school mornings and rare days off, my involvement with sea-beans has served me as a break from the ordinary and an escape from my busy everyday life.

One giant blessing has been a connection to other interesting beachcombers throughout the world. I have friends in Texas, Washington, the Carolinas, many parts of Florida, Bermuda, and the Bahamas. More far-flung friends span the globe: England, Ireland, Holland, France, Spain, Africa, South and Central America, Australia, Japan, Hawaii, and the Marshall Islands.

I never would have guessed, however, I might someday have a sea-beaning friend in Jackson Hole, Wyoming!

Her name is Liz McCabe. She's as colorful as a sea purse, as tough as a weathered walnut, as sharp as a starnut, and was as much fun to find as a thick-banded mucuna. This last March, on the 20th, she had the honor of turning 100 years-old. I ask this to our newsletter readers: Is she the first 100-year old sea-beaner among our group?



Liz was born in San Francisco and later grew up in Atherton, California. She's been beachcombing nearly her entire life, for seashells. Just about 15 years ago, sea-beans piqued her curiosity.

A winter get-away with her husband Fred on the Caribbean island of Little Cayman provided the background that began Liz' journey into the world of sea-beans. Her busy life in Jackson Hole as co-owner and publisher of the local newspaper (now *Jackson Hole News & Guide*) was rejuvenated each year with this wonderful winter get-away to the tropical island paradise. Here, she could pursue her favorite hobbies: fly fishing, beachcombing, and tennis. Liz' daughter, Ann Ramsay, now accompanies her back to Little Cayman each year since the passing of her husband. Liz has never retired. As a professional wildlife photographer, she still provides a feature photo to her beloved newspaper each week.

I first met Liz in April of 2008 when she traveled up the coast of Florida from Miami (a stop-over from Little Cayman before heading back to Jackson Hole). She and Ann joined our local and loose-knit group of sea-beaners in Brevard County, FL. We informally meet monthly for a "Beaners' Night Out" that consists of a very casual dinner at a local restaurant. The get-togethers are filled with fun, sharing, stories, IDs, camaraderie, and lots of laughter. Liz and Ann were excited to meet the group as we converged at the local Panera bakery.

Over the next three years Liz and I kept in touch through an occasional phone call, but April of this year brought us back together in Melbourne, FL, face to face. Liz was excited to show me a strangely colored sea purse she beachcombed during this year's stay on Little Cayman. It wasn't a sea purse but a lightly colored Cathie's bean, *Canavalia nitida*! After inspection, I labeled Liz' special bean as "the bull's-eye Cathie's bean," for it appears that a fungus or something may have attacked the seed in development and left a permanent ringed spot on the seed coat.

Liz is a wealth of knowledge, an ever-optimistic spirited person, and a lot of fun to just be around. I couldn't help but to also think about my dear deceased friend Cathie Katz. How Cathie would have loved to meet Liz.

Curious, I Googled Liz' name and found a most interesting article written about her turning 100 years-old (http://www.jhnewsandguide.com/article.php?art_id=7105). In that article, Matt Mead, the Governor of Wyoming, proclaimed Sunday, March 20th of 2011 as "Elizabeth McCabe Day."

In his signed proclamation Mead said this about McCabe, "She has taught us that a life of engagement and activity rewards the spirit and a spirit rewarded will often do its best to extend one's body." He also stated that "Liz brings people of diverse backgrounds and regions together to enjoy the views from her porch. In that, she represents the best of Wyoming, where people from all walks of life and different milieus can come together and find they share many things in common."

I'm invited to visit Liz on her porch this summer. I plan to take a few days out of my hectic life to slow down and learn how to live to be a hundred from a very wise friend.

Census of Flotsam in a Narrow Essex Estuary, England, October 9, 2010

by R.A. Hewitt, 12 Fairfield Road, Eastwood, Leigh-on-Sea, Essex SS9 5SB U.K.

A predicted tide backed by E.N.E. breezes (of Beaufort Numbers 4 to 5), following three similarly dry days with slightly lower tides, had an elevation at 3.35 m above mean sea-level (O.D.) in the 3.0 m wide brook under the Salt Bridge in Rochford, Essex. This was around 13:20 Hrs. G.M.T. on October 9, 2010. It produced a strandline in the estuary to the east of there, on salt march vegetation at the base of the dykes, composed of *Ascophyllum nodosum* (L.) overlain by reed stem debris and silt. Due to the lower elevation of subsequent tides and dry weather, it was possible to sample this strandline for flotsam (other than wood and local plants) by lying on it at later dates listed for each site on Table 1. Distances measured rather directly along the north bank in km from the North sea are shown for each sample, with reference points on the ground at the Mine Control Tower built in 1941 near Holliwell Point defined as 2.0 km, and the footbridge at the 6 m wide head of Fleetwood Creek at 19.4 km. None of the coconuts and oil seen in the parallel estuary studied by Hewitt (2010) had entered this one. For example, there were none of the old endocarp fragments seen concentrated in gravel at the Battery and other undisturbed sites in Shoebury.

The Salt Bridge is at 19.8 km on an adjacent branch of the estuary separating near Broomhills Wharf at 17.9 km. The area to the east of 19.6 km is fully saline at high water and so devoid of trees and urban development to give an insight into the drifting of leaves, seeds and human litter in seawater. Most of the 2010 leaf fall had not yet taken place. One hundred or so large leaves joined a single plastic bottle in the flow upstream under the Salt Bridge as the level was continuously watched rising from 3.00 to 3.25 m O.D. The geological question to be investigated is where they are taken downstream by high ebb tides with the less conspicuous bracts or seeds from local trees. Human litter helps to date the age of the stranded material at each site and is of interest in environmental pollution studies.

My interest in the plastics that day was due to the reappearance of particular yellow sponge-like foam blocks, with a coconut, at Shoebury East Beach on the previous day. They both had evidently come from the N.E. and although no coconuts were seen when walking between the sites for the present survey, it became apparent that these foam plastic blocks did come from the North Sea. They were particularly common where the strandline transgressed from beach sand on to a salt marsh, formed where a spring tide backed by N.W. wind made a 100 foot break in the seawall on February 16. 1736 and was repaired then by building an inset wall (Greve 1959, p.30). The block of plastic foam there (1.8 km) like one from the site near Stannetts Creek (14.5 km) are still coated on both sides with silver foil. It shows the long, deep marks made by the offshore dwelling bird *Fulmaris glacialis* (L.). Moving westward both at Southend and along the northern estuary strandline these plastic blocks become smaller and brown, rather than yellow with a white freshly broken core. Measurements of the maximum length of the fragment at each site and the number present with the other items of collected flotsam in strandlines of cited length (Table 1) give some indication of their eastern origin. A site on Two Tree Island in Hadleigh, 7 km W. of Southend Pier and 70 km around the low water mark from Rochford, was sampled mainly for plastics on the same strandline, nearer to the River Thames. It is termed TT on Tables 1-2. Southend-on-Sea beaches are regularly cleaned of these plastics elsewhere.

Table 1. Strandline of October 9, 2010. Sample station with distances from the North Sea, the direction faced towards the water on each strandline estuary width (km) the sampled length (m) and data etc.

Parameters	Sample Stations							
Location km	19.4	17.9	17.4	15.8	14.5	11.2	1.8	T.T.
Estuary width km	0.006	0.25	0.25	0.4	0.3	0.3	1.1	0.8
Strandline facing	E.S.E.	E.	S.	E.	S.E.	E.S.E.	S.E.	S.
Length sampled m	10	8	100	58	13	30	15	360
October dates	22	9	9+14	14	16	16	19	10
Last sale	9.10	-	4.10	7.10	1.10	9.10	9.10	-
1st sale	5.06	-	6.99	1.05	9.07	2.09	5.07	-
Block mm	-	62	52	39	150	60	210	120
Plastic swab stick	0	0	0	2	2	1	22	257
Broken stick	0	0	0	0	0	1	22	34
E. polysty.	6	27	116	32	13	16	35	2
E. p. chip	0	3	15	8	3	1	1	-
Styrofoam	2	6	34	17	12	9	17	6
Hard bits	1	2	23	5	14	6	60	60
Bottle ± top	1	4	3	3	10	1	18	1
Bottle top	0	0	26	9	3	6	28	32
Bottle ring	0	0	2	0	0	3	5	27
Hard cap	0	0	10	8	2	6	22	15
Packaging	19	1	26	55	21	19	45	15
Foil foam	0	0	0	0	1	0	5	0
Similar foam	0	1	9	2	2	2	11	3
Rubber-like	0	3	7	1	6	1	2	14
Flexible	0	0	2	0	1	4	6	21
Straw	0	0	4	1	0	0	2	13
Lollipop	0	0	3	0	2	2	2	7
Pen ± top	0	0	1	0	0	0	2	10
Cutlery + jar	0	0	7	7	2	2	6	7
Clay pigeon	0	0	0	4	0	1	2	4
Twine	0	0	1	0	0	0	3	13
Polythene	2	0	5	11	1	6	9	17
Hard item	1	0	3	4	1	1	5	7
Smooth stick	0	0	1	1	1	1	3	2
Rubber	0	0	1	0	5	1	9	4
75 mm r. band	1	0	0	0	1	0	0	25
Al can open	1	1	5	11	3	2	0	0
Shut Al. can	0	0	0	0	0	1	1	0
Glass bottle	0	0	2	0	1	2	0	0

An interesting distinction can be made between swab sticks, representing household waste, and lollipop sticks. These are seen after being dropped in streets with plastic soft drink bottles, open Al cans, drinking straws and a particular type of red rubber band with a width of 4 mm and a doubled length of 75 mm listed separately on Table 1. The hollow swab sticks were identified when broken from their longitudinal striation. When complete they had a uniform length of around 72 mm, external diameter of 2.5 mm, internal diameter of 1.6 mm and the transverse U-shaped ridges at each end. The buoyant lollipop sticks were smooth, somewhat bigger and had one, or sometimes two, lateral holes near one end.

Table 1 includes first and last sale dates deduced from the litter via an "offer closes 31.7.99" notice on one packet and supported in that sample by a best before date of "19/May/01" on a foil and plastic *Sprinters Crisp* packet. None of the litter consisted of fresh milk bottles, but it was possible to deduce September 2010 dates by looking at the best before dates of the same brands on sale at the end of October and subtracting the difference in time from cited best before dates in early 2011 in the October strandline. Dates on plastic bottles of soft drink and the bottom of beer cans were also studied, but in the latter case, the longer shelf life made the result less precise. The can dated 30/04/10 was more obscured by brown spots after perhaps two years than those on the crisp packets and wrapping 'paper' of confectionary termed "packaging" on Table 1. Dates indicating the greater age of the litter reworked by the tide, 15.8 to 17.4 km from the open sea, are supported by the larger number of expanded polystyrene fragments counted there and at 17.9 km strandline (E. polysty on Table 1, with typically more robust packing chips of a similar plastic listed as a separate taxon E. p. chip there). If the polystyrene was recorded by weight it would probably be found to be more abundant towards the sea in that estuary; although it was also only represented by small fragments of decayed spheres at the Two Tree Island (T.T.) open coastal site.

Table 2. Census of additional typically marine stranded items (L.E.C.A and *Argex* both being expanded clay products, although much of the modern L.E.C.A. is made from fly ashes) plus all the stranded leaves (L), seeds (s) and bracts (b) which had lost their seeds. Known species names are omitted to save space and include the Oak *Quercus robur* L., Beech mast *Fagus sylvatica* L., Hazel nuts of *Corylus avellana* L. empty catkins on one twig of Hornbeam *Carpinus betulus* L., and wind dispersed seeds of Ash *Fraxinus excelsior* L., Field Maple *Acer campestre* L. (=Sp. 1), Norway Maple *Acer platanoides* L. (=Sp. 2) and Sycamore *Acer pseudoplatanus* L (=Sp. 3) Common seeds of *Triglochin maritima* L., leaves of *Halimione portulacoides* (L.), reeds and wood are omitted from the table.

Km from sea	19.4	17.9	17.4	15.8	14.5	11.2	1.8	T.T.
Quercus s	2	4	37	5	1	0	0	0
Quercus *b*	1	2	8	5	2	0	2	0
Quercus L	46	11	86	25	16	4	0	0
Fagus s	0	1	2	0	1	0	0	0
Fagus b	0	0	9	0	0	1	0	0
Corylus s	0	4	0	2	1	0	0	>1
Corylus b	1	0	0	0	0	0	0	0
Carpinus b	1	0	0	0	0	0	0	0
Fraxinus s	2	1	10	2	1	0	0	0
Platanus b	0	2	2	0	0	0	0	1
Platanus L	3	0	4	1	0	0	0	0
Aesculus s	1	0	1	0	0	0	0	0
Aesculus b	0	0	9	2	0	0	1	0
Aesculus L	23	11	3	10	7	2	0	0
Acer sp. 1 s	0	0	7	2	1	0	0	0
Acer sp.1 l	1	0	0	0	0	0	0	0

Acer sp.2 s	0	1	13	1	2	0	2	0
Acer sp.3 s	0	2	4	0	1	0	0	0
Crataegus s	5	1	1	0	0	0	0	0
Crataegus L	141	9	13	4	4	0	0	0
?Prunus spp. s	0	2	17	2	0	0	2	>7
Arachis s	0	0	0	1	0	0	0	0
Tilia s	0	0	1	0	0	0	0	0
Tilia L	1	0	0	0	0	0	0	0
Salix spp. *L*	569	8	1	1	4	o	0	0
Other thin *L*	111	5	2	1	0	1	0	0
Hedera L	54	1	4	1	3	0	0	0
Cypress *L*	0	0	0	0	1	1	0	1
Other thick *L*	4	8	6	7	1	1	0	0
Cork	0	1	0	0	0	2	1	2
Charcoal	1	2	11	6	6	7	30	>6
Clinker	0	1	3	1	0	0	9	8
L.E.C. A.	0	0	1	0	0	2	2	1
Argex	0	0	1	1	0	0	11	2

Conclusion

The rapid decline in the abundance of thin and other rapidly sunk leaves away from trees at Rochford is not unexpected from earlier tests in seawater (Hewitt 2006), which also predicted that Oak leaves float in seawater longer than Willow and most other local leaves which fall in the autumn. What is evident, however, particularly from the dating of plastic “paper” and foil litter, is that this upper narrow part of the estuary also contains the oldest still buoyant material. It also contains relatively new litter probably brought from the sea including a white plastic trawl net float with many scratches in it, a discharged hypodermic syringe of insulin with the needle not rusted inside the plastic cap and a more worn felt-tip pen advertising a mall in New York 45th Street. Apart from all this plastic this site at 17.4 km had changed little since John Winthrop stayed there to go duck shooting, then woo his wife and so get married there in April 1605!!

Studies have been done in both the fall of 2009 and 2010 by sampling lower strandlines on the sandy beach at the 17.9 km site. On November 10, 2010 it was possible to resample exactly the same length and position of the strandlines at the 17.9 km Broomhills Wharf and 15.8 km Wall End salt marsh sites. The area cleared of plastic at 15.8 km was still clearly defined by the bottles left around it and evidently had not been disturbed by lateral flow seen in the more east-west trending and proximal sites. None the less the 15.8 km site yielded new plastics (61), 35% of the previous sampling there and also the following minor additional items to the Table 2 material: *Q robur* 4 leaves and 1 acorn, buoyant ?Prunus seeds1, Ash seeds 2, Norway Maple seeds 1, *Hedera* leaf 1. By contrast the 17.9 km site showed a major influx of new green and also brown leaves which evidently had been taken that far by the tides and freshwater flooding on November 7 to 9 2010.

References

Cadée, G.C. (2002). Seabirds and plastic debris. *Marine Pollution Bulletin* 44:1294-1295.

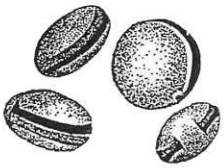
Greve, H. (1959). *The Great Tide* Essex County Council, Chelmsford, 883 pp.

Hewitt, R.A. (2006). Short-term floatation experiments on vegetation and flight feathers in cold English seawater. *The Drifting Seed* 12(3):3-8.

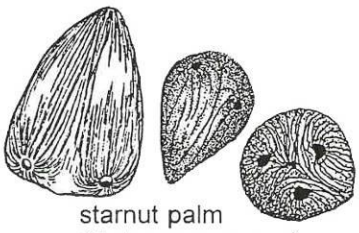
Hewitt, R.A. (2010). Fuel Oil and coconuts stranded at Southend, September 20, 2010. *The Drifting Seed* 16(3):2-4.

Simple Guide to Common Drift Seeds

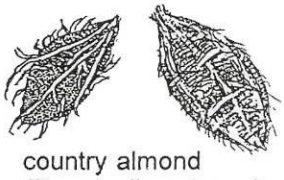
(Illustrations by Cathie Katz and Pamela J. Paradine)



hamburger bean
(*Mucuna* spp.)

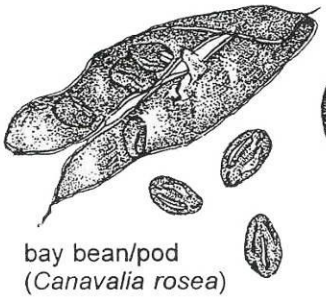


starnut palm
(*Astrocaryum* spp.)

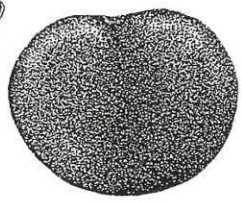


country almond
(*Terminalia catappa*)

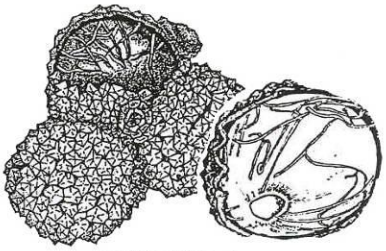
sea pearl/pod
(*Caesalpinia bonduc*)



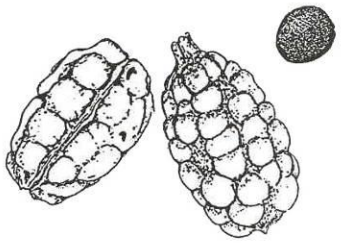
bay bean/pod
(*Canavalia rosea*)



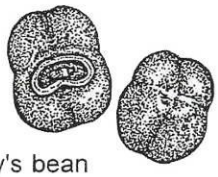
sea heart
(*Entada gigas*)



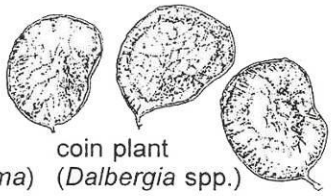
golfball/pod
(*Manicaria saccifera*)



hand grenade
(*Sacoglottis amazonica*)

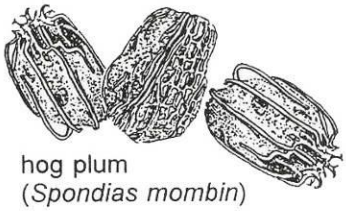


Mary's bean
(*Merremia discoidesperma*)

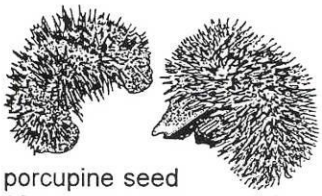


coin plant
(*Dalbergia* spp.)

sea purse
(*Dioclea reflexa*)

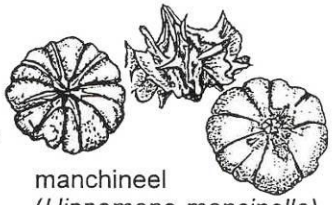


hog plum
(*Spondias mombin*)



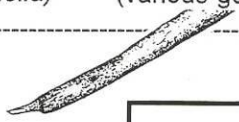
porcupine seed
(*Caryocar microcarpum*)

LEGO® toys
(*plasticus legoii*)



manchineel
(*Hippomane mancinella*)

white/black/red mangrove
(various genera)



The Drifting Seed
PO Box 510366
Melbourne Beach, FL 32951