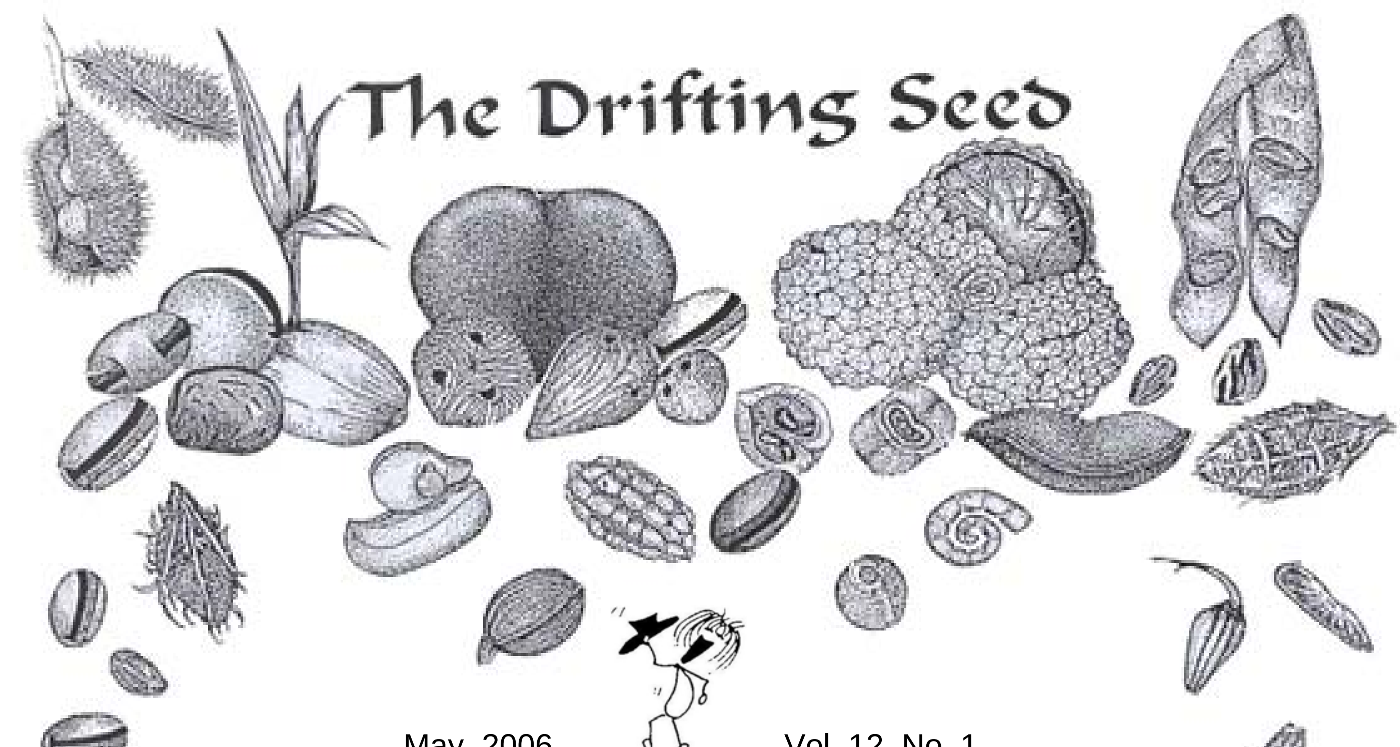

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THE DRIFTING SEED

A triannual newsletter covering seeds and fruits dispersed by tropical currents and the people who collect and study them.

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The 11th Annual International Sea Bean Symposium will be held at the Cocoa Beach Public Library, October 13th-14th, 2006.

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Non-floating *Entada* seeds on the Dutch coast

by Gerhard C. Cadée & Rien de Ruijter
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Sea hearts, *Entada*, are probably the best-known and most frequently collected drift seeds from tropical plants (Gunn & Dennis, 1976; Nelson, 2000; Perry & Dennis, 2003). On the 27th of February 2005 Rien de Ruijter was very lucky when he collected two sea hearts on the Dutch North Sea coast. However, at home both appeared *not* to float in freshwater, nor in seawater. We must conclude, therefore, that these sea hearts cannot be real tropical drift seeds. How then did they arrive on our coast?

From older literature (in particular Guppy, 1906) it appears that only part of the seeds produced by *Entada* can float. Half or more of the sea hearts produced lack the hollow, air-filled center, which gives them their floating ability. Moreover, we know that *Entada* seeds are sold in shops in the Netherlands (Brochard & Cadée, 2005). Combining these facts this suggested to us that these two non-floating sea hearts found in February 2005 were collected in the Tropics, brought to the Netherlands and sold there. They were probably lost on the beach; another example of the importance of the 'human factor' in drift seeds (Cadée, 1997).

H.B. Guppy on sea hearts

Henry Brougham Guppy (1854-1926) did probably more research on drift seeds and tropical coastal vegetation than anyone before or after him. His life must have been adventurous, suitable for a splendid biography. He was born in Falmouth (Cornwall, UK), an excellent place for beachcombers to collect tropical drift. He remembers as a boy to have often collected on Cornish beaches shells of the tropical pelagic snail *Janthina* (Guppy, 1917: p. 29). He studied medicine in Edinburgh and became surgeon for the Royal Navy from 1876-1885. Much of his navy time he spent in the Pacific a.o. aboard the *HMS Lark*. This enabled him to study the geology and coral reefs 1882-1884 of the Solomon Islands (Rice, 1986) and to visit tropical beaches to start his life-long studies of tropical vegetation and drift seeds. When he became financially independent he left the Royal Navy and started travelling. He collected plants on the Solomon Islands, on Keeling and Java, did botanical and geological research on Hawaii and the Fiji islands and botanical research in the West Indies in 1907 to 1911 (Desmond, 1994). As no one before him, he had the possibilities to study tropical coastal vegetation on a worldwide scale and to collect drift seeds and fruits. His studies were published in three books that still form a rich source of information (Guppy, 1906, 1912, 1917).

In Guppy (1906: p. 181) he writes that half or less of the *Entada* seeds fresh from the plants could float. They had the hollow center that gives the seed its floating ability. As a result, only a small part of the seeds produced by plants growing along rivers will be transported by these rivers to the sea. Guppy already suggested that those that can drift can do this for a very long time. This suggestion is now supported by the drift experiments started by John Dennis in 1971 and continued by Ed Perry: two of these sea hearts are still drifting (Perry & Dennis, 2003, p.23 - 26).

Sea hearts as souvenirs and used for window-dressing material

In Europe sea hearts can regularly be bought in shops as souvenirs (Cadée, 1991; Nelson, 2000; Brochard & Cadée, 2005). Also tropical shells found now and then on Dutch beaches already for a long time are thought to be imported and sold in beach resorts (van Regteren Altena, 1937). In the Netherlands some years ago also a firm (BeekWilder) dealing in window-dressing material sold sea hearts in large quantities. Most sea hearts therefore will reach the Netherlands, not as real tropical drift seeds, but to be sold here. If those sold here were collected where the plants live, it is quite possible that part of these sea hearts will not be able to float. Up to now we have been able to test three sea hearts that were used as window dressing material in our country, and two of these did not float. This corroborates our conclusion that the two found on the beach by Rien were introduced by man. Moreover, the shape (Fig. 1) is also different from the *E. gigas* seeds found on Atlantic shores on both sides of the ocean (Nelson, 2000; Perry & Dennis, 2003). It is rectangular in outline with straight sides, rather than round. This fits better the description of *E. phaseoloides* of the Indian and Pacific Oceans (Gunn & Dennis, 1967; Nelson, 2000). *E. phaseoloides* has never before been reported from European coasts. It is hardly possible for drift seeds from the Indian or Pacific Ocean to arrive with sea currents on European coasts (Brochard & Cadée, 2005). We are convinced that the sea hearts we report on here were introduced by man, forming another example of the importance of 'the human factor' in tropical seeds and fruits found on the Dutch beach (Cadée, 1997; Cadée & Nijhuis, 2005).

This asks for testing the earlier reports of sea hearts from the Dutch beaches. Gerhard tested those in his drift seed collection. These were found by different people, always as single seeds on Terschelling (~1965), Castricum (1993), Texel (2 in 1994) and Rottumeroog (1994) all in the northern part of The Netherlands. All these could float in fresh water as did the specimen Rien had collected in 2001 on Vlieland. Two sea hearts found in France, and one collected by Gerhard on Skye in 2003 floated. Therefore we think all these are real tropical drift seeds. The tens of sea hearts found in drift in the 1970s on beaches in the southern part of the Netherlands were thought to be from a ship load of seeds probably transported to our part of the world for a pharmaceutical company (van Benthem Jutting, 1977).

Figure 1 One of the non-drifting sea hearts found by Rien de Ruijter on the North Sea beach near Schoorl (prov. North-Holland)

Literature

Benthem Jutting, W.S.S. van, 1977. Zaden van *Entada gigas* (L.) Fawcett et Rendle op het strand bij Domburg. *Gorteria* 8: 156-157.

Brochard, C. & G.C. Cadée, 2005. Tropische drijfzaden van de Nederlandse kust. *SWG Tabellenserie* 30: 1-66.

Cadée, G.C., 1991. Nieuwe gegevens over *Entada gigas* en andere exotische vruchten en zaden van ons strand. *Het Zeepaard* 51: 56-64.

Cadée, G.C.. 1997. Tropical drift disseminules from the coast of the Netherlands: The human factor. *The Drifting Seed*. 3(2): 3-4.

Cadée, G.C. & H.W. Nijhuis. 2005. Will Terschelling's mermaid tell us her secrets? *The Drifting Seed* 11(2): 3-4

Desmond, R., 1994. *Dictionary of British and Irish Botanists and Horticulturists*. Taylor & Francis, London, 825 pp.
Gunn, C.R. & J.V. Dennis, 1976. *World Guide to Tropical Drift Seeds and Fruits*. Demeter Press, New York, 240 pp (reprinted 1999, Krieger Publishing, Malabar, Florida).
Guppy, H.B., 1906. *Observations of a Naturalist in the Pacific between 1896 and 1899*. Vol. 2. *Plant Dispersal*. Macmillan, London, 531 pp.
Guppy, H.B., 1912. *Studies in seeds and fruits*. Williams & Norgate, London, 528 pp.
Guppy, H.B., 1917. *Plants, seeds, and currents in the West Indies and Azores.* William & Norgate, London, 531 pp.
Nelson, C.E., 2000. *Sea Beans and Nickar Nuts*. Botanical Society of the British Isles, London. Handbook no 10: 1-156.
Perry, E.L. & J.V. Dennis, 2003. *Sea-beans from the Tropics, A collector's guide to sea-beans and other tropical drift on Atlantic shores*. Krieger publisher, Malabar, Florida, 232 pp.
Regteren Altena, C.O. van, 1937. Bijdrage tot de kennis der fossiele, subfossiele en recente mollusken, die op de Nederlandse stranden aanspoelen, en hunner verspreiding. Nw. Verh. Bataafs Gen. R'dam. (2)10(3): 1-184.
Rice, T., 1986. *British Oceanographic Vessels 1800 – 1950.* Ray Society, London, 193 pp.

A request for sea-beans (that was filled!):

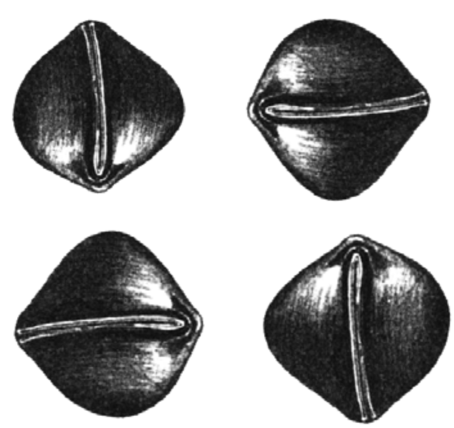
Dear Ed & Paul,

I'm writing ahead of the Symposium later this month to ask a favor: I'm looking for small samples of fresh drift seeds (*Mucuna*, *Entada*, *Canavalia*, *Caesalpinia*) from the bean family for a research project. I'd like to test the beans for cyanide compounds in their tissues. I have no idea if these seeds might contain cyanide compounds in their tissues, but I'd like to play this hunch and find out. Cyanide compounds in seeds are both defensive and a storage sink for nitrogen.

Dear Ed, Christopher & Paul,

Despite interruptions from hurricanes, holidays, etc., I was finally able to test the *Mucuna*, *Entada* and *Canavalia* seeds for cyanogenesis. Alas, no joy. It seems these legumes do not defend their seeds with cyanide, but instead rely on their hard seed coats for physical protection. Ah, well, it was fun playing out the hunch, even if it didn't yield any exciting results.

Thanks to you all for the seeds and your willingness to help out.
All the best for the holidays and the coming new year.
Sincerely,
Scott



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Sea-Beans in Hog Heaven
by Dr. Curtis C. Ebbesmeyer

— ***Piggy banks of beans and flotsam.***

To ball, glass, shell or bean. Each compulsion reveals much of the sea. Pacific beachcombers yearn for glass fishing floats deployed in oriental fishing, glassers hunt shards from centuries' old bottles, shellers prowl for magnificent specimens, and beaners search for the rock-hard seeds produced in tropical jungles. Which obsession shall it be?

Seeking sea-bean nirvana, eleven raqueros—beachcombers in Spanish—mostly from Florida, holidayed in Mexico. Though famed for the number of beans they provide, the beaches of eastern Florida pale in comparison with the shores of eastern Mexico which are both up-current and closer to the jungles of Central and South America where many Floridian beans originate. In one week (December 7-15, 2005) along Mexico's Costa Maya facing the Caribbean, we counted 3,000 Mary's beans, sea hearts, hamburger beans, and assorted very rare specimens (*www.seabean.com* shows the beans and the plants they sprout).

A liquid railroad hauls the fabled-floaters—some can remain buoyant for 30-plus years—a thousand miles in three weeks between the Costa Maya and eastern Florida. It highballs north from Belize through the Yucatan Channel, then snakes east across northern Cuba and north along eastern Florida into the Atlantic. Judging by Florida's relative paucity, most keeper beans fall along the tracks in Cuba and the Gulf of Mexico, or continue aboard the Gulf Stream into the North Atlantic Ocean.

After landing in Cancun, we drove five hours south through Mexico almost to the Belize border. Near Mahahual, we stayed at the *Mayan Beach Garden*, truly a garden on the beach well removed from tourist resorts (*MBG*; visit *www.mayanbeachgarden.com*). Eleven of us shared five cabanas, each with an immaculate shower and toilet. In 2003, **Marcia** and **Kim Bales** constructed *MBG* from native Mayan materials as clean and inexpensive, with fine Mayan meals—breakfast, lunch, dinner—included.

"Geographically, MBG is in the Costa Maya," said Marcia. *"The Mayan Riviera is the area north of Tulum and extends almost to Cancun. Costa Maya spans the region south of the Sian Ka'an to Belize."* In the Mayan language, *Sian Ka'an* means *Origin of the Sky*. The *Sian Ka'an Biosphere Reserve,* a 1.3-million-acre park set aside in 1986 to preserve tropical forests, mangroves, savannas, coral reefs and 25-plus Mayan ruins, reaches south from Tulum.

The band of eleven beaners included an odd bean, i.e., me, searching for flotsam amongst the seeds of Elysium. Being a novice amongst experts, did

I stand a chance of finding any in the wake of their beaning? No worries, for multiple wrack lines, each a rich vein, blanketed the beaches. Five abreast Hoovering along could not hope to detect all the beans in a single sweep. In fact, for days the miles of virgin wrack fronting our cabanas yielded bumper hauls.

It was difficult for me to focus exclusively on beans when so much other flotsam possessed deep significance. I kept thinking how the toy plastic wheels could represent the great fluid gyres that spin the oceans between the continents, and the motion of the flotsam as it is pulled along the imaginary railroad tracks that run round the gyres. The plastic pigs the beaners kept finding came to symbolize the engines known as hogs operated by hoggers (engineers). And that makes beachcombers foamers—slang for railroad enthusiasts—searching beside the liquid RR tracks.

The piggy banks soon morphed into metaphors for the banks of flotsam the gyres harbored within their rails. Hair combs I saw literally as beach combs. *Bic* lighters containing lighter fluid were *Bic* bombs symbolic of floating military ordnance such as the 35,000 live submarine mines adrift all across the North Pacific Ocean after WW II. Since he first began beaning twelve years ago, Ed has recovered numerous *Barbie Doll* torsos which reminded me of murder cases I'd worked on involving heads, arms, legs and feet.

The first day of beaning littered everybody's cabana porch 'cept mine with high-grade beans. As I sorted beach trash, the proper beaners added flotsam they'd discovered betwixt beans. Word of my trashy obsession spread. Even a young Mayan boy stopped by to contribute a small wheel and a sea coconut.

The piggy banks added yet another dimension to our magical trip. They, along with a dragonfly overhead, signaled **Cathie Katz** was with us! Surging interest generated by her books on the nature of Florida's beaches caused Cathie to convene the *1996 Sea Bean Symposium*, the first public gathering devoted to drifting seeds. Though she'd passed away four years earlier on Thanksgiving Day 2001, each time we gathered, Cathie joined us in special ways.

At the *2002 Symposium*, high above our booths flew a large dragonfly. We knew it was Cathie's spirit because she adored dragonflies. Other poignant signs followed. In Ed Perry's presentation, just when he said 'Cathie's Bean,' a returning *Space Shuttle* twice sonic-boomed on approach to Cape Canaveral. Cathie had semaphored her approval of the superb red *Canavalia nitida*, the species we'd chosen to carry her name.

With piggy banks, Cathie shed a spectral glow. During November 2001–October 2002, sea beaners reported a dozen peripatetic piglets. But none suggested their origin. Only Ed's yellow porker sported hints: *Amor es . . . ahorrar* on one flank, and *amor es . . . seguir ahorrando* across the other, or *Love is . . . saving* and *Love is . . . to keep saving*, respectively.

Kari Sauers proposed the Spanish proverb symbolized a charity drive. A reply from *CubaNet*, a network of independent journalists in Cuba, fueled Kari's pig-pothesis (as **Cathy Yow** quipped). *"We asked CubaNet journalists about the plastic pigs,"* replied **Rosa Berre**, *"and learned that around 1993 and 1995 there was a national saving campaign, because people had too much cash and few articles to buy in the government shops. Authorities feared the money was going to private farmers and the black market. In the banks (in Cuba there is only a government controlled central bank) there were these plastic pigs, probably the ones arriving in Florida. The Cubans I talked to did not recall the word "Amor" (Love) on the piggy banks, and I doubt the government would use this word in lieu of a more ideological term."*

In the four years since Cathie passed, Floridians reported 18, whereas in a single week we combed 18 from the Costa Maya and Sian Ka'an. Some of the banks must originate upstream of Cuba and Mexico, likely from the northern coasts of South America. As to the numbers adrift, I applied my 100:1 guideline (formulated from messages in bottles) that beachcombers report 1% of flotsam. Thus far, they've turned in 31, suggesting on the order of three-thousand banks adrift, a number comparable to those in *Mark 5:13*, the earliest known porcine spill (as **Sue Bradley** recalled from Bible study classes):

". . . and the herd [of pigs] ran
violently down a steep place into the sea,
(they were about 2000)
and were choked in the sea."

As we beaners were packing for the trip home, Marcia searched her Spanish/English dictionary for terms by which Mexican customs agents might understand our obsessions. She came up with *joyeria de playa* for beach sea-bean jewelry, and *basura de playa* for beach trash.

Transporting the pigs, however, presented a space problem. We found so much that I could not bring it on the plane. So I filled the banks with beans and flotsam. Back in Seattle, as I unpacked, I realized that the piggy banks once used to save money had become bean banks. I will tell this story to the kids at the *Kids Science Go Round* as I hand them hamburger beans during the 2006 Ocean Shores, Washington, *Beachcombers' Fun Fair*.

Jaded by a plethora of beans, we stopped bagging starnut palm seeds, and other keeper beans in Florida. As a small offering to the munificent bean god, on the beach we left behind scores of sea hearts. Having beaned in nirvana, we dreaded bean-withdrawal back in Florida. In 2006, we hope to once again bean in hog heaven.

*Thanks: **Christopher Boykin** for organizing our magnificent Mayan adventure; **Greg Lowe** for supplying railroad terminology; **Alice Lowe** for handouts to go along with the sea-beans presented to kids at the 2006 Ocean Shores Beachcombers' Fun Fair; **Alex** and **Raphael** for preparing authentic Mayan meals at MBG; **Nan Rhodes** for the great T-shirt design (pg. 5); and **Sally Mussetter** for editing.*

Eleven Costa Maya raqueros: Cecelia Abbott, Bill Blazek, Christopher Boykin, Curt Ebbesmeyer, Betsy Fagan, Joyce Kelly, Alice Lowe, Ed Perry, Gina Reed, Alice Surrency, Erika VonLoon.

Flotsam on the Costa Maya collected by eleven raqueros during December 7-11, 2005. Sea-beans include Mary's beans, sea hearts, and hamburgers (red, brown). Oddly, we found few sea pearls. For every 10 sea-beans, we picked up a keeper flotsam.

Flotsam	Number
Sea-beans (3 keeper species)	3,000
All other flotsam (total):	283
Bic lighters (clear plastic)	135 total
Containing fluid	29 (22%)
Empty	106 (78%)
Toy plastic wheels	54
Lego pieces (not from 1997 spill)	22
Piggy banks	18
Toy tops spun with string	11
Doll heads, arms, legs	26
Hair combs (i.e., beachcombs)	7
Barbie torsos	6

Sea-beans collected on the Costa Maya during 7-13 December 2005. Totals compiled by Christopher Boykin and Gina Reed. See www.seabean.com for descriptions of the beans.

	2005	2004
Sea hearts	850	1187
Brown Mucuna	898	1056
Red Mucuna	280	
Dioclea	403	153
Black Mucuna	27	
Little Black Mexican	147	
Bumpy Black Mexican	27	
Brown Nickernut	7	5
Oxyrhynchus	20	2
Thick Banded Mucuna	8	
Mary's Bean	258	30
Miscellaneous	305	
Total	3,230	2,433

Floatation experiments on cephalopod shells in sea-water in England

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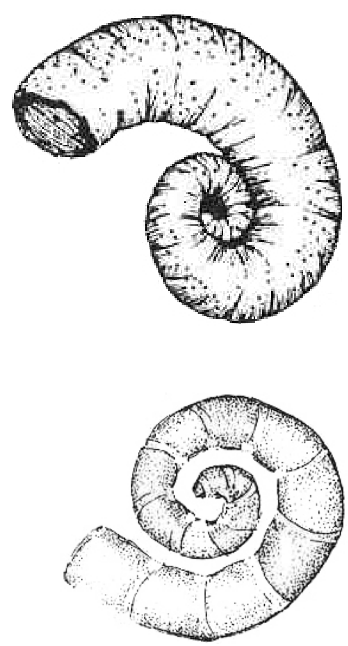
Introduction

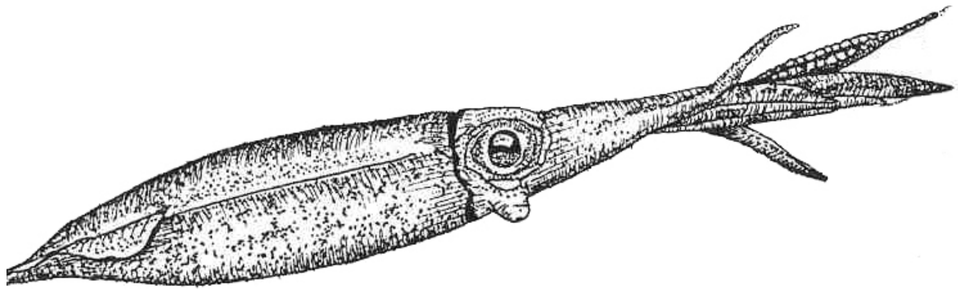
Floatation of natural materials in sea-water simulating North Sea annual temperature (ELLIOTT & CLARK 1991) and pressure variations (but not waves) illuminate the more rapid loss of air during warmer weather in summer. Long-term floatations define singularities in sinkings during the middle of November (and perhaps also early December and September), due to raised barometric pressure after a net loss of gas during storms. Bird feathers floated in a fresh condition show the difference in sinking rate due to temperature effects. Essex vegetation is a similar more complicated case. It is most likely to be washed out to sea with westerly November gales and flash floods and then sinks quickly. Cephalopod shells are an example of longer floatation, similar to a coconut and pumice in terms of final dates of sinking. A closed system is found here to inhibit sinking of *Spirula* shells.

Table 1 lists of the barometric pressure (in KPa, at sea-level from weather reports and not at the instant of sinking 31 m above that datum), tank water temperature in °C and floatation times in days of all the non-cephalopod samples which sank at Eastwood after more than 400 days in open sea-water systems. Note that four of the seven driftwood twigs floated in the summer of 2002 are still floating. Even in static tests only two are still intact. Table 1 suggests that wood tends to sink in warmer water, unlike more obviously air-supported structures; but still at pressures elevated above the average for southern England (which is around 101.5 KPa in June and September). Nut E is the hollow case of *Castanea sativa* Miller (which are normally sunk quickly when fertile) and Wood L was probably *Cupressocyparis leylandii* (Dallimore &Jackson) felled on the floatation day. The Lake Talpo Pumice (15.4 g) was run first as T1 and then again after being dried as T2 to the same mass (plus salt added) as T2.

Table 1. Sinkings after more than 400 days in tank n

Date	Sample	KPa	T°C	Days
April 25.02	Nut E	102.8	15.6	498
June 5.05	75x11 mm twig	102.1	15.0	1141
June 11.03	Wood L 350 ml	101.7	17.2	875
Aug.20.03	79x14 mm twig	102.2	19.4	486
Aug.28.03	115x25 mm twig	101.6	17.8	494
Aug.28.03	59x14 mm twig	101.6	17.8	494
Sept.15.03	122x12 mm twig	102.6	17.2	409
Sept.16.04	Charcoal 7 ml	102.5	13.9	881
Oct.7.04	101x16 mm twig	101.6	12.8	899
Nov.2.01	T1 pumice	104.0	13.9	1126
Dec.7.04	T2 pumice	103.0	8.6	586
Dec.8.04	Coconut B	103.1	10.0	445
Dec.10.05	Coconut A	104.1	5.9	816





It needs to be explained that although two tanks and various open buckets were similarly supplied with natural and aerated sea-water, as described by HEWITT (2005), in the longer-term the two tanks n and o developed different ecological characteristics. By May 1998 both contained small polychaete worms. Both used the calcite powder sediment (provided to buffer the acidity of the water and ground to pass 250 threads per inch mesh apertures) to form transverse mucus pellets in their tube walls. But only tank o favored long-term animal growth and neither was well enough illuminated for green algae to develop to a significant extent. A larger, more clearly terebellid tube was first noted under one of the sunken *Sepia* shells in tank o in February 2002; when the tank walls and floating shells had been covered by patches of the hydroid *Hydractinea echinata* (Fleming) since the previous fall. Both species and perhaps individuals have persisted in that tank and in January 2006 one could observe the 400 mm long, white tentacles of the worm periodically cleaning the surfaces of floating coconuts D, E and F placed in that tank a year before. By contrast tank n, although generally kept clean, was used for tests on decaying materials such as coconuts A, B and C, which required complete cleaning after they had sunk. Conditions in the jars a and b were clean but lifeless and additional jars with green algae growth contain three *Spirula* shells showing similarly slow waterlogging rates.

Cephalopod Shells

The internal chambered shells of the cephalopods *Sepia officinalis* L. and *Spirula spirula* (L.) are thought to make transatlantic post-mortem journeys from strandings in Florida (PERRY & DENNIS 2003), Anegada in the West Indies (DONOVAN *et al.* 2001), western Ireland with coconuts (MINCHIN 1996) and elsewhere in Europe (BROCHARD & CADÉE 2005). It would be a mistake to think that all species of *Sepia*, or all types of cephalopod chambered shell, have a low enough density to float in this way. One *S. esculenta* Hoyle of 8.77 g is shown on Table 2, which only lists sinkings after more than 600 days.

Breakage of just the body chamber wall of the adult *Nautilus pompiluis* L. shell J of HEWITT & WESTERMANN (1996) and the exponential decline in the flooding rate also seen in the field study by WANI *et al.* (2005) has permitted it to float with five fragments of *Spirula spirula* shells in warm, closed jars of artificial sea-water in Ontario since 1994 (P.B. BENTHAM personal communication 2006). The *Spirula* shells moved in their closed jar (J) to the annual temperature cycle of Eastwood (water a on Table 2) include four more complete shells which have now floated for over 12 years and the listed more fragmentary shells (broken before floatation to study that aspect). On Table 2 the *Spirula* shells are listed as Ch.. This refers to the intact chambers counted from the protoconch zero at the start of the experiment. Additional closed jars (J) are listed as water b there.

Starting in December 1997 tanks (T on Table 2) of natural sea-water from Westcliff-on-Sea were established and aerated once a day by removing half the water to plastic bottles and shaking it up, before slowly returning it and covering the tanks to limit evaporation. This method was continued with only one or two lost days per year until the middle of 2001, when aerations became less frequent and most of the new shells housed in the tanks had sunk at a more rapid rate. Pumps were avoided because they would clearly have raised the gas partial pressures in the water above the atmospheric pressure acting higher in the tank on the shell air pockets. Since air bubbles are seen trapped in the larger chambers of *Spirula* by the calcified siphuncle, it is unlikely that waves can shorten floatation times except by breakage.

Table 2 Cephalopod shell sinking dates (with *Sepia* dry mass in g) after > 600 days

Date	Sample	Water	KPa	°C	Days
Jan.9.00	*Sepia* 2.71	n	102.5	7.8	645 T
Jan.13.01	*Sepia* 23.3	o	103.2	6.7	1108 T
Jan.21.98	Ch.0 to 9	a	103.5	5.6	1469 J
Jan.26.05	Ch.1 to 22	a	103.2	3.9	2595 J
Feb.15.02	*Sepia* 25.7	n	103.2	7.0	1406 T
Feb.20.00	*Sepia* 8.77	n	103.0	6.7	687 T
Apr.6.00	Ch. 25 to 34	n	103.0	6.7	784 T
July 9.99	Ch. 1 to 18	a	103.0	19.4	2029 J
July 29.04	Ch. 25 to 32	b	101.6	20.6	2363 J
Aug.22.00	Ch. 7 to 30	n	101.9	17.8	871 T
Sept.1.96	Ch. 28 & 29	a	103.0	14.4	943 J
Sept.2.03	Ch. 8 to 26	b	102.6	15.3	2032 J
Sept.2.00	Ch. 1 to 26	b	100.8	16.7	937 J
Oct.4.99	Ch. 1 to 18	a	100.9	12.8	2013 J
Oct.15.03	*Sepia* 88.2	o	102.8	12.2	1558 T
Oct.28.01	Ch.25 to 29	a	101.8	13.9	2774 J
Nov.14.04	Ch.1 to 31	o	103.3	6.1	671 T
Nov.14.05	*Nautilus* 55.3 g/71 ml	o	102.6	4.8	703 T
Nov.16.98	Ch.31 to 35	a	102.1	8.3	1876 J
Nov.16.02	Ch. unclear	o	100.2	11.1	700 T
Nov.17.02	*Sepia* 10.0	n	100.7	10.1	764 T
Nov.18.05	Ch.0 to 33	o	102.2	5.8	4249 N
Nov.19.99	Ch.35 & 36	n	101.5	6.1	645 T
Dec.8.01	*Sepia* 44.6	n	103.9	7.8	1337 T

An entirely unbroken and clean shell (N, on Table 2) originally collected and kept wet on the flight from New Zealand by Dr. JEAN WESTERMANN, has now sunk after being moved from this closed and clean jar on day 3040 of floatation. It floated for a further 1209 days in the tank o containing various marine animals which tend to arrive when natural water is being periodically replaced. Dissolution of these small shells with a larger surface to volume ratio than *Nautilus* shells is one factor explaining why those specimens which flooded at a slower initial rate in jars, became gradually more difficult to sink, due to a decline in their dry density. Some specimens housed at Hamilton were dissolved to such an extent that they were suddenly sunk by entry of water through dissolution holes. A set of ten adult (but originally less clean) *Spirula* shells from the same New Zealand set, showed the following much shorter floatation times when eventually re-floated in the cleaned tank n at 3.30 hrs. G.M.T. on July 16 2003 at 22°C: 349.7, 373.9, 380.9, 381.2, 382.8, 386.6, c.402.2, c.402.2, 411.4, and c.537.0 days. But it is stressed that none of these shells or those on Table 2 developed decalcification holes in their chambers.

Conclusion

This account is intended to provide background environmental information about experiments done on rapidly sunk vegetation and annual singularities in sinking events. But it also shows that *Sepia officinalis* and *Spirula spirula* shells both have realistic maximum floatation times of four years.

Acknowledgements

The experiments on cephalopod shells form part of a joint study of rates of mass increase and hydrodynamics with Dr. MARTIN A. WHYTE of Sheffield University, and previously with Dr. GERD E. WESTERMANN of McMaster University. JEAN E. WESTERMANN and PATRICE B. BENTHAM also provide much assistance.

References

Brochard, C.J.E. & Cadée, G.C., 2005. Tropische drijfzaden van de Nederlandse Kust. *Tabellenserie van de Strandwerkgemeenschap* 30, 1-66.

Donovan, S.K., R.W. Portell & R.K. Pickerill 2001. A shell of the cephalopod *Sepia* from the coast of Carriacou, Genadines, Lesser Antilles *Caribbean Journal of Science*, 37, 125-127.

Elliott, A.J. & T. Clark, 1991. Seasonal stratification in the northwest European shelf seas *Continental shelf Research* 11, 467-492.

Hewitt, R.A., 2005. Drift coconuts. *The Drifting seed* 11 (2): 6-8, 11(3):7.

Hewitt, R.A. & G.E.G. Westermann, 1996. Post-mortem behaviour of Early Paleozoic nautiloids and paleobathymetry. *Paläontologische Zeitschrift* 70 (3/4), 405-424.

Minchin, D. 1996. Tar pellets and plastics as attachment surfaces for lepadid cirripedes in the North Atlantic Ocean. *Marine Pollution Bulletin* 32, 855-859.

Perry, L. & Dennis, J.V. 2003. Sea-beans from the topics: A collector's guide to sea beans and other tropical drift on Atlantic shores. Krieger Publishing, Melbourne, Florida 217 pp.

Wani, R., T. Kase, Y. Shigeta & R. de Ocampo, 2005. New look at ammonoid taphonomy, based on field experiments with modern chambered nautilus. *Geology* 33(11), 849-852.

The Drifting Seed, May 2006

More on Seed Dispersal

by Dr. Jeremy Smith

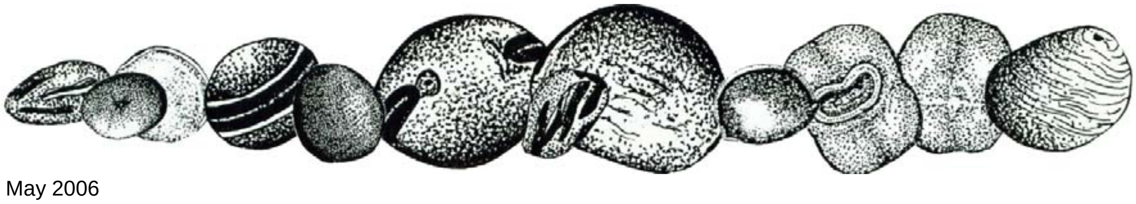
Being a long-time fan of Charles Darwin, I was most interested to read Wayne Armstrong's article 'Charles Darwin and Driftseeds' in the December 2005 issue of *The Drifting Seed*. My interest quickened as his attention turned to the flora of Hawaii, and how it might have derived from just 280 sea-drifted ancestors. For many years I too have been interested in how floras have become established, including in remote spots by seed dispersal over long distances. Wayne speculates for Hawaii that sea drift was mainly responsible, "if dispersal by birds and air currents are ruled out."

Certainly sea drift provides the clearest example of long distance seed dispersal that can be seen and studied today. But sea drift is not the only way for seeds to be carried over very great distances, nor possibly is it the most important (and I am not speaking here of human transport of seeds and plants which, of course, has in recent years and centuries been by far the most potent means of plant transport around the world).

Particular floras on which I have done research are those growing above the tree-line on equatorial mountains, especially isolated mountains like Mt Kinabalu in Malaysia, and the high peaks of New Guinea. Fewer plant species are involved there than in the Hawaiian archipelago discussed by Wayne, around a hundred on any particular peak, having perhaps only fifty or so remote, ancestral immigrants. These clearly arrived over long distances as, with very few exceptions, their nearest relatives lie not in the forests down-slope but in distant temperate regions to the north (e.g. Himalayas, China) or south (e.g. Australia, New Zealand). It seems inescapable that when the mountains first became too high and cold (through uplift and climatic cooling) to support a forest cover, the 'alpine' flora that replaced it did so originally from seeds dispersed from hundreds or thousands of miles away.

But in this case, unlike Hawaii, the sea can have had nothing to do with it. The most likely mechanism, I have concluded, is migratory birds. Experiments have shown that birds can swallow large numbers and variety of seeds, often 'accidentally' with other food, and retain them in viable state inside their guts for several days. Over the same period, birds can and do migrate over thousands of miles, and even though they might not intentionally visit mountain peaks, corpses recovered from New Guinea glaciers (for example) shows that they nevertheless often do so. I believe that migrant birds with seeds in their crops were responsible for immigration of most of the plants now growing in the grasslands and on the rocky peaks of high equatorial mountains. If birds carried seeds to mountain tops, perhaps they also did so to islands and elsewhere. Of course the sea is also responsible for many spectacular cases of long distance seed dispersal, but for relatively small seeds I believe birds are the main agents.

It is interesting to note that many demonstrably sea-dispersed plants cannot rely entirely on the sea. Even such famous drifters as *Caesalpinia bonduc* and *Entada phaseoloides* grow in places like Fiji in high hill forests (as well as on the coast), far above where any storm wave could have dropped their seeds. The natural world is remarkably complex; sometimes it seems that every time we peer behind one question and start to see an answer, another score of previously unasked questions appears just behind it!



The first star nut *Astrocaryum* sp. from the Dutch coast

by Gerhard C. Cadée & Pieter Smit, Royal Netherlands Institute for Sea Research
PO Box 59, 1790 AB Den Burg Texel NL (cadee@nioz.nl; smitquik@quicknet.nl)

Figure 1

Although Brochard & Cadée (2005) included the star nut in their booklet on tropical drift seeds from the Dutch coast, they had never seen one from a Dutch beach. They simply included it because it might be found there. What a surprise therefore that Pieter Smit appeared to have found one on the North Sea beach near Den Helder (province North-Holland) in October 2004!

The specimen, with a length of 5.2 cm and a diameter varying from 2.6 – 3.2 cm (Fig.1), fits the size given by Gunn & Dennis (1976) and Perry & Dennis (2003). It also shows the characteristic lines radiating from the three prominent holes near the base, as pictured in Gunn & Dennis (1976), Nelson (2000) and Perry & Dennis (2003). It lacks the luster of those depicted in Perry & Dennis (2003), but these are apparently polished specimens.

Only few star nuts have been found on European coasts, although it is rather common on Florida beaches (Perry & Dennis, 2003). This might be related to its flotation time of 2 years according to Perry & Dennis (2003). This may be too short for most to make it to Europe. Guppy (1917: p. 181) found one on the Azores and thinks it likely that they would reach the shores of Europe. Indeed, Nelson (2000) mentions one from Barra (Outer Hebrides) collected in the early 20th century by William L. MacGillivray and a few collected since 1980 in Ireland and Cornwall. William L. MacGillivray visited the Outer Hebrides between 1908 and 1919; he was a nephew of the more famous biologist/artist William MacGillivray (1796-1852), see Hardy (1956: p. 21). Star nuts probably arrive regularly on European coasts in low numbers and the findings since 1980 are related to the renewal of interest in drift seeds. In the Netherlands this renewal of interest has resulted in a gradual increase in the number of tropical drift seeds since the first was reported in 1955 (Brochard & Cadée, 2005; Cadée, 2005).

For comparison we give a picture (Fig. 2) of some oil palm nuts (*Elaeis guineensis*). Gunn & Dennis (1976) mention their superficial resemblance to palm star nuts. There are four records of oil palm nuts from the Dutch coast (Brochard & Cadée, 2005). The first was collected on Texel in 1987 (Cadée, 1988). They are not reported from other European coasts; Nelson (2000) does not mention them. Although fresh ones do not float, as tested by Perry & Dennis (2003), dry ones do, as already suggested by these authors. The oil palm nuts of Fig. 2 were collected in 1978 near Boma in drift near the mouth of the river Congo, Africa. They have a smaller size than star nuts. They have coarser striae, which do not radiate from the three basal pores. They are variable in shape, and only few have the tear-shape of *Astrocaryum.*

References

Brochard, C.E.J. & G. C. Cadée. 2005. *Tropische zaden van de Nederlandse kust*. Strandwerkgemeenschap, Leiden. Tabellenserie 30: 1- 66.

Cadée, G.C., 1988. Nieuwe exotische vruchten en zaden van ons strand. *Het Zeepaard* 48: 62-68.

Cadée, G.C., 2005. Is the increase in tropical drift seeds found on the Dutch coast related to global warming? Poster North Sea conference, October, Texel.

Gunn, C.R. & J.V. Dennis, 1976. *World guide to tropical drift seeds and fruits*. Demeter Press, New York. 240 pp. (reprint 1999 Krieger Publishing Cy, Melbourne, Florida).
Guppy, H.B., 1917. *Plants, seeds, and currents in the West Indies and Azores*. William & Norgate, London, 531 pp.
Hardy, A., 1956. *The open sea, its natural history*: Part I. *The world of plankton*. The New Naturalist, Collins, London, 335 pp.
Nelson, E.C., 2000. *Sea beans and nickar nuts*. Bot Soc. Brit. Isles, London. Handbook no 10: 1-156.
Perry, E. IV, & J. Dennis. 2003. *Sea-Beans from the Tropics*. Krieger, Melbourne Fl. 232 pp.

Figure captions

Fig. 1. Starnut *Astrocaryum* sp. collected from the Dutch coast at Den Helder October 2004 by Pieter Smit (scale in cm).

Fig. 2. Oil palm nuts (*Elaeis guineensis*) collected in 1978 near Boma from drift along the river Congo, Africa, by Gerhard Cadée (scale in cm).

Figure 2

The Black Sea Biscuit

by John Beerensson

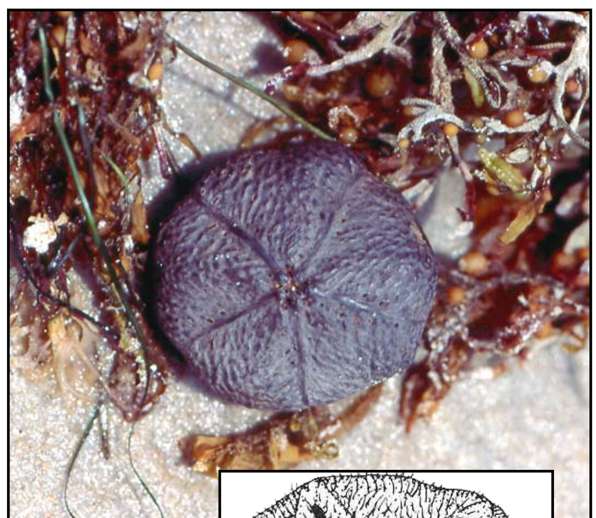
Merritt Island, Florida

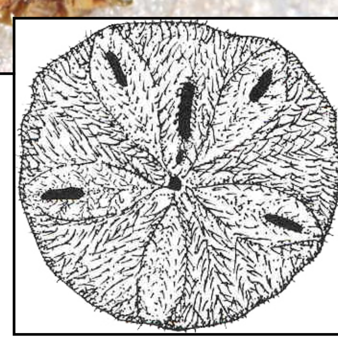
We tend to have favorites. For sea-beaners maybe it is one of the “regulars” like the sea heart, hamburger bean, sea purse, or sea pearl. If you live in Florida, then maybe your favorite is one of the “rarities” like the Mary’s bean, “Oxy,” coralbean, or Cathie’s bean. If you march to a slightly different drummer like I do (which is not necessarily a good thing), then your favorite might be the unusual, like the gothic looking anchovy pear, or the cerebral beach brain, or, in my case, the black sea biscuit.

Mother Nature also has her favorites. She loves a great design. In the Animal Kingdom there are the echinoids (Echinodermata). Their tests, or skeletons if you will, are quite familiar to sea-beaners. The shape and design of the sand dollar, urchin, and sea biscuit make these beach treasures highly collectable. Most collections of shells and sea-beans include one or more of these intricate objects.

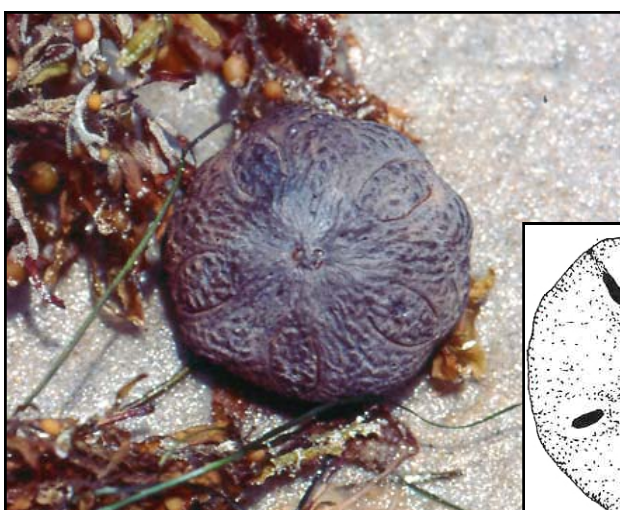
To think that Nature would like the echinoid design so much that it would be replicated in the Plant Kingdom is really amazing. You don’t find any seeds with vertebrate designs, like five toes per foot, or even toes or feet for that matter, nor do you find seeds that have thumbs (hey, Nature really hit a home run with thumbs). You get my point. However, Nature liked the sea biscuit so much that it copied it in the seed of *Poupartia amazonica*, a.k.a. the black sea biscuit.

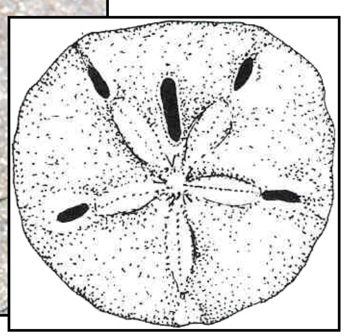
The first time I found this drifter I thought that it was a true sea biscuit. It is as near a copy of this animal as one can imagine. A five-pointed star on top, urchin-like bumps here and there, and the indents on the bottom that are so commonly present on many sand dollar species. If I didn’t know better, this seed would have gone into my collection of shells.





Beachcombing and sea-beaning bring Nature’s diverse wonders to us more than any other activity. The beauty of the ocean and the mysteries of the tropical rain forests are brought to our feet. We are fortunate that Mother Nature gave us those feet and toes, and those thumbs so we can pick up these amazing treasures!





News and Notes

In an inquiry to www.seabean.com :

I thought you may be interested in the attached photo of two seabeans I found on beaches along the north coast of Scotland in late 2005. I am the countryside ranger for North Sutherland and I would be very grateful if you could shed some more light on the identification of the beans and from where you think they may have originated. They are great things for letting the local schoolchildren gain a better understanding of ocean currents and species colonization, etc.

Any information you could offer would be gratefully received.

Thank you.
Bye,
Paul Castle
North Sutherland Countryside Ranger
Bettyhill Service Point
Bettyhill
By Thurso
KW14 7SS
01641 521884

(We got back to Paul and let him know he had found an *Entada gigas*, or seaheart, and a *Mucuna urens*, or (red) hamburger bean.)

News from Drifters Bob and Jeanne Gray—their daughter-in-law Lona Gray has had her first book published, *Caught by the Lure of the Sea*, which portrays their travels across the world's oceans in their boat *Immanuel*. Lona e-mailed with instructions that the best way to obtain the book is online at Barnes and Noble, Amazon, Borders, or Books-A-Million. Way to go Lona!

This photo was sent to us by new Drifter Nancy Reukauf who was introduced to the world of seabeans when she (also) visited the Mayan Beach Garden resort (www.mayanbeachgarden.com) in August of 2005. Nancy sent us a cd with her pictures and a most enthusiastic letter about her discovery of sea-beans. Nancy, we welcome you aboard as an official Drifter! Oh, and we are secretly jealous of many of your finds you have pictured!

It's time for newsletter donations again! Please make contributions payable to: The Drifting Seed, P.O. Box 510366, Melbourne Beach, FL, 32951, USA. Let us know if you would like to remain on the mailing list even if you cannot afford a donation at this time. Cheers, and <u>thank you</u> everyone!