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Tropical drift fruits and seeds on coasts in the British Isles and western Europe, 1. Irish beaches

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ABSTRACT

Seeds and fruits of tropical American plants capable of floating in sea-water for over one year can drift in the surface currents of the North Atlantic Ocean to the coasts of western Europe. Eight species of such disseminules ('drift seeds') washed ashore on Irish beaches are described. Several other seeds, not of American origin, also collected from Irish beaches are noted. The western and northern coasts of Ireland are the most likely to receive tropical drift; the surface currents in the vicinity of Ireland seem to deflect drift from the southern and eastern coasts.

INTRODUCTION

'It should be observed that scarcely any means of transport would carry seeds for very great distances; for seeds do not retain their vitality when exposed for great lengths of time to the action of sea-water . . . Ocean currents, from their course, would never bring seeds from North America to Britain, though they might and do bring seeds from the West Indies to our western shores, where if not killed by so long immersion in salt-water, they could not endure our climate.'

C. Darwin, *The Origin of Species* (1859)

As observed by Darwin (1859) and others (e.g. Sloane 1696, Guppy 1917), ocean currents in the North Atlantic carry seeds and fruits of tropical American plants to the coasts of north-western Europe. The disseminules (fruits and seeds) of many plants can float, though flotation time is variable (Guppy 1906, Praeger 1913); those capable of floating in salt-water for over one year could make the ocean voyage from the Americas to Europe.

The first record of tropical plant disseminules washed ashore on the coasts of the British Isles was published by L'Obel (1570). Records from the coasts of Great Britain will be reviewed in a later paper. The present paper discusses records from Irish beaches.

Sloane (1696) was the first to record 'drift seeds' on Irish beaches; he noted (Sloane 1696) that *Entada gigas* 'is cast upon the coast of Kerry in Ireland', and later (Sloane 1725) that *Caesalpinia bonduc* had been 'cast ashore on the north-west coast of Ireland'. A few other records were published in the nineteenth century. Brown (1818) noted that a seed of *C. bonduc* collected on an Irish beach had been successfully germinated. Other records noted by Blake (1823), Johnson (1897) and Tatlow (1899) were reviewed by Colgan (1919). Harvey (1846) noted that 'tropical woods and seeds are . . . frequently [stranded] and occur all along the west coast of Ireland'.

In his classic work, *Plants, seeds and currents in the West Indies and the Azores*, Guppy (1917) was unable to discuss Irish drift seed records because of lack of data. As Guppy's information from Ireland was meagre, Colgan (1919) assembled a list of eight species whose disseminules had been picked up on Irish beaches. Colgan (1919) surveyed the literature available to him, as well as noting museum specimens collected before that time. Since Colgan's review, little has been added to the Irish aspect of the topic; both Ridley (1930) and Praeger (1937) mentioned drift seeds but provided no new data. Gunn & Dennis (1976) published a guide to drift seeds which included discussion of Irish records but no details of recently collected specimens.

In the preparation of this paper, records subsequent to Colgan (1919), published and unpublished, were used. The sources included the collections and register of botanical specimens of the Irish National Herbarium (**DBN**), which was the register used in the Botany Section of the National Museum of Ireland, prior to the transfer of the museum's botanical collections to the National Botanic

Gardens in 1970. Unpublished records from the Ulster Museum, Belfast (**BEL**) were also used, as were data obtained from amateur naturalists and beachcombers throughout Ireland.

DRIFT SEEDS FROM IRISH BEACHES

Three categories of plant disseminules—commonly called 'drift seeds', though fruits are also found—can be washed ashore on any beach in western Europe that directly receives water from the North Atlantic currents. The first category—*local*—contains disseminules from plants that are growing in the environs of a beach, and includes fruits and seeds of locally-growing native and naturalized plants, as well as locally cultivated plants that might be of tropical or subtropical origin. The second category—*refuse*—consists of fruits and seeds discarded into the ocean by man, such as disseminules thrown or washed overboard from ships, washed into the sea from local urban refuse dumps, or discarded on beaches. The third category—*peregrine*—(true drift seeds)—comprises those disseminules that have travelled substantial distances in ocean currents, and it is of prime interest to phytogeographers. As all three categories can be encountered on any beach, each specimen must be carefully assessed in order to ascertain the category into which it should be placed. All the disseminules described below have been assessed; *local* and *refuse* disseminules have been included.

In the following section, each disseminule is described; collection localities are noted briefly according to vice-counties and are mapped in Fig. 1. Vernacular names and scientific synonyms are noted where relevant. A key to all the drift seeds recorded from European coasts will be included in the second paper.

1. *Amblygonocarpus andongensis* (Welw. ex Oliv.) Exell & Torre (Leguminosae: Mimosaceae). Vernacular name of the plant: banga-wanga. Drift category: refuse. 1 collection: *c* 1973, W. Galway, v.c. H16. Fruit woody, shining dark brown, slightly curved near peduncle, sides parallel, *c* 15cm long, *c* 2cm broad, tetragonal in cross-section. Seeds may rattle inside when mature.

The parent plant is a tree (*c* 15–20m tall) of the savannah and moist savannah woodlands in central, eastern and western Africa, from Mozambique to Ghana (Irvine 1961, Hutchinson & Dalziel 1958). Although the pod is capable of floating, it is very unlikely that it drifted in ocean currents from Africa. Logs of *A. andongensis* are imported into Europe, and the fruit most probably was washed off the deck of a timber-carrying ship. The species could not be cultivated out-of-doors in Ireland.

2. *Baillonella heckelii* (Pierre ex A. Chev.) Baehni (Sapotaceae) (syn. *Tieghemella heckelii* Pierre ex A. Chev., *Mimusops heckelii* (Pierre ex A. Chev.) Hutch. & Dalz.). Vernacular name of the plant: makoré. Drift category: refuse. 1 collection: 1965, W. Cork, v.c. H3. Seed light and dark brown, woody, one half boat-shaped, shining, light brown, other half rough, dull, dark brown or black, *c* 5cm long, *c* 3cm broad.

Like *Amblygonocarpus*, the parent plant is an African forest tree (*c* 36–40m tall) found from Sierra Leone to Zaire (Hutchinson & Dalziel 1963, Baehni 1965). The timber of *B. heckelii* (makoré) was imported into Ireland until recently. In western Africa the seeds are used for many purposes, including the extraction of oil (Irvine 1961) which can be used for cooking and making soap. It is probable that the seed was discarded from a ship, and thus it belongs in the refuse category. Gunn & Dennis (1976, p. 200) noted this record, but considered that the seed was incorrectly identified, and should be *Calocarpum mammosum* (L.) Cronquist. However, the specimen, originally determined by C. E. Hubbard (Royal Botanic Gardens, Kew), has been checked and is correctly identified (Gunn pers. comm. 1977).

3. *Caesalpinia bonduc* (L.) Roxb. (Leguminosae: Caesalpiniaceae) (syn. *Guilandina bonduc* L., *G. bonducella* L., *C. bonducella* (L.) Fleming). Vernacular names of seeds: nickar nut, grey nickar. Drift category: peregrine. 7 collections: *ante* 1725–1930 (Fig. 1). Seed light grey, shining to dull, hard, often with concentric hair-like cracks, *c* 2cm diameter, ovoid to spherical or subglobose, sometimes slightly flattened.

The seed of *C. bonduc* is light grey and about the size of an acorn. The parent plant is a thorny bush, widely distributed in the tropics, including the West Indies and Florida. Gunn & Dennis (1976) noted that the species is a native of south-eastern Asia but has now attained pantropical distribution

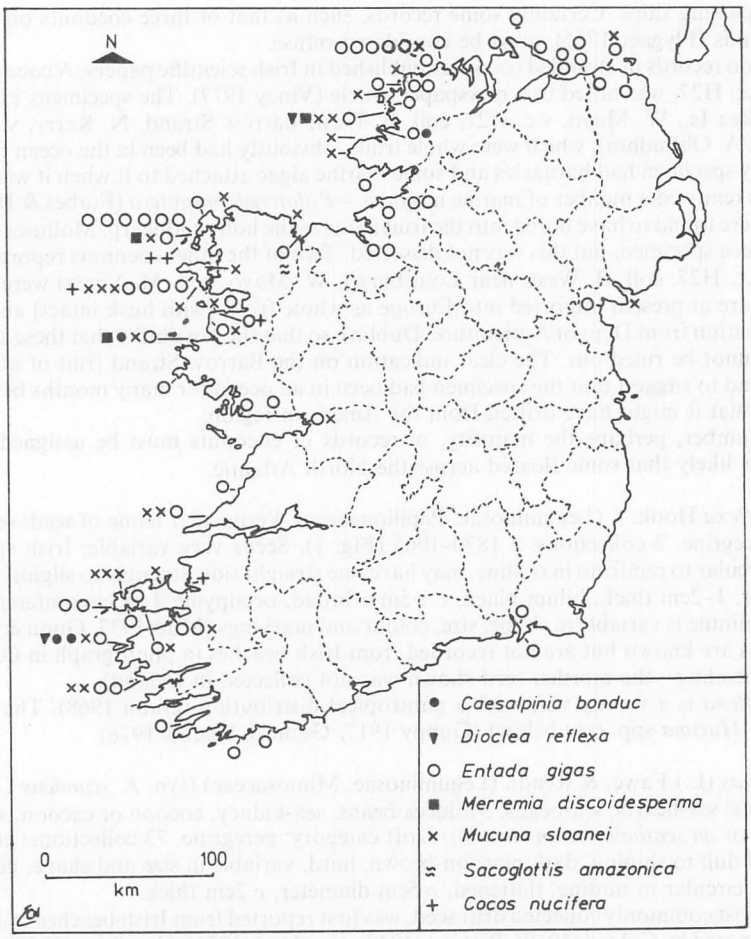

FIGURE 1. Recovery sites of peregrine drift fruits and seeds in Ireland; each symbol indicates a single specimen. A list of records is available from the author (vice-county boundaries indicated by dashed lines).

primarily by drifting in ocean currents. The shrubs often form thickets above the high-tide zone on tropical beaches.

This was one of the first drift seeds reported from Ireland (Sloane 1725). Robert Brown (1818) reported that a seed collected from an Irish beach had been germinated and a drawing of the seedling sent by the unnamed grower to Sir Joseph Banks; the drawing cannot be traced in Banks' correspondence (P. I. Edwards pers. comm. 1977, Colgan 1919). The most recent collection was made by Delap in 1930, when a seed apparently was 'fished' out of the sea near Valentia Island, S. Kerry, v.c. H1.

4. *Cocos nucifera* L. (Palmae). Vernacular name: coconut. Drift category: peregrine and refuse. 5 collections: 1974–1977 (Fig. 1). Fruit grey-brown to light brown, subglobose, *c* 30cm long, *c* 20cm broad, fibrous husk surrounding hard bony dark brown seed ('coconut').

Coconuts have been reported from European beaches for several centuries (see Guppy 1917). Most workers regard these records as refuse, believing that the specimens have been 'washed overboard' from passing ships. Guppy (1917) noted records from beaches in England, the Faroe Islands, Norway and the Lofoten Islands, but he dismissed them as having come with 'extreme probability' from

wrecked or passing ships. Certainly some records, such as that of three coconuts on a beach in the Lofoten Islands (Flygaer 1765), must be considered refuse.

There are no records of stranded coconuts published in Irish scientific papers. A coconut stranded in W. Mayo, v.c. H27, was noted in a newspaper article (Viney 1977). The specimens examined by the author (Iniskea Is., W. Mayo, v.c. H27, coll. B. West; Barrow Strand, N. Kerry, v.c. H2, coll. L. O'Donnell & A. OhEadhra), which were whole fruits, obviously had been in the ocean for a long time. The N. Kerry specimen had barnacles and some marine algae attached to it when it was found. When the husk was removed a number of marine molluscs—*Psiloteredo megotera* (Forbes & Hanley), det. D. Minchin—were found to have bored into the fruit as far as the bony endocarp. Molluscs had also bored into the Iniskea specimen, but this was not dissected. Two of the other coconuts reported (Iniskea Is., W. Mayo, v.c. H27, coll. B. West; near Louisburgh, W. Mayo, coll. M. Viney) were whole fruits.

Coconuts are at present imported into Europe as whole fruits (with husk intact) and as 'prepared nuts' (information from Dept of Agriculture, Dublin), so that the possibility that these specimens were discarded cannot be ruled out. The clear indication on the Barrow Strand fruit of attached marine organisms tend to suggest that the specimen had been in an ocean for many months before being cast ashore, and that it might have drifted from the American region.

While a number, perhaps the majority, of records of coconuts must be assigned to the refuse category, it is likely that some floated across the North Atlantic.

5. *Dioclea reflexa* Hook. f. (Leguminosae: Papilionaceae). Vernacular name of seed: sea-purse. Drift category: peregrine. 2 collections: *c* 1870–1965 (Fig. 1). Seeds very variable; Irish specimens dark brown, ± circular to reniform in outline, may have one straight side, strongly to slightly compressed, *c* 3cm diameter, 1–2cm thick; hilum black, *c* 1·5mm broad, occupying $\frac{3}{4}$ of circumference.

This disseminule is variable in shape, size, colour and markings (Muir 1937, Gunn & Dennis 1976); spotted forms are known but are not recorded from Irish beaches (a photograph in Gunn & Dennis (1976) is misleading—the mottled seed shown was not collected in Ireland).

Dioclea reflexa is a woody vine with a pantropical distribution (Gunn 1968). The seeds may be mistaken for *Mucuna* spp. (see below) (Guppy 1917, Gunn & Dennis 1976).

6. *Entada gigas* (L.) Fawc. & Rendl. (Leguminosae: Mimosaceae) (syn. *E. scandens* L.). Vernacular names of seeds: sea-hearts, sea-beans, Molucca beans, sea-kidney, cocoon or cacoon, *sliogán bóileid, sceartaims* (? or *an scathain,* or *an cartain*). Drift category: peregrine. 73 collections: *ante* 1696–1977 (Fig. 1). Seed dull to shining, dark maroon-brown, hard, variable in size and shape, generally heart-shaped to ± circular in outline, flattened, *c* 5cm diameter, *c* 2cm thick.

This, the most commonly collected drift seed, was first reported from Irish beaches by Sloane (1696), and has been noted by Colgan (1919), Praeger (1937), Kertland (1956), Hamilton (1957), Hickin (1975) and Viney (1977). The frequent strandings of these seeds on Irish coasts has resulted in at least two vernacular Irish names, both of obscure origins and meanings (P. Ua Maoileoin pers. comm. 1977). *Sliogán bóileid,* recorded by Ua Maoileoin in the W. Kerry Gaeltacht, is derived from *sliogán* (= a mollusc), referring to the seed's hard testa and its shell-like appearance, and *bóileid,* which is not recognized by linguists but may be a corruption of *Boletus* and may mean 'fungus-like'. *Bóileid* is also encountered in the Irish name for a sea anemone—*siné bóileid* (=? fungus-like pap) (Ua Maoileoin pers. comm. 1977). *Sceartaims, an scathain* and *an cartain,* which may be renderings of the same Irish name, were reported by O'Sullivan from the W. Donegal Gaeltacht (Tory Island), but cannot be identified or translated.

Entada gigas is a woody vine that produces large pods over 1m long. The species occurs in central tropical Africa, central and southern tropical America and in the West Indies (Hutchinson & Dalziel 1958). The seeds have a tough impermeable testa; it is necessary to erode the testa substantially before moisture can be absorbed and germination proceed.

A seed of *E. gigas* collected in W. Donegal, v.c. H35 (coll. P. J. Haugh, *c* 1970), was germinated at the National Botanical Gardens, Glasnevin, and the plant is under cultivation. This is the first time that the species is known to have been germinated from seeds washed ashore on Irish beaches. Seeds of *Entada* sp. (probably *E. phaseoloides* (L.) Merrill) collected on Australian beaches (Twilight Cove, W. Australia, *ante* 1973; Moruya, New South Wales, 1974) were successfully germinated at the Australian National University, Canberra, by the author, and a second specimen, from Twilight Cove, has been germinated at Glasnevin.

Seeds of *E. gigas* washed ashore in Ireland have been made into snuff-boxes and used as play-objects for children (Colgan 1919), as well as being used as key-minders (D. J. O'Sullivan pers. comm. 1977) and as substitutes for padlocks (Miss A. Gallagher pers. comm. 1977). Superstitions are associated with these seeds in western Ireland.

7. *Mangifera indica* L. (Anacardiaceae). Vernacular name of plant: mango. Drift category: refuse. 2 collections: undated and unlocalized. Endocarp woody, dark brown to tan, surface may be slightly fibrous, *c* 5cm long, *c* 4cm broad (but variable), ellipsoidal, compressed with prominent basal scar.

These were certainly refuse, either thrown into the ocean from ships or washed into the sea from refuse dumps. They are capable of floating only for a few months and could not make a long ocean journey (Gunn & Dennis 1976, Muir 1937).

8. *Merremia discoidesperma* (Donn. Sm.) O'Donnell (Convolvulaceae) (syn. *Ipomoea discoidesperma* Donn. Sm.; often wrongly named *I. tuberosa* L. in literature, see Gunn 1977). Vernacular name of seed: Virgin Mary's bean. Drift category: peregrine. 3 collections: *c* 1823–1970 (Fig. 1). Seed black or dark brown, *c* 3cm diameter, *c* 2cm thick, ± circular in outline, flattened, hilum C-shaped on ventral surface, impressed cross-mark on dorsal surface.

This seed is recognized by the indented 'cross' on the dorsal surface and the conspicuous C-shaped hilum on the ventral surface. The species is discussed in detail by Gunn (1977). The parent plant is a high-climbing woody liana of wet mixed forests in central tropical America, Cuba and Hispaniola.

9. *Mucuna sloanei* Fawc. & Rendl. (Leguminosae: Papilionaceae). (Generally referred to as *M. urens* (L.) Medikus in drift literature; see Gunn & Dennis 1976). Vernacular name of seeds: (true) sea-bean, horse-eye bean. Drift category: peregrine. 33 collections: *c* 1823–1977 (Fig. 1). Seed dark brown, lustrous, with lighter band (greyish or reddish brown) around hilum, ± spherical or slightly compressed, *c* 2·5cm diameter, surface slightly rough (tuberculed); hilum black, 3–5cm broad, straight, occupying $\frac{3}{4}$ circumference.

As it is difficult to identify *Mucuna* seeds to species level (Muir 1937, Gunn & Dennis 1976), it is probable that more than one species of *Mucuna* is represented in material stranded on Irish beaches. Most of the seeds probably belong to *M. sloanei*, but *M. fawcettii* Urban and true *M. urens* are possibly represented (Gunn & Dennis 1976); the latter name has been most frequently applied in the drift literature. Colgan (1919) incorrectly referred some of the specimens he examined to *M. altissima* DC.

M. sloanei is a woody pantropical vine whose pods have stinging hairs on the surface (Gunn 1968). *M. fawcettii* and *M. urens* are similar.

A seed of *Mucuna* cf. *sloanei* collected in W. Donegal, v.c. H35 (coll. D. Griffith, 17. iv. 1976), has been germinated at the National Botanic Gardens, Glasnevin. It is hoped to be able to germinate further material in order to establish the specific identity of a range of seeds.

10. *Sacoglottis amazonica* Mart. (Humiriaceae). Drift category: peregrine. 1 report: *c* 1890 (Fig. 1). Endocarp 2–6cm long, 2–4cm in diameter, oblong, circular in cross-section, light to dark brown, surface dull with lumpy cysts, contains 2 seeds.

S. amazonica is a native of the Amazon and Orinoco estuaries. The woody endocarp of this tall forest tree contains a number of empty vesicles (Guppy 1917) which enables it to float in salt water for over two years (Gunn & Dennis 1976). The species is included in the Irish drift seed list on the basis of a description of the disseminule given by Miss Warren (Colgan 1919).

11. *Trachycarpus* sp. (Palmae). Drift category: local. 1 collection: 1960, W. Donegal, v.c. H35.

The single *Trachycarpus* specimen was identified by C. E. Hubbard (Royal Botanic Gardens, Kew). At least two species of *Trachycarpus* are grown out-of-doors in Ireland: *T. fortunei* (Hook.) H. Wendl. and *T. martianus* (Wall.) H. Wendl. (Morley 1975). It is probable that this disseminule came from a garden plant.

12. Native and naturalized species.

The fruits and seeds of certain native and naturalized plants are recorded from Irish beaches, including hazelnuts (*Corylus avellana* L.), beech fruits (*Fagus sylvatica* L.) and pine cones (*Pinus sylvestris* L., *Pinus* spp.) Other disseminules such as acorns (*Quercus* spp.) and horse-chestnuts (*Aesculus hippocastanum* L.) can occur.

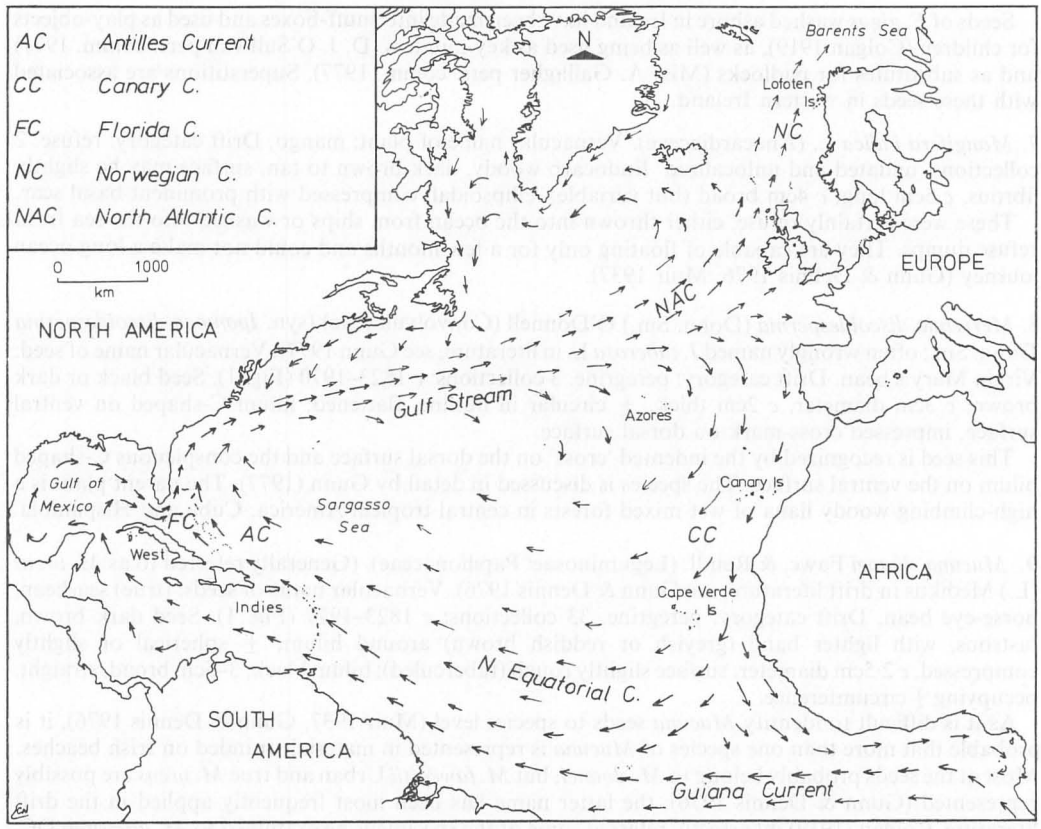

FIGURE 2. Surface currents in the North Atlantic Ocean, generalized.

OTHER BOTANICAL DRIFT

Fruits and seeds are the most frequently collected drift objects, but occasionally other pieces of plant debris are found on Irish beaches. Colgan (1919) did not list *Cocos nucifera* among his drift seeds, but quoted the following extract from a letter he received from Rev. W. Spotswood-Green (1. iii. 1917, Caherdaniel, Kerry): 'At various times I have picked up palm nuts of various species, fronds of palms and pieces of bamboo . . . I have moved house so often that such things as I collected were periodically abandoned.' The pieces of bamboo and palm fronds could have come from gardens in south-western Ireland which are renowned for the cultivation of subtropical plants, including palms and bamboos. However bamboo is common among debris on the beaches of Florida and possibly could float from America to Europe. The present author received a similar report from D. J. O'Sullivan (22. i. 1977, Lifford, Donegal), who wrote that: 'My first encounter with the beans (*Entada gigas*) was in Tory Island where the temporary lighthouse keeper . . . told me of "a stick of bamboo which was washed ashore with seeds in pods attached to it".' This seems to be a description of a piece of the *Entada* liana with intact pods attached. It is most unlikely to have been of local origin, if it was a piece of *E. gigas*, as this species could not survive in an Irish garden.

Logs, both with bark intact and prepared, are common on beaches on the west coast of Ireland, but are most likely to have come from ships. The most abundant plant debris on any beach is sea-weed, most of which is of local origin, but Sargassum weed (*Sargassum bacciferum* Ag.) has been reported from Valentia Island, S. Kerry, v.c. H1 (coll. Miss Delap; see Colgan (1919), p. 41). However, Harvey (1846) indicated that he had never seen this species from Irish beaches, and there are no recent Irish records of it (M. J. P. Scannell pers. comm. 1977).

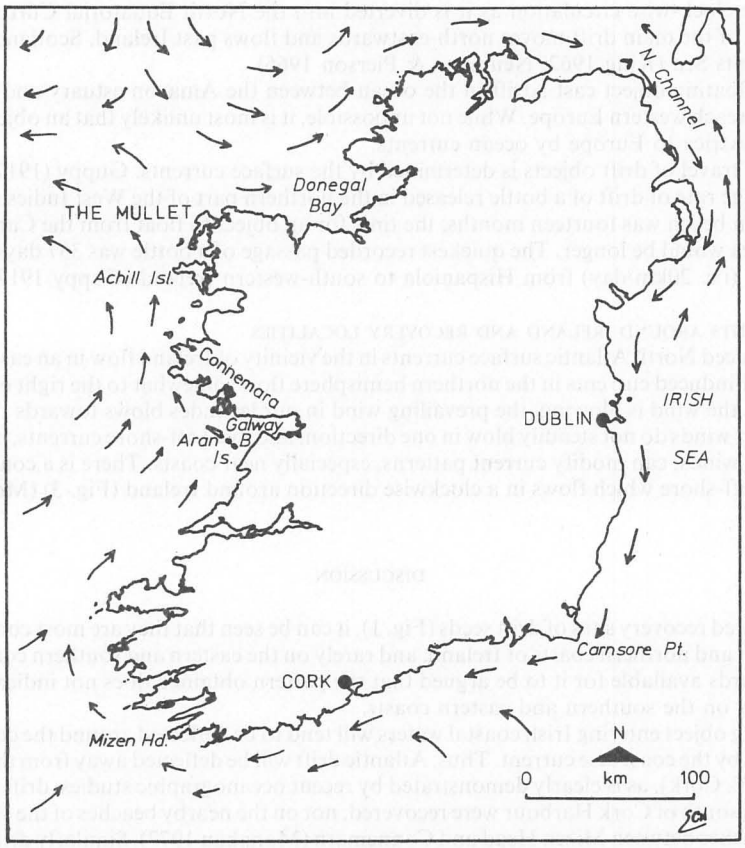

FIGURE 3. Surface currents in the vicinity of Ireland; note the counter-rotating gyres north-west of Galway Bay (after Monahan (1977), see also Tulloch & Tait (1959)).

OCEAN CURRENTS

SURFACE CURRENTS IN THE NORTH ATLANTIC OCEAN

Seeds and fruits float on or near the water surface; the method by which buoyancy is achieved and maintained in each disseminule is discussed by Gunn & Dennis (1976). Their transport is determined by the surface currents in the oceans, which are caused primarily by the friction between the winds and surface waters. Other factors, such as differences in the salinity and temperature of ocean waters and the Coriolis effect also influence surface current patterns (King 1962, Neumann & Pierson 1966).

The major surface currents in the North Atlantic circulate in a basic clockwise direction (Fig. 2). In the region of the Tropic of Cancer, the surface water of the North Equatorial Current flows in a westerly direction, primarily under the influence of the trade winds. Part of this water flows into the Caribbean Sea and thence into the Gulf of Mexico, and part forms the Antilles Current which flows to the east of the West Indies. The water in the Gulf of Mexico then issues from the Florida Strait and, joining the Antilles Current, forms the Florida Current, which moves northwards along the south-eastern coast of North America past Florida to Cape Hatteras. Beyond Cape Hatteras, the surface water, now the Gulf Stream, is diverted eastwards into the North Atlantic. In the region of the Grand Banks (south-east of Nova Scotia) the Gulf Stream becomes more diffuse and tends to branch, part of it forming the North Atlantic Current (or Drift). North of the Azores, some of the surface water turns southwards between the Azores and the Iberian Peninsula forming the Canary Current and then

completes the clock-wise circulation as it is diverted into the North Equatorial Current again. The other portion of the main drift moves north-eastwards and flows past Ireland, Scotland and Norway into the Barents Sea (King 1962, Neumann & Pierson 1966).

Thus any floating object cast adrift in the ocean between the Amazon estuary and south-eastern U.S.A. could reach western Europe. While not impossible, it is most unlikely that an object would float from central Africa to Europe by ocean currents.

The rate of travel of drift objects is determined by the surface currents. Guppy (1917, p. 80) noted that the average rate of drift of a bottle released in the northern part of the West Indies and recovered on a European beach was fourteen months; the time for an object to float from the Caribbean Sea or South America would be longer. The quickest recorded passage of a bottle was 337 days for a journey of 4140 miles (i.e. 20km/day) from Hispaniola to south-western Ireland (Guppy 1917).

OCEAN CURRENTS AROUND IRELAND AND RECOVERY LOCALITIES

The wind-induced North Atlantic surface currents in the vicinity of Ireland flow in an easterly direction (Fig. 3). Wind-induced currents in the northern hemisphere flow somewhat to the right of the direction toward which the wind is blowing; the prevailing wind in our latitudes blows towards the east-north-east. However, winds do not steadily blow in one direction, and local off-shore currents, not induced by the prevailing winds, can modify current patterns, especially near coasts. There is a coastwise current immediately off-shore which flows in a clockwise direction around Ireland (Fig. 3) (Monahan 1977).

DISCUSSION

From the plotted recovery sites of drift seeds (Fig. 1), it can be seen that they are most commonly found on the western and northern coasts of Ireland, and rarely on the eastern and southern coasts. There are sufficient records available for it to be argued that the pattern obtained does not indicate a dearth of beachcombers on the southern and eastern coasts.

Any floating object entering Irish coastal waters will tend to be deflected around the coast in a clock-wise direction by the coastwise current. Thus, Atlantic drift will be deflected away from the coast east of Cape Clear (W. Cork), as is clearly demonstrated by recent oceanographic studies; drift cards released into the ocean south of Cork Harbour were recovered, not on the nearby beaches of the southern coast, but on the beaches between Mizen Head and Connemara (Monahan 1977). Similarly drift seeds will be carried away from the southern coast towards the western coast. The few seeds that have been obtained from southern beaches may have been washed ashore after storms had induced a strong northwards surface drift that overcame the coastwise current.

The records of drift seeds from the northern coast of Ireland can also be explained by the coastwise current; objects entering the in-shore waters will be carried along the north-western coast towards the northern coast, perhaps being washed ashore after northerly winds had modified the surface drift. The remarkable records of *Entada gigas* and *Mucuna* cf. *sloanei* from Louth, v.c. H31, on the eastern coast (Fig. 1) can only be explained by the seeds drifting in the coastwise current through the North Channel into the Irish Sea.

The best areas for collecting drift seeds are the western and northern coasts. The available records indicate that good beaches are those of the Dingle Peninsula (S. Kerry, v.c. H1), Achill Island (W. Mayo, v.c. H27), The Mullet (W. Mayo) and W. Donegal (v.c. H35) north of Glencolumbkille. However, the concentration of records in these areas may only reflect the distribution of keen beachcombers; the four areas named have observant resident beachcombers, or, in the case of the Mullet, a regular visitor.

Two areas on the western coast have produced few records, though they would be expected to have good beaches; these are Donegal Bay and Galway Bay. The Aran Islands may act as a barrier (or sieve) preventing drift from the open ocean entering Galway Bay in large quantities. It is interesting that there are no records of drift seeds from the Aran Islands, but the western shores of the islands are cliffed and therefore lack suitable beaches (Stephens 1969). The relative paucity of records from beaches between the Mullet and Glencolumbkille on Donegal Bay may be due to the possible presence of two counter-rotating currents (gyres) to the west of Donegal Bay (Tulloch & Tait 1959) (Fig. 3). Drift may be directed towards the Donegal coast north of Glencolumbkille by the northern clockwise gyre, little entering Donegal Bay.

CONCLUSION

Seeds and fruits of plants growing in the West Indies and central America set adrift in the ocean can, by floating in the surface currents, reach the shores of the British Isles. These disseminules must be capable of floating in salt water for over one year. The chance of an individual seed floating across the Atlantic, being washed ashore on Irish coasts, and being picked up by an inquisitive beachcomber is remote, and the chance of this seed coming to the attention of a scientific institute or research worker is even more remote. Superstitious people believe that good luck will attend the finder of a 'sea-bean'!

When disseminules which belong to the *local* and *refuse* categories are eliminated from the list of Irish records, Irish beaches have produced about eight species of *peregrine* drift disseminules of tropical American origin. These are *Caesalpinia bonduc, Cocos nucifera, Dioclea reflexa, Entada gigas, Merremia discoidesperma, Mucuna* spp. (probably *M. sloanei, M. fawcettii, M. urens*) and *Sacoglottis amazonica*. All these, except *Cocos nucifera*, were recorded by Colgan (1919), though sometimes under different names, and all are also recorded from Great Britain.

The peregrine drift seeds recorded from Irish beaches are mostly of West Indian origin; at least the parent plants are recorded from the West Indies. *Sacoglottis amazonica* is an exception (see above). The ocean currents that transport these fruits and seeds to Ireland do pass along part of the North American coast, but it is unlikely that seeds of plants from temperate areas of North America are transported to Europe by these currents. Some species of temperate North American plants are recorded in western Europe (e.g. *Sisyrinchium bermudiana* L., *Eriocaulon aquaticum* (Hill) Druce) but their disseminules could not have arrived in Europe by ocean currents in recent times. During periods of lower sea-levels which coincided with glacial maxima during the Quaternary, ocean currents did not circulate in the way observed today. During such epochs, long-distance transport of disseminules of temperate N. American plants to Europe might have taken place and produced some of the extant amphi-atlantic distribution patterns. However, only those plants with seeds or fruits capable of floating in salt water for a long time and remaining viable during such immersion could successfully cross the considerable ocean barrier.

Some of the seeds which arrive on Irish coasts from tropical America are capable of germinating; *Entada gigas, Mucuna* cf. *sloanei* and *Caesalpinia bonduc* seeds have been germinated. However, the seedlings cannot survive out-of-doors in Ireland. The seeds germinated at Glasnevin were scarified severely to stimulate germination, so they are unlikely to germinate on Irish beaches unless their very tough testas are broken.

Data available at present indicate that about 15 peregrine species have been collected from the beaches of the Outer Hebrides and other Scottish islands. The Irish coasts receive the same ocean currents, yet the numbers of species recorded from Irish beaches is only about half. One reason for this discrepency could be that no-one has collected in Ireland as intensively as collections were made in Scotland at the beginning of this century. According to Colgan (1919) there was a lack of interest in drift seeds in Ireland at the beginning of this century; an appeal made by the present author through provincial newspapers produced about a dozen records, suggesting that this disinterest continues. While lack of collections may be partly to blame for the low number of species, the coastwise current which seems to deflect drift from the southern coasts of Ireland may also deflect drift away from Ireland as a whole. However this seems unlikely; records show that more drift-bottle recoveries have been made in Ireland than elsewhere in western Europe (J. V. Dennis pers. comm. 1977).

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