

The Gulf Stream Coconut: Flotsam and Jetsam or Natural Dissemination?

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1. Balevulin
Beach, Tiree,
collection site of
a drift seed
coconut. Photo:
Colin Woodcock.



In maritime law, *flotsam* applies to wreckage or cargo left floating on the sea after a shipwreck. *Jetsam* applies to cargo or equipment thrown overboard from a ship in distress and either sunk or washed ashore. The common phrase flotsam and jetsam is now used loosely to describe any objects found floating or washed ashore. Are seashore coconuts evidence of a natural event or just flotsam and jetsam from a shipwreck or careless cargo handling? Here's how to determine which is which if you are lucky enough to find one.

Despite its sparkling white sand and azure waters, a beach on one of Scotland's Western Isles is the last place you would expect to find a stranded coconut. Surprising though it may seem, however, coconuts appear not to be strangers to these shores, as the second author of this note can testify. Being a creature of habit, WB enjoys annual holidays at his wife's family cottage on the Isle of Tiree (Map 1), the outermost island in the Inner Hebrides group. This tiny flake of low-lying land is famed for its bird life and summer flowers, as well as for its exposure to the North Atlantic, which provides excellent conditions for windsurfing – a sort of Hawai'i of the North. The beachcombing is excellent too, but the discovery of a coconut washed up in Balephetrish Bay seemed as unlikely as it was coincidental, given that WB, the discoverer, is a palm taxonomist at the Kew Herbarium. The fruit was still partly covered in battered husk and saturated in water, and the prospect of carting the soggy mass back to Kew was unappealing and so the nut remained on the beach. On admitting this foolish course of action to his boss, John Dransfield, WB was firmly reprimanded for missing the opportunity to record a potentially exciting drift fruit, the origins of which were far from certain.

A return visit to the island in 2003 provided a chance to make amends. While visiting local artists Colin & Susan Woodcock at their studio in Balemartine, Bill spotted a rather weathered coconut, completely enclosed in its husk, sitting on the doorstep. This fruit too had been picked up on another Tiree beach at Balevulin (Fig. 1) earlier in the year. Seeing Bill's interest, both in the nut and in the good opinion of his boss, the Woodcocks kindly donated their coconut to Kew, where it is now preserved in the Herbarium for perpetuity. Bill also brought the nut to the attention of the first author, a long-time student of the coconut and its perplexing distribution.

Coincidentally, while drafting this article, BBC television broadcast a documentary series on the natural history of the British Isles and the first program showed the celebrity presenter picking up a coconut from a beach in the Scilly Islands and claiming that coconuts float to Britain from Central America. Coconuts have in fact been reported washed ashore on European beaches from Devon to Denmark, including the Hebrides. The Gulf Stream has a significant impact on western Scotland's weather, most notably ameliorating its climate,

and may well be responsible for bringing coconuts to the Hebrides quite naturally from the Caribbean, but how to tell?

The first point to make is that any nut totally without a husk is likely to be flotsam or jetsam because it is only a human action to completely remove the husk. The coconut crab (*Birgus latro*), which is reputed to be able to tear the husk from mature coconuts, is not found on Atlantic Ocean beaches and, with respect to Charles Darwin who accepted that apocryphal story, it is rats, squirrels and monkeys, not crabs, that make holes in immature coconuts, and they do it to drink the sweet water, not to eat the hard, white endosperm.

In the remainder of this article, we explain what we discovered when we examined the Tiree coconut more closely and the implications of our findings for its likely origins.

The Tiree coconut

This coconut (Figs. 2–4) is a normal fruit in every outward appearance, showing superficial damage consistent with a period of immersion in the sea before being stranded on a beach. From its size, amount of husk and generally spherical shape the coconut is more like a hybrid between domesticated forms than a wild type (but more about that later). The calyx is not present so it is impossible to say whether it had dropped naturally or had been harvested manually, but internal evidence confirmed that it must have been fully mature before entering the sea. When collected it was saturated with sea water and heavy. After the initial drying period there was no sound when the fruit was shaken, showing there was no water inside the cavity of the nut, but after a longer period a rattling noise could be heard. Upon opening, the kernel was seen to have dried into ball copra (Fig. 4). As the husk was being partially removed the track of a toredo worm (*Teredo navalis* or Shipworm) was found (Fig. 3). A shipworm is not a worm, but a greatly elongated clam, a marine bivalve mollusk specialized for boring into wood. Its two shells, enclosing only the front end of the body, function as a tool, rather than a protective covering; their ridged and roughened surfaces are used for boring. The burrow (lined with a calcareous coating produced by the clam's mantle) is begun when the animal is in its larval stage and is expanded as it grows. The common shipworm of the Atlantic Ocean, *Teredo navalis*, may grow up to



Coconut collected from Balevulin Beach. Fig. 2 (upper left). Whole coconut. Fig. 3 (upper right). Husk partially removed showing shell; note Tored worm damage to left. Fig. 4 (lower right). Shell partially removed to reveal ball copra with Tored worm damage. Photos: John Dransfield.



2 ft (60 cm) long, although its shells remain only 0.5 in. (12 mm) long. Shipworms do enormous damage to piers and ships but, in this instance, although it had penetrated the shell and damaged the kernel (Fig. 4), it had not caused the kernel to rot, as might have been expected if the shell had cracked open for any other reason. Possibly the high oil content of the kernel was not to the shipworm's taste!

Of course, an inspection of the fruit cannot rule out the possibility that it had been part of a ship's cargo – except for the knowledge that very few coconuts *with their husks intact* are nowadays shipped across the Atlantic.

The Gulf Stream

Off the coast of South America, the North Equatorial Current forks into a two branches: one passes into the Caribbean, the other flows north and east of the West Indies. The two branches rejoin and pour through the Straits of Florida to become the Gulf Stream, one of the strongest ocean currents in the world. It is a warm, salty current, typically 80 to 150 kilometers wide and the fastest current is near the surface with a maximum speed of about 2 m/sec. It flows northwards along the eastern coast of the United States, crossing the North Atlantic at 40–50°N and entering the Norwegian Sea around the Faeroe Islands some 402 km north of Scotland. It finally meets colder water masses from the Arctic Ocean and

makes it cool down, causing the density of the water to increase, and it sinks. Between the Faeroe Islands and Scotland, the Gulf Stream has an average temperature of 8°C; this might not kill a coconut embryo, supposing that it would still be viable after floating more than 8000 km, a journey that could take 6 months. It is this distance and time scale that persuaded Henry Nicholas Ridley, the author of a standard text book on plant dispersal in 1930 to state categorically that a coconut that drifted up on the coast of Norway, and grew successfully when planted, was evidently jetsam from some ship. What Ridley did not know was that the Caribbean coconut has wild type characteristics, one of which is slow germination. Moreover, it has been suggested that floating in sea water before germination begins, may induce dormancy.

Coconuts were introduced to the Caribbean islands and coasts of America only in the early

16th century. These coconut palms had wild type characteristics and were not significant, either agriculturally or commercially, until the mid- to late-19th century so it is no coincidence that that was when the debate began about the origin of the coconut and its dissemination by floating, with or without human assistance. For a brief period in the mid-1800s entire coconuts in the husk are known to have been shipped to Europe and North America. Thereafter, primary processing for industrial use was carried out at the place of origin and cargoes consisted of the dried kernel (copra), the extracted fibers (coir) or, for domestic consumption, nuts with the husk removed. To further complicate matters, over the last half century lethal yellowing disease has virtually eliminated wild type coconuts in Florida and the Bahamas, potential places of origin for our Tiree nut. The Maypan hybrid has been the preferred planting material for 30 years and its two parents only arrived in the Caribbean in the 20th century and are both much quicker germinating domestic types.

If the coconut is a wild type, similar to the Jamaica Tall (and still to be found on other Caribbean islands) it can take more than 200 days to complete germination, may be more than enough time to float on the Gulf Stream to Europe, especially if salt water induces dormancy or lower temperatures delay development. If it is a domestic type, such as the Maypan hybrid, these can begin to germinate while still on the palm and may complete germination in 100 days which may not be enough time to float across the Atlantic and still be viable.

Flotsam and jetsam or natural dissemination?

If more coconuts are found on Tiree, or any other European shore, for that matter, then certain tests could be applied that might distinguish flotsam and jetsam from natural dispersal or even to see if the coconut is viable. Readers may wish to carry out some of these tests for themselves the next time they find a coconut on the beach!

For entire coconuts the advent of DNA technology brings the possibility of using molecular techniques to distinguish coconuts from Afro-Indian sources and those from Asian-Pacific sources, but that alone may not eliminate those from Afro-Caribbean sources and the cost (currently 70 Euros per sample) and effort make the idea unrealistic.

A more practical approach would be to remove the coconut from the beach to a warm place next to a stove or boiler for example (a minimum night temperature of 25°C is desirable). It should be repeatedly and frequently bathed (not soaked) with warm water (up to 30°C) to wash the excess sea-salt from between the husk fibers (warm tropical rainfall is a necessary pre-requisite to successful germination). If the treatment works and a shoot appears, it should immediately be given as much light as possible while still maintaining the minimum temperature. Otherwise, if nothing has happened after a couple of months, and no rotten smell has developed, a little careful peeling back of the husk fibers from the “eye-end” might reveal signs of life. If so, just replace the husk and leave the nut a little longer. Even a coconut responds to patience and tender loving care.

We hope that someone reading this note will find a beached coconut, make the experiment and – perhaps – re-write the textbooks!

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Note added in proof

Following the submission of this article, the authors corresponded with Ulrike Rawson, a resident of Tiree living at Balephetrish. She reports finding six whole coconuts and the remains of many others washed up on Balephetrish Beach, all of which she believes to have arrived on a single tide. While it is possible that these fruit may have fallen and entered the Gulf Stream *en masse*, perhaps as a result of severe weather in their place of origin, it seems unlikely that they would float in close enough proximity to each other to arrive on a single tide. A more consistent scenario might be that a quantity of nuts in a sack has floated as flotsam or jetsam, the sack disintegrating and releasing the nuts towards the end of their journey. This additional information does not affect our interpretation of the coconut found at Balevullin, which was collected much more recently, arrived apparently unaccompanied by other coconuts and shows evidence of long-exposure to the sea in the form of Shipworm damage.