

Acoustic and visual survey of cetaceans off the Mullet Peninsula, Co Mayo

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Although monitoring schemes suggest that a rich diversity of cetaceans occurs around the Irish coast (23 species recorded to date), there have been relatively few recent sightings or strandings of large whales (Evans 1980, Berrow and Rogan 1997). Historically, large cetaceans were abundant in Irish waters. Whaling in Ireland dates back to Viking times (Fairley 1981) and commercial whaling started in the 18th century when it was combined with the hunting of the basking shark *Cetorhinus maximus* (Gunnerus) mainly off the west coast (McNally 1976). From 1908-1923 two Norwegian owned whaling companies operated from Co Mayo (South Iniskea and the Mullet Peninsula) on the north-west coast. Fairley (1981) describes the operation and catches by these stations in detail and provides some of the little historic information on the status of large whales in Irish waters. During this period, at least 894 whales were killed, mostly between May to September and within a 95-120km radius of the Mullet Peninsula. Most of the whales caught (66 per cent) were fin whales *Balaenoptera physalus* (L.), with blue *B. musculus* (L.) (14 per cent), sei *B. borealis* L. (10 per cent) and sperm *Physeter macrocephalus* L. (7 per cent) whales also frequently taken. A few humpback *Megaptera novaeangliae* (Borowski) and right *Eubalaena glacialis* (Bonnaterre) whales were also caught up to 1910 but were considered to be already scarce in Irish waters (O'Riordan 1975, Fairley 1981). The Whale Fisheries Act, 1937 restricted commercial exploitation of the larger whale species and the hunting of all cetaceans in Irish waters was banned under the Wildlife Act (1976).

Since whaling ceased, there has been little contemporary information on the relative status of cetaceans in the area. There have been few strandings of large whales from Co Mayo to Co Donegal since the end of whaling: three fin whales, with only one since 1972, and twelve sperm whales (Berrow and Rogan 1997). Seven minke whales *Balaenoptera acutorostrata* Lacepède, have also stranded, five of these since 1990. In 1990, seven sperm whales were washed up on the Irish coast

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(six in the north-west) which Berrow *et al.* (1993) suggested reflected an increase in their abundance since the 1950s.

A survey was carried out off the coast of Co Mayo in 1993 to monitor cetaceans in the area and investigate whether large whales were present at locations where they were formerly abundant. Despite the importance of Irish waters for cetaceans, there have only been few dedicated cetacean surveys in this area (Evans 1981, Hammond *et al.* 1995, Pollock *et al.* 1997, Berrow and Petch 1998). In 1991 the Irish government declared all Irish waters a whale and dolphin sanctuary (Rogan and Berrow 1995) and information on the abundance, distribution and status of all cetaceans is essential for its proper management.

Methods

The survey was carried out between 10 June and 10 July 1993 from *Song of the Whale*, a 46ft ketch specially adapted for acoustic surveys of marine mammals and owned by the International Fund for Animal Welfare (IFAW). The LOGGER computer programme (written by IFAW by Conservation Research Ltd., Cambridge, England) was used to impose a standardised survey protocol. LOGGER was designed to maximize the information on cetacean density and distribution that can be collected from vessels which are not conducting strictly controlled surveys and runs on a portable PC in real time. Some data, such as the position of the survey vessel and water depth, are collected automatically from the vessel's navigation instruments while LOGGER prompts for other data to be entered by the researchers at regular intervals. Data are stored in a standard database (Paradox) format.

Because of the lack of baseline information on cetaceans in this area and the limited boat time available, it was decided to carry out a series of investigative cruises. Survey effort was classified as one of a number of types: *Passage* when the boat was traversing from one port to another, *Definite track* when a survey was being conducted by sailing along pre-determined tracks, *Hunch* when the vessel was going to an area in which there was reason to believe that there might be cetaceans and *Bumbling*, a general investigation of an area. During any of these cruise types the boat's survey status was considered to be either *off effort*, when no watch was kept; *searching*, when a full watch was being carried out; *searching at night*, which involved acoustic monitoring and *with cetaceans*, during an encounter with cetaceans. Two different methods of monitoring for cetaceans were employed: acoustic and visual.

Visual Survey

While at sea, a watch was kept by two or more observers standing on the deck (height c3.5m) and if possible from the crow's nest (height c1.1m). The number and location of watchers and the survey status was noted in LOGGER whenever they changed. Every 30 minutes wind speed and direction, sea state (on a modified Beaufort scale), wave height, swell height, cloud cover and visibility were entered into LOGGER.

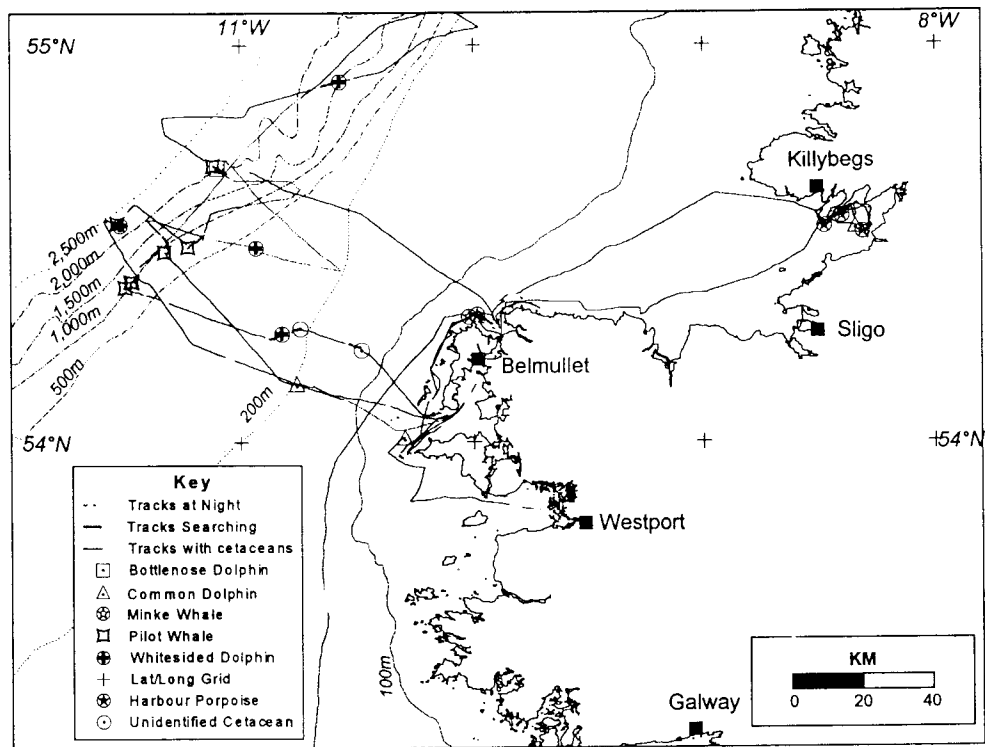


Figure 1. Location of cetacean sightings and survey tracks off Mayo and Donegal during June and July 1993.

Acoustic Survey

A stereo towed-hydrophone and amplifier box designed and built by IFAW, to monitor passively for cetacean vocalisations while at sea. The hydrophone consisted of two elements separated by about 3m in a 10m oil-filled polythene tube with a 100m tow-cable (Leaper *et al.* 1992). While towing, one of these elements was directly behind the other and by listening in stereo it was usually possible to tell whether vocalizations were coming from in front of, or behind, the vessel. A directional hydrophone could also be lowered when the vessel was stationary and used to obtain a more precise bearing to a vocalizing animal by listening for maximum strength signal while rotating the hydrophone through 360°. Every 15 minutes the boat was slowed down to around 5 knots if sailing, and the engine placed into neutral if motoring, and the hydrophones were monitored for 1 minute. The levels of background water noise, self noise and any cetacean vocalizations were noted in LOGGER. Recordings of cetacean vocalizations were made from the hydrophone on a Sony DTC 10 Pro Digital Recorder.

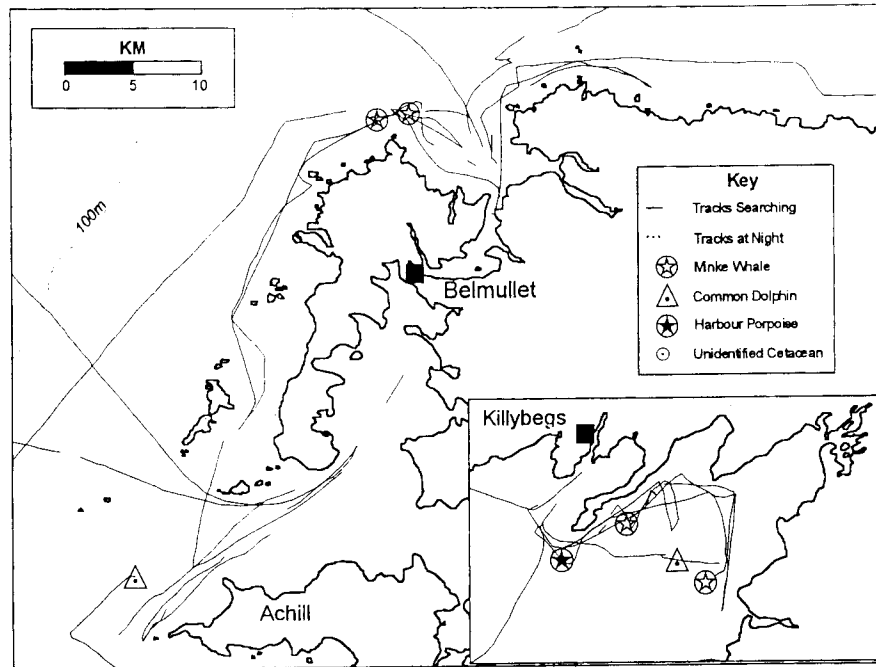


Figure 2. Location of cetacean sightings and inshore transects around the Mullet Peninsula and in Donegal Bay.

Results

Twenty days were spent at sea between 10 June and 10 July 1993. Two main regions were surveyed (Fig. 1): inshore waters (up to 18km offshore) and offshore regions (75-90km offshore) particularly around the edge of the continental shelf. Offshore surveys involved making a passage directly to the shelf edge and then conducting zig-zag transects across depth contours before returning to port. Inshore effort was concentrated around the Mullet Peninsula, the waters off Erris Head and into Donegal Bay (Fig. 2).

Sighting conditions

The sea state was 2 or less for 42 per cent and wind speed less than 10 knots for 48 per cent of the survey time. The most frequently recorded wind direction was northerly (88 per cent) and the modal value for cloud cover was 8/8 with it being greater than 6/8 on 50 per cent of the survey period. Weather was recorded as being fair on 90 per cent of occasions and drizzle on 7 per cent.

Sightings

In total, 26 sightings of six species were recorded (Table 1) and their locations shown in Figures 1 and 2. Two groups of common dolphins *Delphinus delphis* L. and

Table 1. Identification and location of cetaceans sighted off Co Mayo during 1993.

| Date | Time | Species | Group Size | Latitude (N) | Longitude (W) |
|-------------|-------------|----------------------|-------------------|---------------------|----------------------|
| 10:6:93 | 19:55 | Common dolphin | 4 | 52°39' | 10°04' |
| 11:6:93 | 08:40 | Common dolphin | 3 | 53°17' | 10°32' |
| 11:6:93 | 13:55 | Harbour porpoise | 1 | 53°45' | 10°06' |
| 12:6:93 | 18:36 | Bottle-nosed dolphin | 1 | 53°50' | 09°37' |
| 14:6:93 | 08:41 | Common dolphin | 40 | 54°00' | 10°17' |
| 16:6:93 | 17:59 | Pilot whale | 4 | 54°28' | 11°20' |
| 16:6:93 | 21:56 | White-sided dolphin | 4 | 54°30' | 10°56' |
| 22:6:93 | 10:26 | Unidentified sp. | 5 | 54°14' | 10°29' |
| 22:6:93 | 12:21 | Unidentified sp. | 2 | 54°17' | 10°45' |
| 22:6:93 | 13:02 | White-sided dolphin | 8 | 54°16' | 10°50' |
| 22:6:93 | 19:27 | Pilot whale | 10 | 54°23' | 11°30' |
| 22:6:93 | 20:14 | Pilot whale | 7 | 54°24' | 11°29' |
| 22:6:93 | 20:37 | Pilot whale | 7 | 54:54' | 11°29' |
| 23:6:93 | 15:15 | White-sided dolphin | 5 | 54:42' | 10°34' |
| 23:6:93 | 22:55 | Pilot whale | 4 | 54:41' | 11°07' |
| 23:6:93 | 23:08 | Bottle-nosed dolphin | 3 | 54:30' | 11°06' |
| 24:6:93 | 08:09 | Pilot whale | 14 | 54:33' | 11°13' |
| 24:6:93 | 11:52 | Pilot whale | 12 | 54:33' | 11°33' |
| 24:6:93 | 12:21 | White-sided dolphin | 15 | 54:09' | 11°31' |
| 24:6:93 | 20:37 | Common dolphin | 5 | 54:20' | 10°45' |
| 28:6:93 | 18:39 | Minke whale | 1 | 54:19' | 10°01' |
| 29:6:93 | 19:13 | Minke whale | 2 | 54:32' | 09°59' |
| 01:7:93 | 17:12 | Minke whale | 3 | 54:36' | 08°18' |
| 01:7:93 | 19:45 | Common dolphin | 10 | 54:33' | 08°20' |
| 04:7:93 | 11:03 | Harbour porpoise | 1 | 54:33' | 08°29' |
| 04:7:93 | 15:17 | Minke whale | 1 | 54:35' | 08°23' |

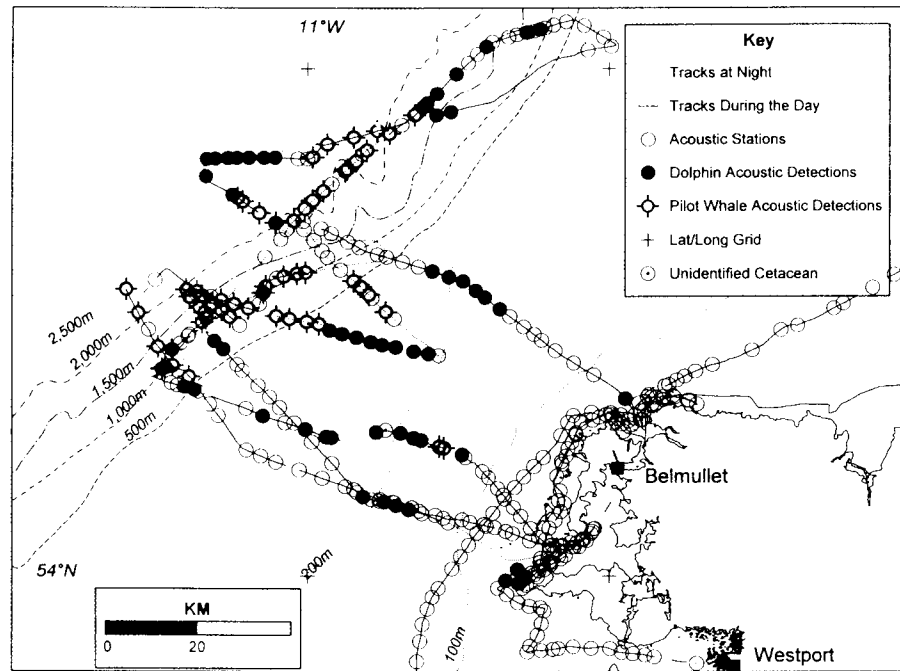


Figure 3. Acoustic monitoring stations and location of cetacean acoustic detections during transects across the continental shelf edge and inshore around the Mullet Peninsula (no cetacean vocalizations were detected in Donegal Bay).

a single harbour porpoise *Phocoena phocaena* (L.) and bottle-nosed dolphin that were sighted during passage to Co Mayo from Shannon are not plotted. Sightings of bottle-nosed dolphins *Tursiops truncatus* (Montagu) in the Shannon Estuary were not included in Table 1 as a resident group is known to occur there (Berrow *et al.* 1996).

Long-finned pilot whales *Globicephala melas* (Traill) were the most frequently reported species (27 per cent of sightings) followed by common dolphin (19 per cent), minke whale (15 per cent), and white-sided dolphin *Lagenorhynchus acutus* (Gray) (15 per cent). Harbour porpoise and bottle-nosed dolphins were each recorded on two occasions. Only two sightings could not be recorded to species level. Common dolphins were observed inshore off Achill Head and in Donegal Bay as well close to the 200m depth contour. All white-sided dolphin sightings were offshore, three on the shelf edge while bottle-nosed dolphins were only seen offshore, associating with a small group of pilot whales. Pilot whales were also reported in association with white-sided dolphins on one occasion. Minke whales were seen on four occasions all within 5km of the coast: two off Erris Head and twice (including one group of three) in Donegal Bay (Fig. 2).

Group sizes varied from 1 (harbour porpoise), to between 4 and 15 for white-sided dolphins and pilot whales and from 1 to 3 minke whales and bottle-nosed dolphins. The largest group sizes were for common dolphin, with a maximum group size of 40 individuals reported close to Achill Head and a mean of 12.4 individuals per group (Table 1).

Acoustic Survey

Most acoustic monitoring was carried out offshore and detections are shown in Figure 3. Dolphins and pilot whales make distinctive sounds and were usually heard before they were sighted. Occasionally cetaceans detected acoustically were never located visually. (Compare for example rate of acoustic detections in Figure 3 with sightings in Figure 1). Overall, cetacean vocalizations were heard on 29 per cent of monitoring sessions. Dolphin whistles were heard on 16 per cent and pilot whales whistles on 14 per cent of all monitoring sessions. Distribution of acoustic detections generally matched those of sightings.

Discussion

Acoustic monitoring greatly improved the detection rate for odontocetes during this survey. The ability of human observers to sight cetaceans at sea is highly dependant on weather conditions and sea state. The nature of these effects varies from species to species, but as an example Leaper *et al.* (1997) showed that the ability to sight minke whales declined markedly in sea states greater than two. A small vessel, such as the one used for this survey, is particularly vulnerable to the effects of poor weather. The weather conditions during the survey period were generally poor for cetacean sightings. Nearly half the available working days at sea were lost, and even when the survey vessel was at sea, conditions were rarely ideal. Acoustic detection efficiency is less severely influenced by weather conditions however, and small quiet vessels are ideal platforms for passive acoustic monitoring.

The higher sighting rate for pilot whales and white-sided dolphins on the edge of the continental shelf is to be expected as this is known to be their preferred habitat (Evans 1980, Pollock *et al.* 1997). Sightings of common and bottle-nosed dolphins inshore were lower than might have been expected. Higher relative densities of dolphins are known to occur off the south-west and north-west coasts of Ireland due to the proximity of the shelf edge (Evans 1981, Berrow 1993). Seasonal movements of large groups of dolphins have been reported in the autumn and the smaller group sizes reported here may indicate a more dispersed distribution at this time of year.

Although six cetacean species were positively identified during the survey, no large whales were seen, even though whaling records show that June and July were the peak months for catches (Fairley 1981). Large baleen whales would not have been detected acoustically with the hydrophone array used here which was not sensitive to their very low frequency vocalizations; however the hydrophones should have an acoustic range of at least 3-5 miles for sperm whale vocalizations (Leaper *et al.*, 1992).

Most fin whales off the west coast of Scotland were caught on the seaward side of the shelf edge (Brown 1976) but there was no evidence during the present survey of large whales in this preferred habitat. This may be due to the relatively

small amount of survey effort that was achieved, especially offshore, in good sighting conditions, but it may also be the case that these populations are still in a depleted state. Other recent surveys in Irish waters have also reported low rates of sightings for large whales. Pollock *et al.* (1997) observed only 12 large whales during 43 241 km of survey effort around the Irish coast. Six of these sightings were of fin whales, with two being encountered on the shelf edge. All other sightings were of sperm whales and in deep water (<2000m) to the west of the continental shelf. The only large whales recorded during 2974 km of transects in the Celtic Sea in July 1994 was a single sighting of two fin whales (Hammond *et al.* 1995) and only one sperm whale and two single minke whale encounters were reported by Berrow and Petch (1998) during 1772 km of visual and acoustic surveys conducted about 200km to the south of the present survey area during 1998.

This is one of the few dedicated cetacean surveys conducted in Ireland and was the first to include acoustic monitoring. Although commercial whaling stopped in Ireland in the 1920s, Scottish, Icelandic, Norwegian and Faroes whalers continued to make substantial catches of fin whales, from what may be the same breeding population, until recent times (Árnason 1995). The results reported here and in the literature suggest that large whales are rare on the former whaling grounds to the west of Ireland and still in need of full habitat protection. Additional surveys and further monitoring is required to determine the status of large whales and other cetaceans if conservation objectives and policies are to be successful.

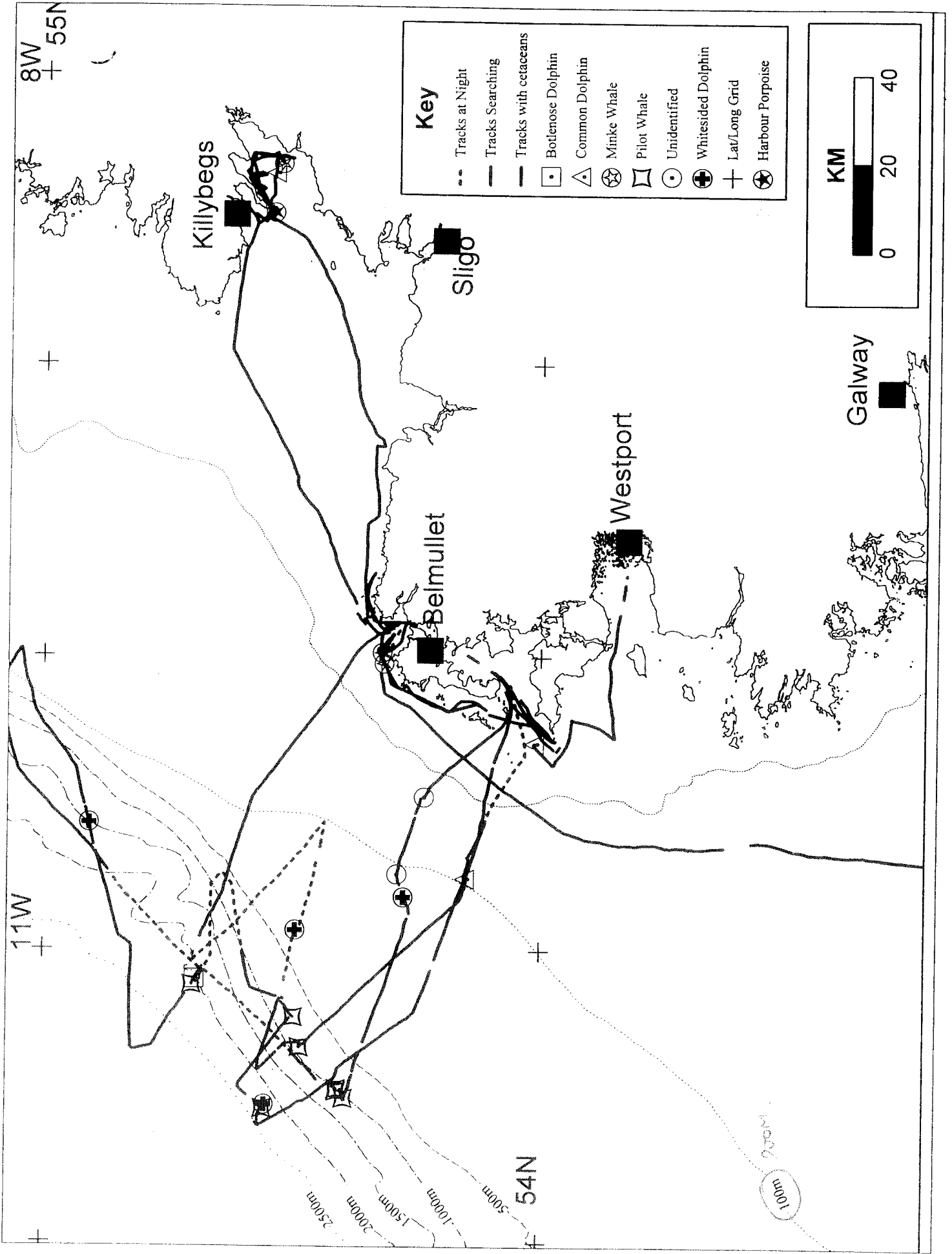
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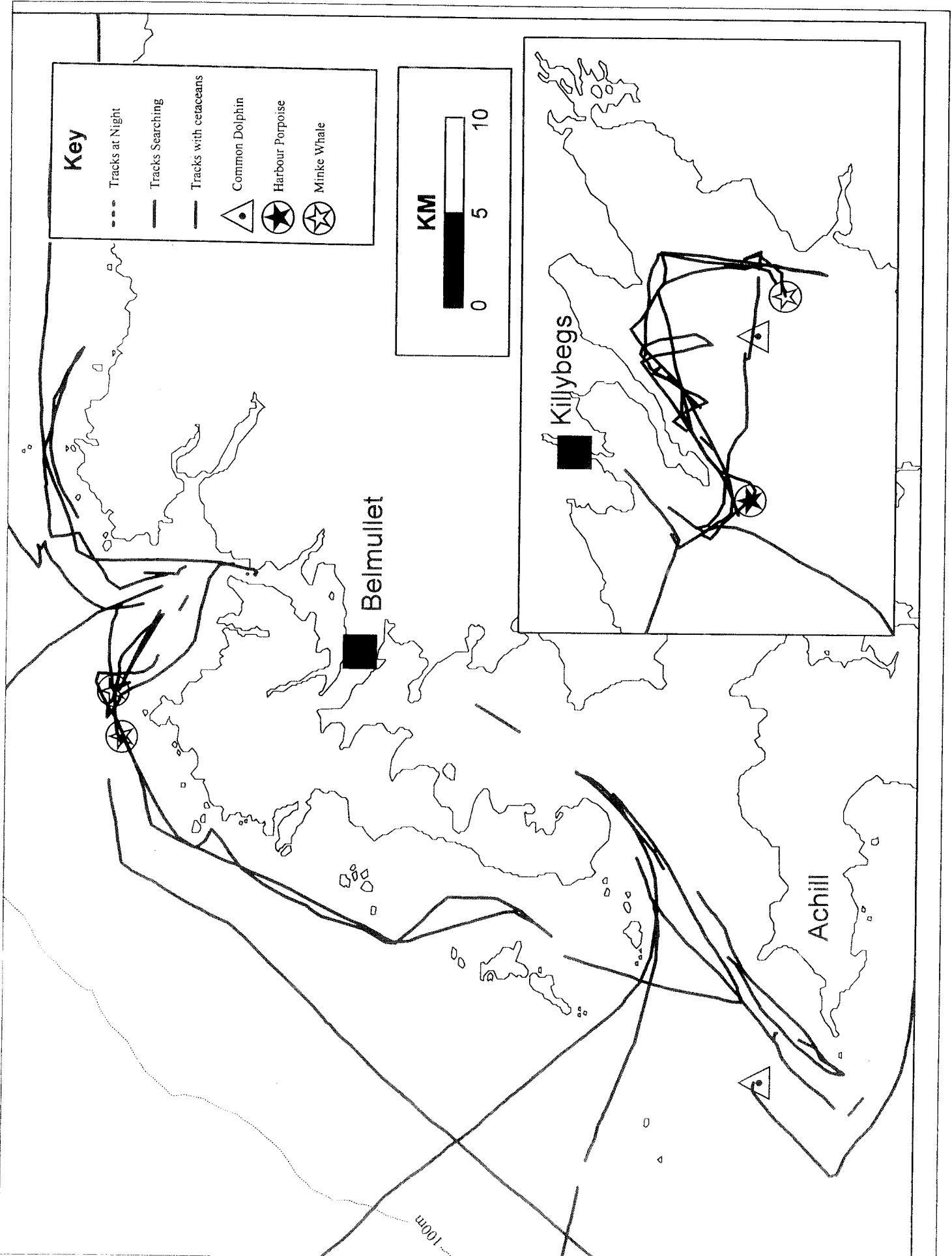
We would like to thank skipper Richard McLanaghan and Janine Booth of IFAW for their valuable contributions to the survey, all the volunteer observers for withstanding the climate of the Mullet Peninsula and to Ballyglass Lifeboat Station and Kilrush Creek Marina for all their assistance. Funding came from IFAW and from the National Parks and Wildlife Service. This work was carried out under the auspices of the Irish Whale and Dolphin Group.

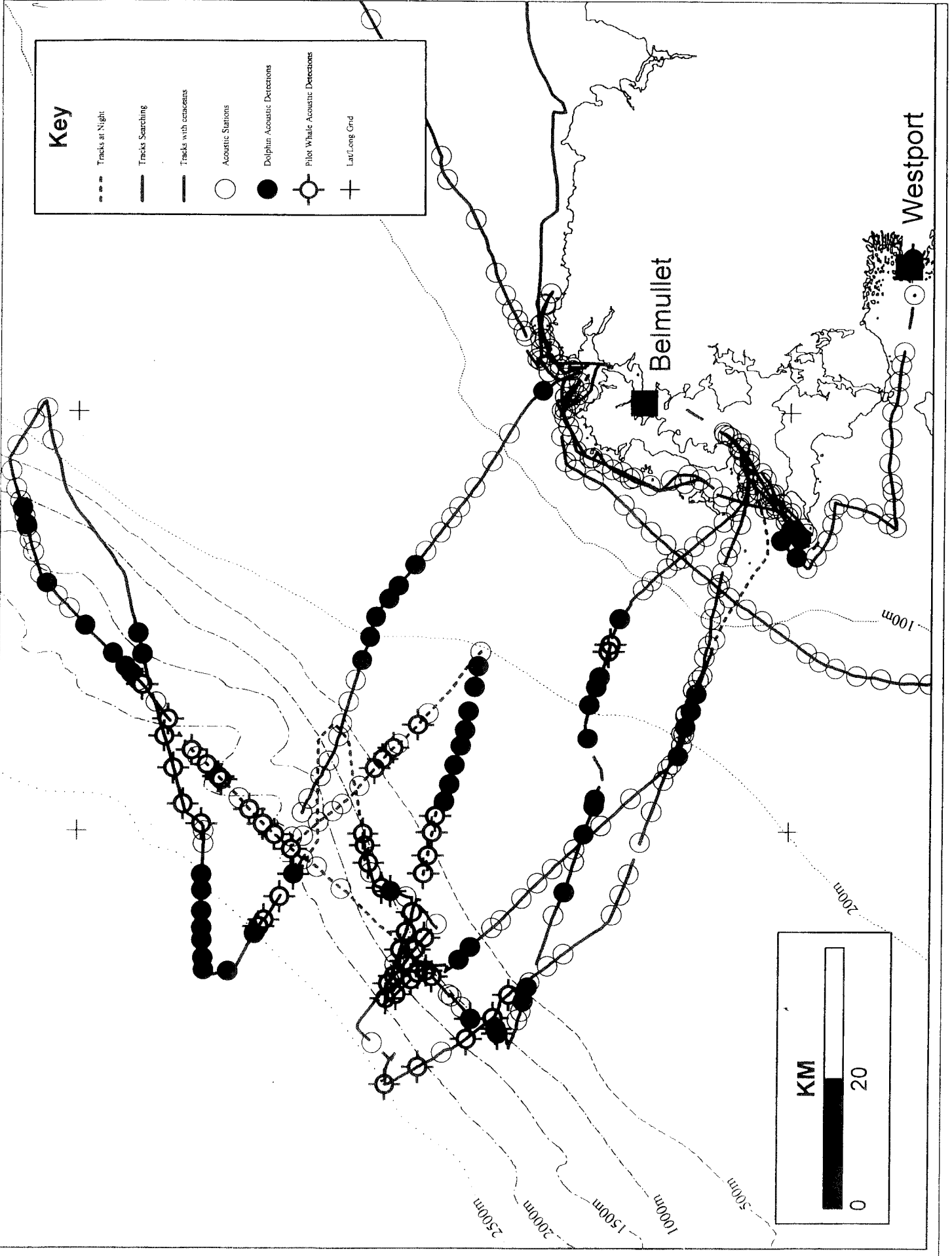
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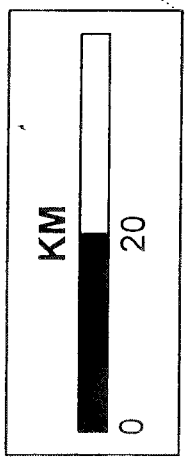






Key

- Tracks at Night
- Tracks Searching
- Tracks with cetaceans
- Acoustic Stations
- Dolphin Acoustic Detections
- ⊙ Pilot Whale Acoustic Detections
- + Lat/Long Grid



Belmullet

Westport

100m

200m

500m

1000m

1500m

2000m

2500m