Revised catch series and cpue for fin whales taken from the early modern whaling land stations in Iceland

J. Sigurjónsson and Th. Gunnlaugsson

Marine Research Institute,
Skúlagata 4, POBox 1390, 121 Reykjavík, Iceland

ABSRACT

Catch record data (some partial and some incomplete) is presented for just over half the catches from land stations in Iceland during the early whaling period 1883 to 1915 when whaling was banned in Iceland. Complete geographical presentation is given of the data but a part of the data had been presented graphically in an earlier. The data is split as requested between the Northwest (Vestfjord peninsula) and east coast regions but stations operated on the east coast only during the years 1901-1913. Only totals by year for all stations combined can be found complete in the published literature. Some totals by station and even species composition have though been published and are used to complement the data where the catch record data is missing. Still some totals by station are missing for the years 1893-1900 where the published totals have to be used, and for the Westfjord operation in the years 1901-1903 when the totals by station for the east coast were subtracted from the published totals to get totals for the West. The total fin whale catch is then prorated from the observed proportion fin whales by year and region. The available sex determined catch shows 52% females and gives no indication for a change over time or space. Catch position records are plottd and show that there is very little overlap in the range of the east and west operations, but the range expands with time. Different cpue indexes are derived. CpB as used in previous fin whale assessments is based on total catch of all species per boat-season and now also split by region. FpB is fin catch per boat rectified for chasing and handling times of all species. No time budget data exists for any of these stations but, where individual catch records are available, the operation time is taken to be from the first to the last whale caught to derive a catch per boat month index (CpBM) and analog to FpB an FpBM index. This index is too scant for the Vestfjord operation but superior for the east coast. Operational factors are discussed.

INTRODUCTION

The history of modern whaling in Iceland has been described by several authors (e.g. see Schmidt, 1904; Risting, 1922; Friðriksson, 1929; Sæmundsson, 1939; Jónsson, 1965; Tönnesen, 1967; Rörvik *et al.*, 1976; Tönnesen and Johnsen, 1982; Einarsson, 1987; Sigurjónsson, 1988; and Gunnlaugsson *et al.*, 1989). The first epoch of modern whaling in Iceland was introduced by Norwegian whalers at Langeyri in the Álftafjord at the west coast of Iceland in 1883. Later, as many as seven stations operated on the west coast until the turn of the century, when due to reduced catches, most of the whaling stations either were closed down or were moved to the east coast of Iceland. In the first few years after 1900, five stations operated at the eastern coast, but with clear signs of over-exploitation already in 1910, when thirty-two vessels searched the grounds. This first period of modern whaling in Iceland lasted until 1915, when the Icelandic parliament banned all whaling activities from land based stations.

Modern whaling with explosive harpoons fired from steam vessels started in Iceland in 1883 when the Langeyri station in Álftafjord was set up by the famous Norwegian pioneer Svend Foyn with his countryman Thomas Amlie as manager. This was in cooperation with Mons Larsen from Haugasund, Norway, that had for several years been involved in the herring fisheries in Iceland and had Icelandic citizenship. Álftafjord is one of the Westfjords, a peninsula on the north west corner of Iceland where the East Greenland ice edge comes closest to the island. According to Schmidt (1904), Risting (1922), Friðriksson (1929) and Sæmundsson (1939), large rorquals, in particular blue whales, migrated close by the Westfjords to the north coast of Iceland in the spring to return back again in the autumn. Other companies followed as catches off Finnmarken, N Norway, plunged, from 1889 and up to 1902, when the last company in the Westfjords started at Hesteyri in Hesteyrarfjord.

Already by 1901 another station which had been at Stekkeyri in Hesteyrarfjord since 1894, had moved to Sveinsstadaeyri in Hellisfjord on the east coast. Other companies followed and new companies started on the east coast in the next few years, and operated up to 1913, while some stations also continued in the Westfjords as late as the year 1915.

Although some catch statistics of the early modern whaling in Iceland has been provided by some of the above authors (see Risting, 1922; Tönnesen, 1967; Rörvik *et al.*, 1976; Sigurjónsson, 1988; Gunnlaugsson *et al.*, 1989; also IWS 1931, 1933), these have to a large degree been limited to catch totals but not by species, vessels or catch area. This has thereby caused problems, for stock modelling purposes, in splitting up historical catches of fin whales into the East Greenland, West Iceland and the East Iceland/Jan Mayen components (Gunnlaugsson *et al.*, 1989; Butterworth and Cunningham, 1999; Gunnlaugsson 2004). Such split up of catch data and cpue has been called upon by both the NAMMCO SC at its 12th annual meeting in 2004 and the Revised Management Procedures subcommittee of the IWC SC at its 57th annual meeting in 2004. At the NAMMCO SC at its 13th annual meeting in 2005 an investigation of alternative cpue series was reccomended. These are now revised based on reccomendations from the joined NAMMCO - IWC meeting in Reykjavik in March 2006.

This paper presents some unpublished early Icelandic modern whaling fin whale catch records and combines these with published figures to construct revised catch series, including catch composition by species and sex, split geographically by East/West component, and corresponding cpue series. Also cpue series based only on the available catch records are derived. In Gunnlaugsson *et al.* (1989), a graphical presentation of these catch position data from 1905 and 1909 shows how the catchers had with time had to increase their range of operation into deeper waters. Additional plots are provided here.

MATERIAL AND METHODS

The catch records presented here includes 9762 full or partial records of individual whales caught from 4 land stations located in West Iceland and 4 stations at the eastern coast of Iceland during the period 1889-1915. The data were extracted from data logs (*Record book*) in possession of the Marine Research Institute, Reykjavik and was hand-written by Mr Sigurleifur Vagnsson who was technician or research assistant at the Fisheries laboratory in Reykjavik. The records were found to be identical to records kept at the Government Archive in Copenhagen (Rigsarkivet), which was recently drawn to the attention of the first author by Dorete Bloch. Apparently, these records were collected under supervision or in cooperation between Danish scientists and Icelandic colleagues. Such collection of data in Iceland and the Faroes Islands was mentioned by the well known fisheries biologist Dr Johannes Schmidt while referring to his fisheries investigations in Iceland and the Faroes (Schmidt, 1904). With reference to cooperation with his supervisor Dr Schmidt, Dr Árni Friðriksson (1929), the first full-time fisheries biologist in Iceland who made his magister dissertation at the University of Copenhagen on marine mammals in the seas around Iceland in 1929, referred to the same material. Bjarni Sæmundsson, a pioneer in fisheries research in Iceland apparently refers to this material in his monograph on mammals in Iceland (Sæmundsson, 1939). Despite these references, no formal or full presentation of this major source of information has been made until now.

An overview of the stations in operation and station codes used in the data coding is given in Table 1. An overview of the available data by station is given in Table 2 where the main source of the information is given in the column *Ref.* and additional information in remarks. The catch compostion from the records as well as from the published data on totals and catch composition by station given in Risting (1922), Tönnesen (1967), totals from Einarsson (1987) and catches from the Fagraeyri station in the Fáskúdsfjord on the east coast (*Germania*) in 1903-1905 (see Barthelmess, 1986) were used to prorate species composition and revise the fin whale catch series for the whaling operation at the west and east coast of Iceland during this first epoch of modern whaling in Iceland.

Table 3 gives the totals for the data used and compares to the catch data records by stations for the years 1893-1903 for which this data is partial. For the other years the published totals are given only where these differ from the totals obtained from the catch data records by stations.

Earlier catches

Not included in the catch series are catches before 1883. Native Icelanders did not catch but a few rorquals, mainly calves, but in 1865 Roys started an operation at Vestdalseyri in Seydisfjordur on the east coast, landing 20 (16?) whales and killing 40 from small boats and two - later three, steam vessels (Johnsen, 1959, p75). In 1866 the reported catch was 41 landed but a lot more killed, but Roys also reported 43 blue whales, 7 humpbacks and 12 fin whales landed (Johnsen, 1959, p91), which adds up to a higher number. In 1867 the catch was 36 whales.

In the 1866 to 1869 seasons, the Danske Fiskeriselskab operated from Djupivogur also on the east coast. It and later Hammers landed there 8, 14, 6 and 1 whales respectively. In the first year more than 30 whales were said to have been killed.

East coast operation 1901-1913

The single blue whale that was landed in Foyns Nordfjordur east coast operation in 1883 (Tönnesen) is included (of no significance here).

Svinskalastekkur (Evensen) has no records for 1904 and 1911-13. Totals then are taken from Risting (1922) and Tönnesen (1967).

No totals are available for Asknes in 1903 (manager Ellefsen) as Catch records are given for only one of 6(7?) catchers (94 whales). To enable East-West allocation, the total catch there was assumed as 400 whales, which is the average of the preceding and following years that also had the same number of catchers. For 1904 to 1911 totals from Risting (1922) are used. In 1912 records are given for 15 whales landed there which Risting (1922) does not mention.

West coast operation 1883-1915

There are no records for the Langeyri station. Totals for 1883-1897 (Amlie) are from Risting (1922) and the catch composition is given from then on (last year 1904) (under leadership of Kobro).

There are no catch records for three stations in operation up to 1903. Of these, two stations started in 1897 and are Meleyri in Veiðileysufjord, (Dansk Hvalfangst & Fiskeriaktieselskab, sold to Salvesen in 1899), totals available for 1900-1902 only, and the Uppsalaeyri station in Seydisfjord (west), whose main holder was Ásgeirsson co. (no information). The third station, Dvergasteinseyri at Alftafjord (Harpunen), started in 1893 or 1896 (Tönnesen, 1967, vol. II, p32) and totals were published only for 1901 and 1902.

A station at Stekkeyri started in 1894. Tönnesen gives totals for 1894 and 1895 but all is missing for the years 1896-1901. Talknastation is missing the first years 1893(1894?)-1896 but Tönnesen has totals for 1894.

If none of these started 1893 then our records should be complete for 1893 but our total is only 432 while the published figure is 495.

Split by region

Due to the lack of data for the years 1893-1903, published total catches and number of catchers are used for these years.

For the years 1901 to 1903 the east coast catches and catching boats on record are subtracted from the published totals to get the totals for the west coast.

Proportion fin whales

No catch composition is available for the years 1885-1888. For these years fin whales are assumed to be 20, 30, 40, and 50%, respectively, based on the fact that in 1883-4 only blue whales were caught while in 1889 fin whales were 60% of the total catch.

No catch composition data was available for any west coast operations in the year 1912 so fin whales were assumed 75% of the total, i.e. the mean of the preceding and following years.

Proportion fin whales from the available data by year and region that was species identified is applied to the totals by year and region to obtain the estimated fin whale catches.

Catch dates
The heading for the date column in the records is *Fangstdato* or catch date. The date landed is not given in the records so the number of whales taken per trip is not clear from these data. In several cases only totals by species for the season are given for a station but in a few cases with a comment on the length of the season (see remarks in Table 2).

Catcher boats
The recoeds are in most cases given by catcher boat (name of boat and captain). Where missing this has been supplemented with figures from the litterature (see Table 2). Towing boats are not mentioned.

Catch positions
Vestfjord stations give catch position records for 794 whales. These are the

Solbakki in Onundarfjord (Ellefsen) 1894 to 1901 (n=392),
Sudureyri in Talknafjord 1904, 1908 and 1910 (n=258) and
Hesteyri in Hesteyrarfjord (Hekla) in 1910-11 and 1914-15.

east coast operations give position records for 2635 whales from the station at Sveinsstadaeyri and the two stations in Mjoifjord in most years (see Table 2) but for instance there are none for 1901 and 1907.

Most positions are given as angle (compass) and distance from a known location on land which was converted to geographic coordinates. A handfull of positions came out on land and were ignored.
In Figs 2-5 catch positions are plotted by region, species and period. Gunnlaugsson *et al.* (1989) plotted positions by month off the east coast so this is not repeated here. The figures are misleading in particular with respect to humpback whales for which positions of the peak catches in the Vestfjord operation are missing.

Positions were checked against the IWC schedule EGI stock boundary (straight line 60°N 18°W to 68°N 3°E on a Mercator projection) also shown on the plots (thick line). Also shown is the 400m depth contour (dotted line) and the present Iclandic fisheries territory.

Sex
Of the 1871 fin whales sexed (see Table 2), there are 970 females or about 52%.

Species mix
Blue whales were the preferred species because of size and they were rather closer to shore than the fin whales and appeared earlier in the season. In the very first years of the operation from the Vestfjords the boats have been able to concentrate on blue whales and for most of the period the proportion is generally above 1/3 but at about 1906 the proportion falls sharply both of the west and east coast. Blue whales were apparently never a large proportion at the east coast. Humpback whales were easier to catch and even closer to shore so they were the next species to be targetted even though they are smaller than the fin whales. There is a dip in the proportion fins and the cpue in 1898. In that year two of the stations with known catch composition (Solbakki, Framnes) turn suddenly to humpback whales (27%) while the third (Talknastation) shows no abrupt change and the catch per boat there is still on the increase in these years. In the years of peak humpback catches positions are known for only one boat which caught relatively few humps, mostly in the North-East. It is thus not possible to conclude from these data that humpbacks were in fact so few west

of Iceland in this period and it is not clear what exploration, or change in operation happened at the two stations in 1898. The operation of the east coast in fact started with large humpback catches that apparently were taken close to shore (most positions are missing for the first years).

Fin whales have a wider and more even distribution than the other species and they were the last species to be hunted down, as they were also largest in number. An exception here is sei whales which are smaller than fin whales and probably even harder to catch, but were always few in the west coast operation. In most years none but in 1910 as many as 4% of the total catch. Sei whales appear late in the season west of Iceland. At the east coast sei whale catches are less than 4% except in 1910 and 1913 when they are 9 and 12%, respectively. As this is towards the end of the operation period, sei whale catches are more likely to alleviate the actual decline in the catch per boat but aggravate the decline in indexes based on fin whales only. Only 11 sperm whales are reported taken by the Vestfjord operation and 35 from the east coast, all in the later years. However the area just west of the Vestfjords was the main ground for sperm whale catches during the more recent Hvalfjord operation and this is a confirmed high density area for sperm whales in sighting surveys, so sperm whales appear to have been there but taken only as a last resort and have had a minimal efect on any cpue when restricted to other species. Other toothed whales and right whales are even rarer.

Cpue

A catch per boat index (CpB) is presented as the total catch of all species per catching boat. Also presented is fins per boat assuming a handling chasing time of one day per caught whale (FpB1). Alternately in FpB2 handling time is assumed 0.75 days per whale but in addition 0.75 days is subtracted per blue and humpback whale. It is assumed that the season was 120 days long. Here 120 was used based on the available catch records and as the maximum CpB is 86.5. In other regions in the North Atlantic 90 is also about the maximum (Bloch pers comm.). Individual boats may however have been somewhat higher.

Other indices were compiled only from the individual catch records available. For each boat-season the time from the first whale caught to the last whale caught was divided into the the total catch per boat to get the catch per boat month (CpBM) (month taken as 31 days). Fin whales per boat month (FpBM1 and FpBM2) as described above are also presented for the east coast, but then long intervals between any catches were truncated to 20 days and only the mid season used for comparability of years.

All catch records by Ellefsen (from one boat only) after August 6th 1901 (station Solbakki in Onundarfjord on the Westfjords, on fire!) are taken at the East coast (16 humpbacks and 1 fin whale), so this is not treated here as a Vestfjord operation, however this data is considered too limited for an east coast index in 1901.

RESULTS AND DISCUSSION

Sex

There are only about a hundred sexed animals from the west coast operation so there is no detectable difference of the operations. Most of the sexed animals are from the later years 1905-1911 and there is no apparent trend with time.

It seems therefore reasonable to assume a constant sex ratio of 52% for all the catches.

Area

The boats from the west coast stations frequently operated north of Iceland around Grimsey in mid summer and as far as Langanes in the north east (Risting, 1922). About 25% of the recorded locations of fin catches of the Westfjord operation are north of Iceland (east of 22°W) but 188 of 303 recorded blue whale catches. Prior to 1900 only 1 of the 93 fin catch positions are east of 16°W but 13 of the 320 later locations are this far east and a few as far as off the east coast. It is possible that some of these are transcription or interpretation errors.

The first west coast catch records from south of 64°N (at the South coast) are in 1904, roughly 50% and in 1910 when 20% of the recorded catches are taken there.

Only from 1910 are there some records of the boats going as far west as 28°W but this occurred mostly in 1915. These catches are so far north (north of 66°N probably in calm waters close to the ice edge) that they are mostly west of the Iceland-Greenland midline or 4%(3/80) in 1910, 0%(n=20) in 1911, 10%(2/20) in 1914 and 33%(13/40) in 1915. There are no recorded catch positions in 1912 and 1913 when it would be reasonable to assume this as 5%. South of 65°30N the boats never go this far west, where are the main whaling grounds of the more recent operation.
In these early days of modern whaling in Iceland, the whalers had no means of communicating to shore or other vessels out of view and the ability to determine position at open seas was limited. When towing boats were available the catchers would still have to bring the whales towards shore to pre-agreed meeting points where they could be picked up by the towing boats. This may explain the limited off-shore range of the early operation.

The catching boats on the east coast, with towing boats, ranged widely but not west of 18°W and only about 1% west of 16°W.

An appropriate North-South separating line would probably be at 18°W to the South and to the North east of Grimsey at 16°W but as there have been very few fin sightings in the area North of Iceland from 22 to 16°W in the sighting surveys, this probably makes little difference to the abundance estimates at hand (Pike and Gunnlaugsson, 2005).

A few catch positions from the East coast operation (23) stray across the schedule EGI stock boundary in to Faroese waters. Of these 18 (out of 1552 positioned) are fin whales. Some of these might be errors.

Seasonal distribution changes
Seasonal changes in distribution are quite clear in the case of blue whales which appeared to migrate by the Vestfjords, possibly to the north of Iceland in early summer and have vanished from the north coastal waters in July farther to the North, but may be returning west in the autumn in deeper waters. East of Iceland there is some shift to the south over the season. Fin whales appear to arrive this far north (west of the Vestfjords) in July and stay there in deep waters. In contrast the fin whale catch positions from the later Vestfjord Talkna operation available 1936-1939 are in May-June concentrated just west of the Vestfjords and only later in the season farther south along the shelfe edge. Of the east coast the picture is very similar for both species. The blue whales are relatively more northerly and fewer in the autumn and blue whales are also more coastal there though fin whales are not as restricted to deeper waters there, particularly not in the spring.

Season length
Where catch records are not available the length of the catch season is unknown. In 11 cases though there are remarks about the length of the season (see Table 1). In 8 cases ca 4 months, two 5 months and one 3 months. In no case is the season remarked per boat. The length of the boat season in the records (taken from first to last whale caught) is in 100 cases from 3 to 5 months (90 - 150 days). In 10 cases it is longer. In 42 cases the boat season is shorter. Almost all the shortest boat seasons are during the last years on the east coast when some of the boats there were also landing catches in the Faroe Islands. Table 6 gives the frequency distribution of intervals between catches per boat. Most of the long intervals are in early spring or late autumn.

Cpue indexes
Table 4 gives the CpB series based on total catch per boat per season. The peak in the Vestfjord operation is in 1895 and thus earlier years must be regarded as a learning period. The proportion fin whales there is up to 40% in 1900 and 1901 and 50% in later years. It is thus reasonable to use a cpue index for fin whales there starting from 1900, or 1902 to be also less affected by the technical progress in the operation.

Table 5 gives the average per year for the CpBM series based on the available individual catch records. There are120 east coast boat seasons 1902 to 1913, so some variation could be estimated from this data. However, since only some stations are represented and the boats from the same station are likely correlated, this may be of limited value and the variation in the series may be best estimated in a model fit. The CpBM

index has the same features as the index based on the totals, but the variation between years is greater for the west coast operation where in most years there are records for only one boat and there is only data for some of the years 1894 to 1915.
Table 7 gives the CpB by month from all available individual catch records. The cpue is lower in spring and autumn.
The index based on totals assumes a constant effort per boat season which was clearly violated in the last years at the east coast, when some boats were only operating for a part of the season. The trend in the index based on totals would thus be too severe there, although the short seasons probably also reflect poor catches. However, in the CpBM series the trend may be too little as the boats in the end mostly operated during the peak season. In the Vestfjord operation there is a shift in the season so that they start later during the last years but also terminate rather later. Fin whale catches there were always low during the spring (see Fig. 4a) and this change is probably an adaptation to that, as the other species were becoming rare, so somewhat shorter seasons there, due to less effort in the spring in the last years, are not of great concern.

At the start of the operation fin whales were supposedly the most abundant, unless a very sharp multi species density response is assumed where fin whales quickly took advantage of the demise of the other species. The fact that not many fin whales were taken early on rather demonstrates that there is a saturation effect (nonlinearity) while there is sufficient availability of whales and that fin whales were ignored while there was hope for a better catch. With less density of whales the cpue does however show a decline as expected. The decline is in good accordance with the slow recovery of blue and humpback whales observed in this area. These species must have been driven quite low, which implies that fin whales were by far the most abundant species in the later years, more so than the proportion in the catch shows. We therefore consider the CpB series is in fact a good index of fin whale abundance in these years.

In an earlier version of this paper (SC/M06/FW13) presented at the joined NAMMCO - IWC meeting in Reykjavik in March 2006 the cpue for fin whales was corrected by subtracting a fixed amount of time per whale caught of other species only. This approach met criticism for not attempting to account for handling times of fin whales. Also though sei and toothed whales are not a large proportion of the catch they should have been treated differently according to this logic. The reason why handling times for fin whales were not subtracted was that in the series based on totals the season length is not known and it was felt that it would increase the noise in that series, as a season with large catches would likely be longer than average and then subrtacting handling times from an assumed average season length would, in that instance, exaggerate the error in the assumption. Upon further inspection we have however concluded that the season length in the west operation was not a problem and that when whaling started early or finished late that time was less productive.

A cpue based on only fin whale catches needs to be corrected for the catches and arguably the effort distraction of prefered species. If no corrections for handling and chasing of whales is included the trend in the cpue for fin whales will be dampened. If the correction is to high it will introduce noise and exaggerate the trend. It will not however introduce a trend where there is none.
When a preferred species were sighted during the chase of a less prefered species it is likely that the whalers changed their target. The chase time of fin whales must therefore be considered effective search time for blue and humpback whales but not the reverse, and the chase time of sei or toothed whales must be considered effective search time for fin whales. Also blue and humpback whales were rather closer to coast and do not overlap completely in time as well as space with fin whales so any catches of these species would in general indicate less effective search effort for fin whales. We have thus adopted a constant handling time correction for all species of 1 day and alternately 0.75 days for all species and an extra detraction of 0.75 days for blue and humback whales. These series are given in Table 4 columns FpB1 and FpB2 respectively based on the totals where the season was assumed 120 days. In Table 8 the coresponding indexes based on individual catch records are under column headings FpBM1 and FpBM2 and given for the east coast only, as the west coast data is too limited. The longer intervals between catches were truncated to 20 days in the FpBM series (Table 8) and the average time per whale then is 3.75 days or 8.3 whales per month. Also the scope is restricted to the period of operation in the last season on the East coast (1913) from 14th May to 12th August. The efect of the truncation turned out to be negligible for this period. The proportion fin whales increases at the east coast from 10% in the first year (1901) to just under half in 1906. The first two

years at the east coast when fins were a small proportion of the landed whales and the other species, in particular humpback whales, were caught quite close to shore, should in any case receive little weight. In 1907 over 2/3 of the catch is fin whales and is at or above that level for the remaining years. The trend in this index is thus quite sensitive to assumptions about handling and chasing times of different species prior to 1907 but insensitive after that. It would be reasonable to limit use of that index to the period from 1907 to 1913. For the west coast the FpB index has to be used and then accordingly starting from 1902, when fin whales remain at over 50% of catches. The two corrections give almost identical series for these periods and in fact the CpB and FpB series are quite similar for these predominant fin whale years.

As the season is taken to start with the first whale caught, if in the later years the first trips took longer or the first or last trips of the boats did not result in any catches taken, then by using the first to last catch dates per boat as a measure of its effort introduces a bias towards less trend. Similarly some of the long intervals between catches, that were truncated, may be factual, in that the boats ran out of fuel before finding any whale in the last seasons.

The 1915 data point has in fact 1/3 of the fin whale catch taken from the Greenland component. However, on the way there the boats must have been searching for whales closer to shore without success, so these last points are definitely upwards biased by the inclusion of these catches.

Comments to cpue

The station Germania on the east coast started operation in early July 1903 and operated only 60 days this first year. Totals by species are known, but we do not have catch records for this station.

In 1906 heavy ice hindered the boats from the Vestfjords in going north off Iceland until 4 June (Risting, 1922, p184). By 1906 the blue whales which were abundant North of Iceland in early summer (see Figs 4) were largely depleted and fin whales were never abundant there so this should not have had much efect on the fin whale index. Rather the reason why the fin whale cpue for the Vestfjod operation is not higher in the first years is that the boats were concentrating on these blue whales that appeared to migrate close to the Vestfjords to the north of Iceland.

Long towing times became each year more common. In 1907 new powerful modern boats were bought, with Ellefsen taking the lead (Risting, 1922, p185). In this connection it is noteworthy that at the west coast in 1910, mostly towed whales were landed (Risting, 1922, p188). And in 1912 west coast operation boats had to go 60 kvm off land (Tönnesen, 1967, vol II p37).

At the east coast operations the same development took place. Chr. Salvesens operation bought in 1906 majority shares of Bulls station at Sveinstadareyri station, Hellisfjord, East Iceland, and had then 10 boats that moved as needed between the stations that were also at Torsvik, Faroe Islands and Olna, Shetland Islands. For example in 1911, only two boats started but later in the summer there were up to seven boats operating (Trausti Einarsson, 1987, p55). There are catch records from 8 of these boats but one of them only caught 2 whales.

Tönnesen (1967, vol II p43) remarks on underreporting: "As is in the first volume (Johnsen 1959 p625) shown that the numbers for Finnmark (17 745) are too low and that the right number lies near 20000. Though the difference in Iceland is hardly as big." The oil yield from Iceland per whale is 50% higher than from Finnmark according to Tönnesen but he considers that this was mostly explained by the higher proportion of blue whales.

Sighvatur Grímsson Borgfirðingur who had a good overview of the operation at Framnes (Höfdaodda) in Dyrafjord, Westfjords, from his home, kept diaries 1890 to 1903, where he recorded each whale landed. A compilation of this information is reported by Kjartan Ólafsson (1999, p 202) where it is concluded that the landings were under-reported and should have been 46.2% higher. The rent for the land that the Victoria company (Berg) had to pay was in proportion to the number of whales landed so there was an incentive to under-report. The numbers that Ólafsson (1999) based his comparison on were from Tönnesen (1967) and are lower than those in the present study. For example, Ólafsson (1999) counts 1644 whales landed in 1890

to 1902 from Sighvatur´s records while the present records give 1605 whales, which is only a minor discrepancy.

According to these diaries the last 10 whales were landed in Dyrafjord in May 1903, the last one on 10th of May. This is in accordance with dates given in catch records for the Victoria company but no other information is supplied there so these whales had been assigned to the east coast. This has not been corrected for in the CpB and FpB calculations in the present study since it would generate complications, but does not affect the pBM series, as the Victoria 1903 records are too lacking to be included there.

Finally, it needs be mentioned here that Tönnesen (1967, vol. II, p44) discussed struck and lost rate in these early operations: "There are those that believe that the numbers for the first 20-25 years after 1867 should be doubled and for the next 15-20 years increased by 50%". While one definitely can assume lower struck and lost rate after this learning period before the turn of the century, the loss factor may have increased somewhat again at the turn of the century due to more catches in off shore waters as well as long towing distances along the coast in later years.

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Table 1. WHALING STATIONS IN OPERATION IN ICELAND 1883-1915 (all stations prior to 1935).

Region		*Years*						
Stat	*ID*	*from*	*to*	*Station*	*Location*	*Managers*	*Owners*	*Comments*
N	E	1883		Nordfjordur	Nordfjord	-	S.Foyn	only one season
8	W	1883	1897	Langeyri	Alptafjord	Amlie	Mons-Larsen & Co.	1898 sold A/S Hvalen
8	W	1898	1904	Langeyri	Alptafjord	Kobro	A/S Hvalen	1906 sold Chr. Salvesen and moved
4	W	1889	1901	Solbakki	Onundarfjurd	Ellefsen	Skjærsnæss A/S	1901 on fire. Moved E
1	E	1902	1912	Asknes	Mjoifjord	Ellefsen	Skjærsnæss A/S	1911 sold LM Christensen
9	W	1890	1902	Framnes	Dyrafjord	Berg	Victor A/S	last whales landed May 10th 1903. Moved E
6	E	1903	1911	Hamarsvik	Mjoafjord	Berg !	Victor A/S	land rent 1902; ! 1906 Sorensen - 1908 Dahl
6	E	1912	1913	Hamarsvik	Mjoafjord	Dahl	Victoria A/S	
2	W	1893	1911	Sudureyri	Talknafj	Stixrud?	Talknaselskab	joined Hekla and moved there
3	W	1902	1911	Hesteyri	Hesteyrarfjord	-	Heklaselskab	1912 Hekla joined in
3	W	1912	1915	Hesteyri	Hesteyrarfjord	Larsen	Hekla&Talkna	
S	W	1894	1900	Stekkeyri	Hesteyrarfjord	Bull	Brodrene Bull	1901 moved Hellisfj.
7	E	1901	1905	Sveinsstadareyri	Hellisfjord	Bull	Brodrene Bull	1906 sold to Salvesen
7	E	1906	1913	Sveinsstadareyri	Hellisfjord	Salvesen	Chr.Salvesen&Co.	
D	W	1896	1903	Dvergasteinseyri	Alptafjord	Herlofsson	A/S Harpunen	moved to Hebridges
M	W	1897	1898	Meleyri	Veidileysufjord		Dansk Hvalf.&Fiskeriakt.	sold Chr.Salvesen
M	W	1899	1903	Meleyri	Veidileysufjord	Henriksson	Chr.Salvesen&Co.	moved to Shetland ? Torsvik 1905
U	W	1897	1903	Uppsalaeyri	Seydisfjord W	Stixrud	Hval-Industri Akt.selsk.Island	main shareh. Asgeirsson; moved to Reydarfj.
5	E	1904	1913	Svinskalastekkur	Reydarfj./Eskifj.	Evensen	Hval-Industri Akt.selsk.Island	no drift 1905
F	E	1903	1905	Fagraeyri	Faskrudsfjord	dr.CarlPaul	Germania Walf. und Fischind.	land rent 1902; moved SH by Salvesen

Table 2. Catch data 1883 - 1915. *StID*: Station ID as in Table 1 and region East/West. *Ref.* is pagenumber from Record book at MRI, other refs. followed by pagenumbers are R=Risting, T2p=Tönnesen, B=Barthelmess. *Bo*: Boats in operation. *Tot*: total landed whales. *TotId*: total whales species identified. *FinId*: fin whales identified. *Fe.* and *Ma.* identified females and males. *Rec.*: records with boat and date. *Pos.*: position records.

StID	*Year*	*Ref.*	*Bo*	*Tot*	*TotId*	*FinId*	*Fe.*	*Ma.*	*Rec*	*Pos*	*Remarks*
1 E	1902	206-211	7!6	476	85	12			*	*	*1 of 6 boats
1 E	1903	212-217	7!6	?	94	34			*	*	*1 boat. total assumed 400
1 E	1904	218-235	7!6	?333	289	129	69	60	+	+	R182 total 333 boats 7
1 E	1905	236-255	7!6	?351	313	149	71	78	+	+	R183 total 351 boats 7
1 E	1906	256-267	7	?210	207	116			+	*	
1 E	1907	268-281	7	?268	265	186			+	-	
1 E	1908	282-297	9	?244	244	187	90	97	+	+	
1 E	1909	298-311	8!7	?260	215	178	99	79	+	+	
1 E	1910	312-319	9!5	?170	99	87	52	35	+	+	
1 E	1911	320-329	5	?134	134	120	64	56	+	+	R173 boats 4-5
1 E	1912	332-333	4	15	15	12			+	-	4 boats catch at different times. Vilma none.
2 W	1893	T2p30	2	42							
2 W	1894		2	?							
2 W	1895		2	?							
2 W	1896		2	?							
2 W	1897	R173	2	85?	85	60					T2p39 110 whales 2 boats
2 W	1898	R173	3	121	121	70					R173 2-4 boats
2 W	1899	R173	3	130	130	58					
2 W	1900	R173	3	124	124	77					T2p boats in 1900 increased to 3
2 W	1901	R173	3	124	124	86					
2 W	1904	102-7	4	108	108	73	4	5	+	+	
2 W	1905	108-9	4	127	127	72			-	-	
2 W	1906	108-9	4	81	81	44			-	-	
2 W	1907	108-9	4	90	90	56			-	-	
2 W	1908	110-15	4	82?	82	56			+	+	R173 total 79
2 W	1909	114-15	5	136	136	103					
2 W	1910	116-121	5	?90	90	70			+	+	
2 W	1911	122-123	4	55							
3 W	1902	86-87	3	106	106	70			-	-	ca. 4 month operation. R24 boats 4
3 W	1903	86-87	4	98	98	57			-	-	ca. 4 months
3 W	1904	86-87	4	122	122	83			-	-	ca. 4 months
3 W	1905	86-87	4	153?	153	83			-	-	ca. 4 months. R25 total 163
3 W	1906	86-87	4	109	109	72			-	-	ca. 4 months
3 W	1907	86-87	4	94	94	45			-	-	ca. 4 months
3 W	1908	88-89	4	97	97	50			*	*	*North of Kap Nord. May8-Sept9.
3 W	1909	88-89	5	135	135	98			*	*	*May8-Sept21 Whale thin 1909
3 W	1910	88-91	5	?114	32	23	11	10	+*	+*	*1 boat Urd Whale fat 1910
3 W	1911	90-91	4	86	86	72	9	11	+*	+*	*1 boat Urd
3 W	1912	R189	8	96							
3 W	1913	R191	7	56	56	38					
3 W	1914	90-91	3	35	35	20	10	10	+	+	
3 W	1915	90-91	4	52?	52	44	24	20	+	+	R191 total 54
4 W	1889	4	2	63	63	38			-	-	
4 W	1890	4	2	74	74	23			-	-	
4 W	1891	4	3	85	85	43			-	-	
4 W	1892	4	4	128	128	47			-	-	
4 W	1893	4	5	196	196	113			-	-	
4 W	1894	6-9	5	216	216	79			*	+*	*1 boat
4 W	1895	10-13	5	343	343	112			*	+*	*1 boat

4 W	1896	14-17	5	271	271	45			*	+*	*1 boat
4 W	1897	18-19	5	161	161	36			*	+*	*1 boat T2p538 total 217
4 W	1898	20-23	5	220	220	47			*	+*	*1 boat
4 W	1899	24-27	5	213	213	62			*	+*	*1 boat
4 W	1900	28-31	5	205	205	87			*	+*	*1 boat
4 W	1901	32-35	?	?	50	13			*	+*	*1 boat. Station on fire
5 E	1904	R182	3	90							
5 E	1906	124-125	3	63	63	34				*	Notes on position
5 E	1907	124-125	3	113	113	82				*	Notes on position
5 E	1908	126-139	3	?85	72	60	26	34	+	*	Notes on position
5 E	1909	130-135	3	?93	94	73	47	26	+	*	Notes on position. T2p: record year 1909 total 135
5 E	1910	136-139	3	?47	47	29	10	19	+	*	Notes on position
5 E	1911	T2p36	3	56							number boats not clear
5 E	1912	R189	3	42							
5 E	1913	T2p36	2	25							
6 E	1903	142-145	4	236?	236	59			*	ca	*totals per day. R20 total 234
6 E	1904	146-159	4	187?	187	59	19	27	+	+	R20 total 180
6 E	1905	160-171	4	205	205	98	47	44	+*	+*	*missing for Sept. 6 fin 1 sei
6 E	1906	172-179	4	?130	125	51	28	23	+	+	
6 E	1907	180-181	4	193	193	132			*		*Apr 5.- Sept 6. totals
6 E	1908	180-181	5	165	165	129			*		*Apr 8.- Sept 6. totals
6 E	1909	182-193	5	?196	195	162	83	79	+	+	
6 E	1910	194-201	5	?137	137	104	59	45	+	+	
6 E	1911	202-205	5	?54	55	48	23	25	+	+	
6 E	1912	330-331	2	7	7	7			*		July 10.-Sept 6.; T2p: 3 rented boats 7 whales
6 E	1913	330-331	2	27	27	15	9	6	+	+	
7 E	1901	40-41	2?	173?	173	18			x		T2p31 3 boats
7 E	1902	40-41	2?	148?	148	27			x		T2p31 3 boats
7 E	1903	40-41	2?	129?	129	50			x		T2p31 3 boats
7 E	1904	40-43	2?	?70	70	20			x		T2p31 3 boats
7 E	1905	44-49	3	?100	100	38	24	14	+	+	
7 E	1906	50-51	3	61	61	23			x	*	*about 120 min East to South Cap Hornæs 1906-9.
7 E	1907	50-51	3	97	97	58			x	*	
7 E	1908	52-53	4	93	93	70			x	*	
7 E	1909	54-59	4	134	134	112			x	*	
7 E	1910	60-65	5	91	91	70	37	33	+	+	
7 E	1911	66-67	8	77	77	66	30	36	+	+	R174 boats 2-7
7 E	1912	68-71	4	31	31	26	12	14	+	+	
7 E	1913	68-71	4	40	40	28	13	15	+	+	
8 W	1883	TE65	1	8	8	0					
8 W	1884	TE65	1	25	?25	?0					
8 W	1885	TE65	1	32							
8 W	1886	TE65	1	25							T2p21 21 whale
8 W	1887	TE65	2	48							
8 W	1888	TE65	2	82							
8 W	1889	R170	2	65							
8 W	1890	R170	2	57							
8 W	1891	R170	2	49							
8 W	1892	T2p21	2	88							
8 W	1893	T2p21	2	65	65	44					
8 W	1894	R170	3								
8 W	1895	T2p22	3	128							
8 W	1896										
8 W	1897										
8 W	1898	R174	2	54	54	10					
8 W	1899	R174	2	68	68	20					

8	W	1900	R174	2	65	65	8	
8	W	1901	R174	2	69	69	13	
8	W	1902	R174	2	56	56	18	
8	W	1903	R174	3	50	50	21	
8	W	1904	R174	3	70	70	40	
9	W	1890	36-37	3	68	68	33	5 right whales from T2p
9	W	1891	36-37	3	71	71	27	
9	W	1892	36-37	3	89	89	43	
9	W	1893	36-37	3!	129	129	?	39 blues (Hjort, p135). !4 boats (Olafsson, 1999)
9	W	1894	36-37	4*	125	125	58	*4 boats to 1902 (Hjort p134-5; letter enkefru Berg)
9	W	1895	36-37	4*	159	159	75	
9	W	1896	36-37	4*	163	163	54	
9	W	1897	36-37	4*	112	112	38	
9	W	1898	36-37	4*	130	130	34?	35 humps. R173 blue average, fins assumed rest
9	W	1899	36-37	4*	143	143	?	there of 71 blue many humps
9	W	1900	36-37	4*	162	162	49	
9	W	1901	36-37	4*	133	133	39	* *Hertig letter 1910-01-13. R175 total 153
9	W	1902	36-37	4*	121			
D	W	1901	T2p32	3	133			majority blues T2p32
D	W	1902	T2p32	3	104			
F	E	1903	B227-50	2	47			60 day effort from early July
F	E	1904	B227-50	2	85			
F	E	1905	B227-50	2	60			
M	W	1900	T2p35		66			
M	W	1901	T2p35		48			
M	W	1902	T2p35		66			
N	E	1883	T2p19	1	1	1		
S	W	1894	T2p30	1	23			
S	W	1895	T2p30	2	102			

\+ Complete records.
* Partial or incomplete records.
x Only species totals by boat.
! Boats from Risting followed by a ! and then the partial number from the records.
? Totals and boats when preceded by a question mark are from Risting.

Table 3. Totals used in CpB series

	Totals used		*Partial# / Published**	
Year	*Whales*	*Boats*	*Whales*	*Boats*
1883	8	1		
1884	25	1		
1885	32	1		
1886	25	1		
1887	48	2		
1888	82	2		
1889	128	4		
1890	199	7		
1891	205	8		
1892	305	9	302	11 *
1893	495	13	432	12 #
1894	523	15	364	15 #
1895	768	16	732	16 #
1896	792	18	434	11 #
1897	796	21	358	11 #
1898	650	21	525	14 #
1899	868	23	554	14 #
1900	823	23	622	14 #
1901	1192	27	730	14 #
1902	1305	30	1077	21 #
1903	1258	30	960	22 #
1904	1065	29	983	27 *
1905	996	24	1041	25 *
1906	654	25	650	*
1907	855	25	843	*
1908	766	29	761	*
1909	954	30	947	*
1910	649	32		
1911	462	29	428	22 *
1912	191	21	152	20 *
1913	148	15	123	13 *
1914	35	3		
1915	52	4	54	*

this catch record data by station is incomplete
* these published totals differ

Table 4. Catch and cpue series based on totals.

Region	*Year*	*Totc*	*Boats*	*CpB*	*IdAll*	*IdFin*	*%Fin*		*Finc*	*FpB1*[#]	*FpB2*[+]
E	1901	173	2	86.50	173	18	10.4		18	32.2	NA
E	1902	624	9	69.33	233	39	16.7		104	27.4	55.1
E	1903	812	15	54.13	459	143	31.2		253	30.7	38.8
E	1904	765	18	42.50	546	208	38.1		291	25.0	27.9
E	1905	716	16	44.75	618	285	46.1		330	32.9	35.6
E	1906	464	17	27.29	456	224	49.1		228	17.4	18.0
E	1907	671	17	39.47	668	458	68.6		460	40.3	39.9
E	1908	587	21	27.95	574	446	77.7		456	28.3	27.3
E	1909	683	20	34.15	638	525	82.3		562	39.3	37.0
E	1910	445	22	20.23	374	290	77.5		345	18.9	18.3
E	1911	321	21	15.29	266	234	88.0		282	15.4	15.0
E	1912	95	13	7.31	53	45	84.9		81	6.6	6.6
E	1913	92	8	11.50	67	43	64.2		59	8.2	8.1
E	total	6448	199	32.40	5125	2958	57.7		3469	23.9	24.5
W	1883	8	1	8.00	8	0	0.0		0	0.0	0.0
W	1884	25	1	25.00			0.		0	0.0	0.0
W	1885	32	1	32.00			20.	*	6	8.2	9.4
W	1886	25	1	25.00			30.	*	8	10.1	10.8
W	1887	48	2	24.00			40.	*	19	11.9	12.5
W	1888	82	2	41.00			50.	*	41	31.1	33.3
W	1889	128	4	32.00	63	38	60.3		77	26.2	26.7
W	1890	199	7	28.43	142	56	39.4		78	14.6	15.4
W	1891	205	8	25.62	156	70	44.9		92	14.6	15.1
W	1892	305	9	33.89	217	90	41.5		126	19.5	21.1
W	1893	495	13	38.08	196	113	57.7		285	32.1	33.0
W	1894	523	15	34.87	341	137	40.2		210	19.7	21.4
W	1895	768	16	48.00	502	187	37.3		286	29.8	34.8
W	1896	792	18	44.00	434	99	22.8		181	15.9	19.6
W	1897	796	21	37.90	358	134	37.4		298	20.7	23.0
W	1898	650	21	30.95	525	161	30.7		199	12.8	14.0
W	1899	868	23	37.74	411	140	34.1		296	18.8	20.9
W	1900	823	23	35.78	556	221	39.7		327	20.3	21.9
W	1901	1019	25	40.76	376	151	40.2		409	24.8	27.4
W	1902	681	21	32.43	162	88	54.3		370	24.1	24.8
W	1903	446	15	29.73	148	78	52.7		235	20.8	21.2
W	1904	300	11	27.27	300	196	65.3		196	23.1	22.9
W	1905	280	8	35.00	280	155	55.4		155	27.4	28.3
W	1906	190	8	23.75	190	116	61.1		116	18.1	18.2
W	1907	184	8	23.00	184	101	54.9		101	15.6	16.0
W	1908	179	8	22.38	179	106	59.2		106	16.3	16.5
W	1909	271	10	27.10	271	201	74.2		201	26.0	25.4
W	1910	204	10	20.40	122	93	76.2		156	18.8	18.4
W	1911	141	8	17.62	86	72	83.7		118	17.3	16.9
W	1912	96	8	12.00			75.	*	72	10.0	9.9
W	1913	56	7	8.00	56	38	67.9		38	5.8	5.8
W	1914	35	3	11.67	35	20	57.1		20	7.4	7.4
W	1915	52	4	13.00	52	44	84.6		44	12.3	12.1
W	total	10906	340	32.01	6350	2905	45.7		4866	19.5	20.7
E+W	total	17354	539	32.20	11475	5863	51.1		8335	21.1	22.1

* for seasons where no whales were species identified %fin is assumed.

[#] 1 day subtracted per whale (from assumed 120 days per season)

[+] 0.75 days subtracted per whale and 0.75 extra per blue or humpback whale

Table 5. Catch per boat month based on records.

Year	*Whales*	*Days* W	*CpBM*	*Whales*	*Days* E	*CpBM*
1894	63	187	10.4			
1895	56	155	11.2			
1896	62	170	11.3			
1897	34	153	6.9			
1898	43	180	7.4			
1899	47	135	10.8			
1900	45	116	12.0			
1901	32	94	10.6	15	29	15.7
1902				84	130	20.0
1903				93	137	21.0
1904	104	475	6.8	466	1195	12.1
1905				599	1620	11.5
1906				321	1308	7.6
1907				258	989	8.1
1908	78	458	5.3	304	1290	7.3
1909				489	1720	8.8
1910	116	703	5.1	356	1892	5.8
1911	25	129	6.0	248	1290	6.0
1912				38	317	3.7
1913				61	333	5.7
1914	32	253	3.9			
1915	48	254	5.9			

Table 6. Interval frequency between catches per boat for all boats.

Days	0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
Catch	695	712	761	496	345	245	178	133	104	64	63	50	31	38	25	25	28	23	9	15	12
Days	21	22	23	24	25	26	27	28	29	30	31	32	33	35	38	39	40	47	48	52	
Catch	13	6	6	5	6	2	3	6	3	3	1	3	1	2	1	1	1	1	1	2	

Table 7. Catch per boat by month based on records (excluding 10 whales in March).

Region	Year	April		May		June		July		August		September	
		CpBM	Days	CpBM	Days	CpBM	Days	CpBM	Days	CpBM	Days	CpBM	Days
E	1901									11.7	19	3.5	9
E	1902			13.2	28	35.1	30	23.0	31	12.0	31	6.4	10
E	1903	4.4	14	20.0	31	27.9	30	28.0	31	16.1	31		
E	1904	0.0	34	1.4	200	11.3	290	19.4	310	16.1	258	11.8	5
E	1905	9.3	110	7.1	359	12.2	390	14.7	393	8.1	351	11.3	6
E	1906	1.4	92	3.2	280	8.6	326	8.4	341	8.0	241		
E	1907	1.6	96	1.4	201	8.6	210	9.7	217	11.2	214	6.4	39
E	1908			4.2	164	4.9	324	10.1	372	6.3	313	5.3	35
E	1909	2.3	13	3.8	332	8.2	450	11.5	465	8.1	427	3.3	29
E	1910	0.0	11	1.1	295	2.7	532	6.3	558	8.1	452		
E	1911	3.2	57	1.7	73	3.3	241	6.3	382	6.2	406	3.3	38
E	1912			1.3	25	2.7	46	2.2	85	3.8	107		
E	1913			0.0	15	4.6	169	6.4	117	2.9	11		
W	1894	5.2	30	10.0	31	12.4	30	15.0	31	13.0	31	18.4	7
W	1895	3.4	27	12.0	31	7.2	30	17.0	31	10.0	31	13.1	5
W	1896	5.2	30	11.0	31	14.5	30	15.0	31	9.0	31	8.3	4
W	1897	2.8	22	8.0	31	8.3	30	4.0	31	4.0	31	8.0	8
W	1898			13.0	31	15.5	30	3.0	31	10.0	31	0.0	11
W	1899	2.8	22	11.0	31	10.3	30	13.0	31	10.5	21		
W	1900			8.1	19	13.4	30	16.0	31	6.0	31	0.0	5
W	1901			8.8	28	12.4	30	7.0	31	5.9	11		
W	1904			3.7	67	3.9	120	8.0	124	8.7	111	3.7	25
W	1908			0.0	30	2.4	114	6.5	124	4.8	124	2.9	65
W	1910			1.1	57	4.2	141	3.9	184	7.3	186	2.1	120
W	1911			1.9	16	5.2	30	5.0	31	9.0	31	1.5	21
W	1914					4.3	44	2.3	93	3.4	92	5.4	6
W	1915					0.0	8	5.3	111	4.7	113	4.1	15

Table 8. Fins per boat month east coast 14. May to 11. August. Catch intervals truncated to 20 days.

Year	FpBM1[#]	FpBM2[+]	Days	Fins	Blue+ Humpb	Other
1904	9.26	10.67	873	149	213	12
1905	7.23	8.22	1163	167	264	16
1906	5.53	5.80	972	126	132	8
1907	9.54	9.43	624	133	57	2
1908	7.51	7.22	1006	185	40	17
1909	9.77	9.28	1349	304	60	20
1910	4.98	4.84	1544	207	34	15
1911	6.45	6.17	908	152	14	12
1912	5.05	4.91	214	29	5	2
1913	4.83	4.70	343	43	12	12

[#] 1 day chasing - handling time subtracted per whale
[+] 0.75 days subtracted per whale and 0.75 extra per blue or humpback whale
[*] 1/3 of the fin catch from Greenland component

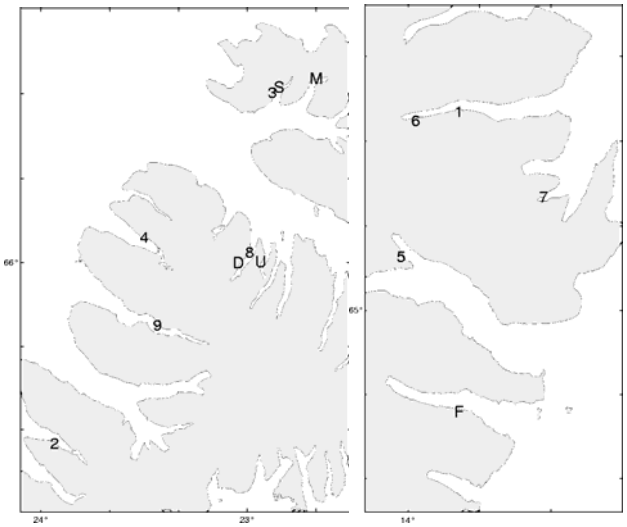


Fig. 1. Station IDs (see Table 1). a) Vestfjord b) East coast.

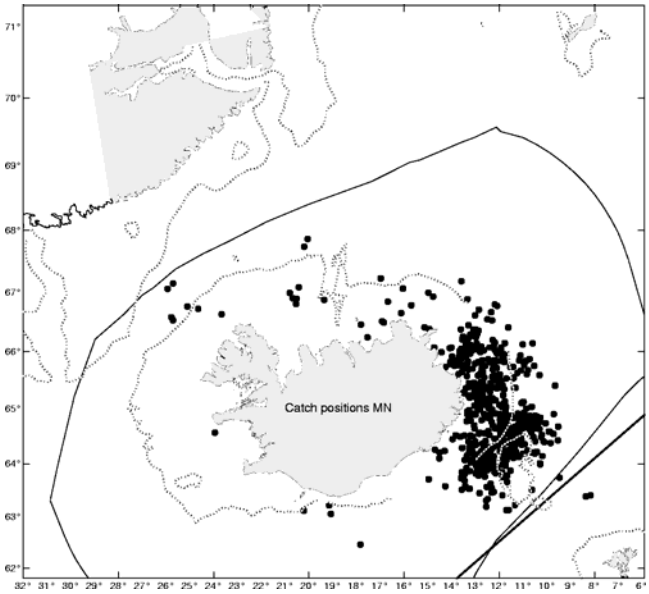


Fig. 2. All known humpback catch locations.

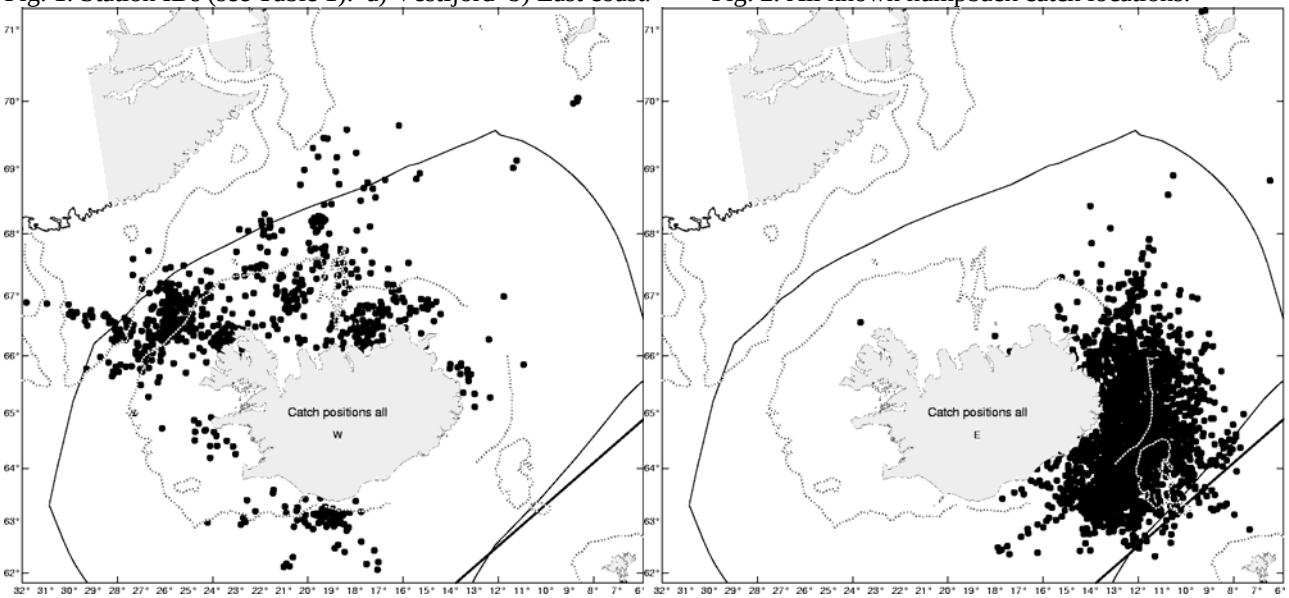
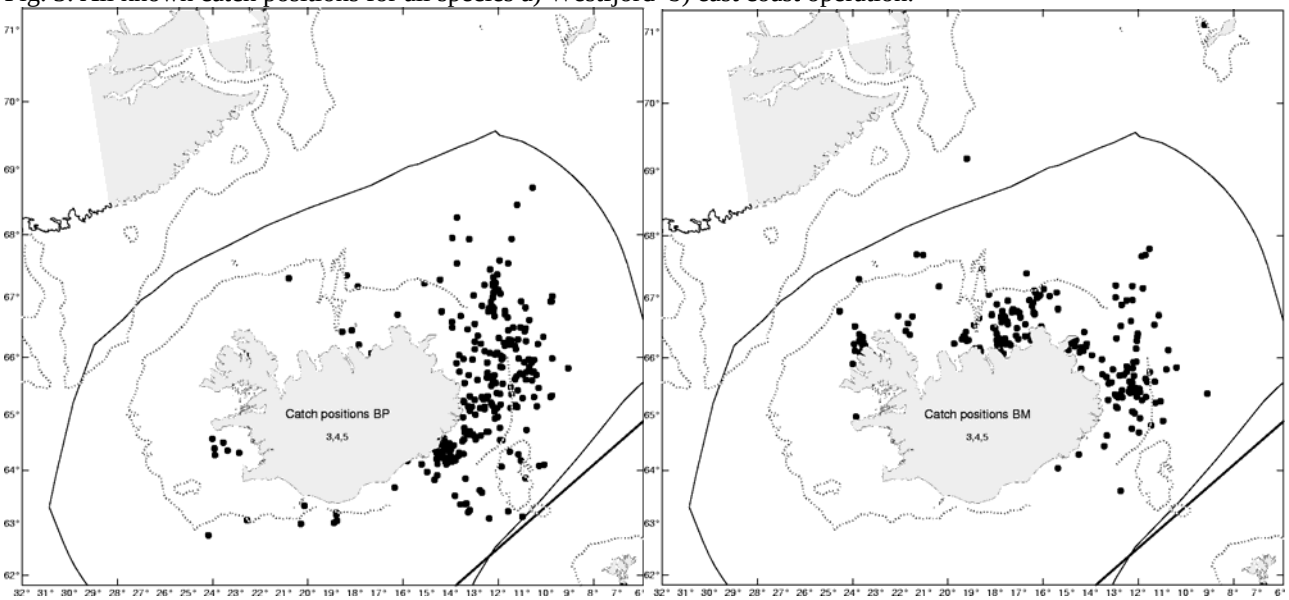


Fig. 3. All known catch positions for all species a) Westfjord b) east coast operation.



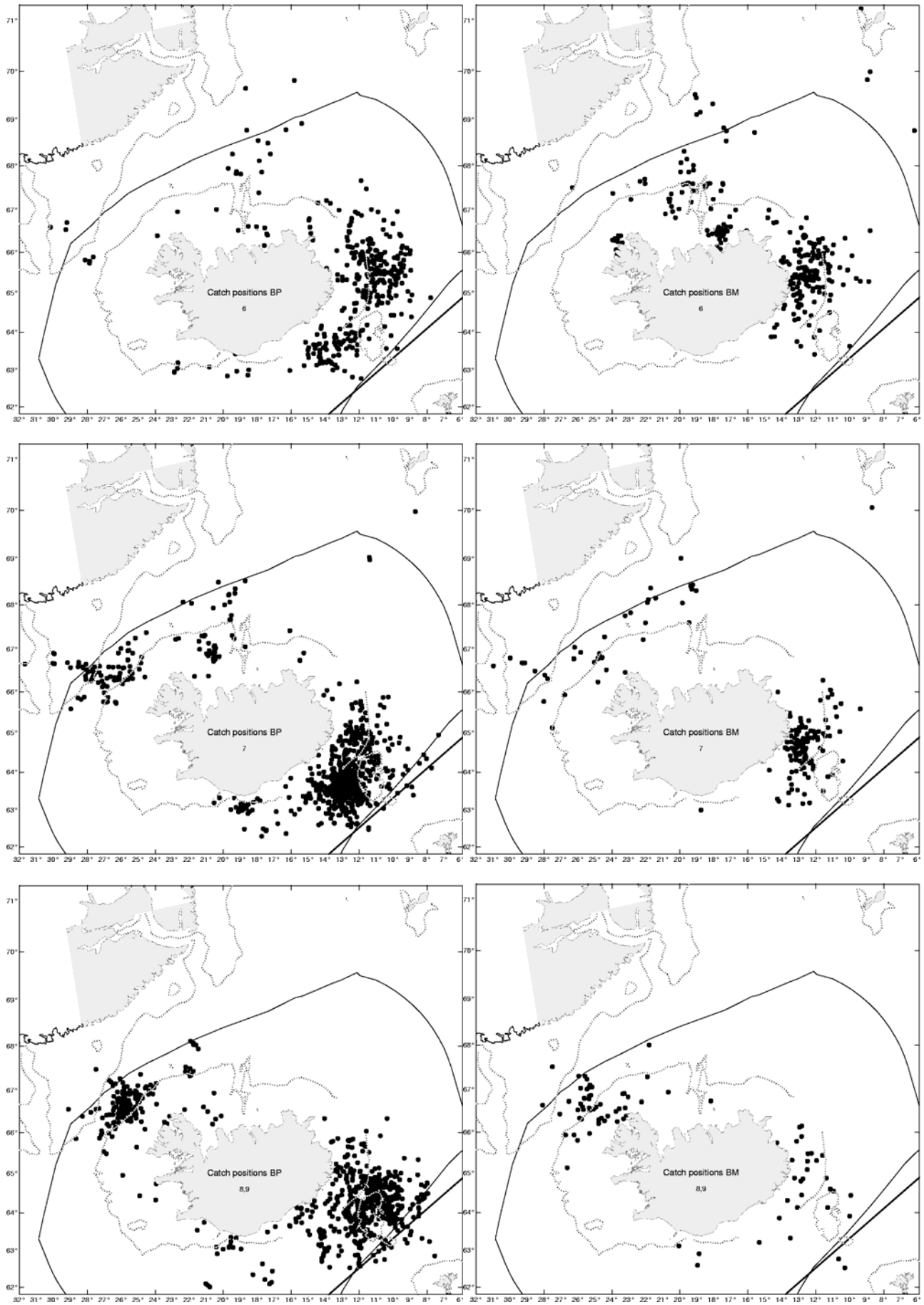


Fig 4. a-h) Catch positions fin and blue whales (left to right) by months (down pages, months 3-5, 6, 7 and 8-9).

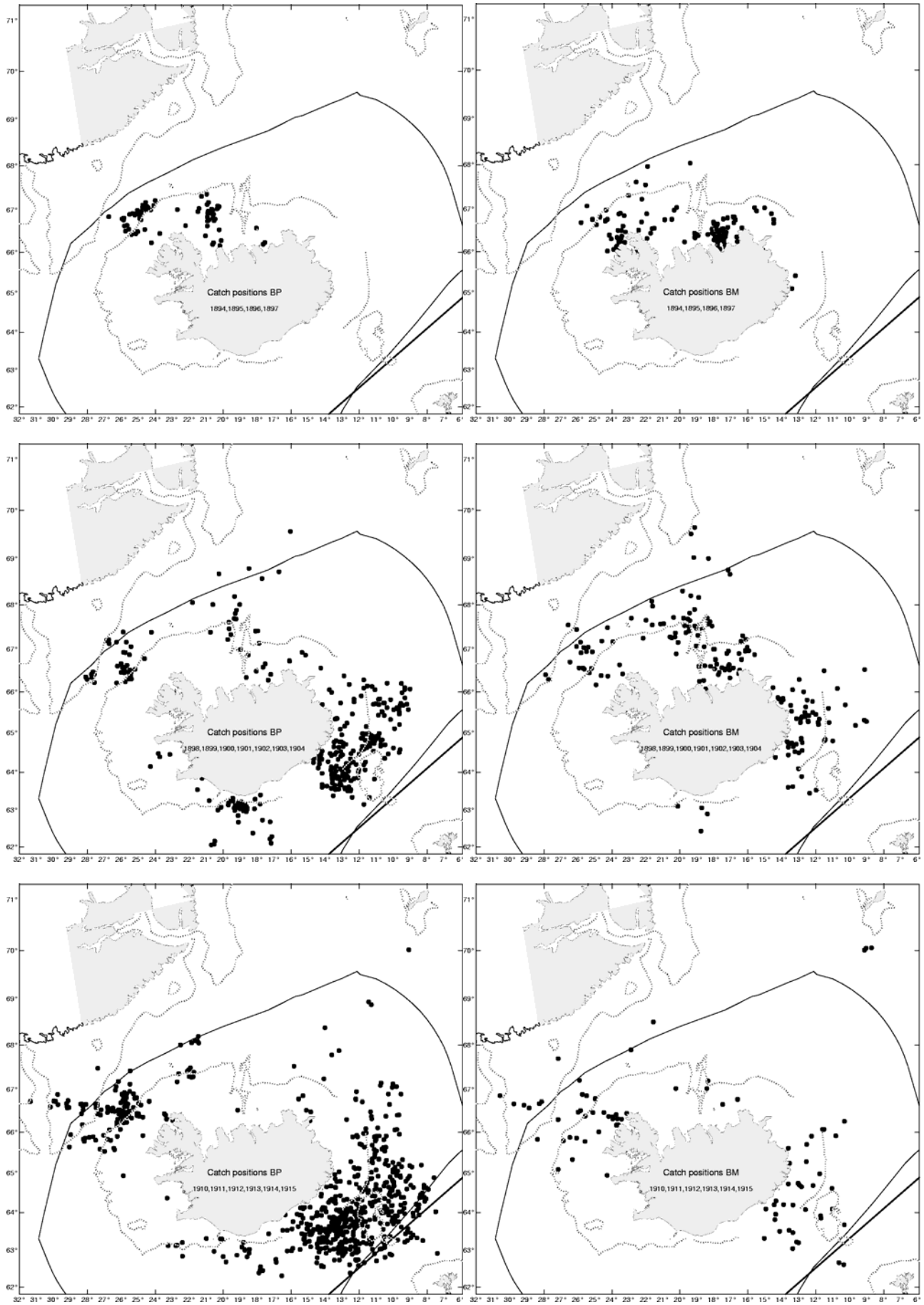


Fig 5. a-f) Catch positions fin and blue whales (left to right) by periods (down page, 1894-7, 1898-1904, 1910-15).