Distribution of North Pacific right whales (*Eubalaena japonica)* as shown by 19th and 20th century whaling catch and sighting records

Phillip J. Clapham*, Caroline Good+, Sara E. Quinn*, Randall R. Reeves#, James E. Scarff** and Robert L. Brownell, Jr.++

Contact e-mail: phillip.clapham@noaa.gov

ABSTRACT

North Pacific right whales (*Eubalaena japonica*) were extensively exploited in the 19th century, and their recovery was further retarded (severely so in the eastern population) by illegal Soviet catches in the 20th century, primarily in the 1960s. Monthly plots of right whale sightings and catches from both the 19th and 20th centuries are provided, using data summarised by Scarff (1991, from the whale charts of Matthew Fontaine Maury) and Brownell *et al.* (2001), respectively. Right whales had an extensive offshore distribution in the 19th century, and were common in areas (such as the Gulf of Alaska and Sea of Japan) where few or no right whales occur today. Seasonal movements of right whales are apparent in the data, although to some extent these reflect survey and whaling effort. That said, these seasonal movements indicate a general northward migration in spring from lower latitudes, and major concentrations above 40°N in summer. Sightings diminished and occurred further south in autumn, and few animals were recorded anywhere in winter. These north-south migratory movements support the hypothesis of two largely discrete populations of right whales in the eastern and western North Pacific. Overall, these analyses confirm that the size and range of the right whale population is now considerably diminished in the North Pacific relative to the situation during the peak period of whaling for this species in the 19th century. For management purposes, new surveys are urgently required to establish the present distribution of this species; existing data suggest that the Bering Sea, the Gulf of Alaska, the Okhotsk Sea, the Kuril Islands and the coast of Kamchatka are the areas with the greatest likelihood of finding right whales today.

KEYWORDS: NORTH PACIFIC RIGHT WHALE; NORTH PACIFIC; DISTRIBUTION; WHALING – HISTORICAL; WHALING – MODERN; WHALING – ILLEGAL; MIGRATION; CALVING

INTRODUCTION

North Pacific right whales (*Eubalaena japonica*) were intensively hunted from 1835 (Scarff, 1986; 2001). The species was depleted throughout its range by 1900, when it had ceased to be a principal target of commercial whaling (Scarff, 2001). Sporadic catches of right whales for commercial and scientific purposes were reported in the early 20th century, and it is now known that Soviet whalers illegally killed at least 508 right whales in the North Pacific from the 1950s to the early 1970s (Yablokov, 1994; Doroshenko, 2000). These catches have retarded the recovery of both the eastern and western North Pacific populations; in particular, the catches had a devastating impact on the former (Brownell *et al.*, 2001).

Brownell *et al.* (2001) reviewed all known 20th century sightings, strandings and catches of North Pacific right whales. Earlier, Scarff (1986; 1991) examined the distribution of 19th century right whale catches using the whale charts compiled by Matthew Fontaine Maury (1851; 1852 *et seq.*, 1853). To date, right whale locations contained in these two large datasets have not been plotted together. This paper provides monthly plots of North Pacific right whale sightings and catches in order to investigate seasonal movements, and to compare the distribution of this species in the 19th and 20th centuries.

METHODS AND MATERIALS

Data sources

Nineteenth century

Data on 19th century catches and sightings of right whales from whaling vessels were taken from Scarff's (1991, table 3) summary of Maury's whale charts (Maury, 1852). Few copies of the Maury whale charts are available in public libraries. A portion of one of these charts can be seen in Scarff (1986, fig. 2).

It is important to recognise, however, that the Maury data for the North Pacific have not been validated by direct examination of his primary sources (whaler logbooks). A recent study for the North Atlantic comparing data found in the logbooks with what was depicted on Maury's 1852 whale chart has revealed major discrepancies (Reeves, T.D. Smith and E. Josephson, pers. comm.).

A general description of Maury's whale charts can be found in Bannister and Mitchell (1980) and in Scarff (1991). The data in Maury's whale charts were shown in 5-degree squares. For each of the 12 calendar months, Maury's (1852 *et seq.*) whale chart displays the data as coloured histograms reflecting the number of days on which (a) whale ships were in the square; (b) right whales were seen; and (c) sperm whales were seen. Scarff (1991) shows numerically the following data: (a) and (b)/(a), the latter figure described as the percentage of days on which right whales were seen,

* *Large Whale Biology Program, Northeast Fisheries Science Center, 166 Water Street, Woods Hole, MA 02543, USA.*
+ *Office of Protected Resources, NOAA Fisheries, 135 East-West Highway, Silver Spring, MD 20910, USA.*
# *Okapi Wildlife Associates, 27 Chandler Lane, Hudson, Quebec J0P 1H0, Canada.*
** *1807 M.L. King Way #A, Berkeley, CA 94709, USA.*
++ *Southwest Fisheries Science Center, 1352 Lighthouse Avenue, Pacific Grove, CA 93950, USA.*

which represents a crude index of abundance adjusted for effort. Thus, the Maury charts provide a useful overview of where North Pacific right whales were —and were not — found in the first half of the 19th century.

Twentieth century

Records of 20th century right whale sightings and catches were taken from the comprehensive review by Brownell *et al.* (2001). This dataset includes sightings of 1,965 animals, as well as 741 catches, from 1900 to 2000; these are summarised in Table 1. Thirteen strandings of right whales (12 from the western and one from the eastern North Pacific) were ignored for the purpose of the present analysis.

Records of right whales from the plots of catch positions given by C.H. Townsend (1935) were not included. There is likely to be considerable overlap between the Maury and Townsend data, but the extent of this problem has yet to be systematically investigated.

Table 1

Total numbers of sightings, catches and strandings/entanglements of right whales recorded in the North Pacific between 1900 and 2000 (from Brownell *et al.*, 2001). For the purpose of that paper, the boundary between the western and eastern regions was set at the 180° line of longitude.

Region	Sightings	Catches	Strandings or entanglements	Total
Western North Pacific	988	330	12	1,330
Eastern North Pacific	693	411	1	1,105
Area not specified	284	-	-	284
Total	1965	741	13	2,719

Plots

Monthly plots of the right whale data were created using ArcView Geographic Information System software. The data from Scarff (1991) were plotted by 5-degree square as they appear in his table 3, but corrected for errors. Negative data (i.e. cases in which search effort was made by whalers but no right whales were seen) were also plotted. A few records of whales involving locations at latitudes above 60°N were presumed to be of bowhead whales (*Balaena mysticetus*) and were ignored. While Scarff (1991) considers the 50 days of sightings made in the period May to August between 60° and 65°N and 165° to 170°W to have been of right whales, a more conservative approach is taken in this analysis and these are excluded from the plots.

For the 20th century data from Brownell *et al.* (2001), each record was plotted with a precise position, if available. In cases in which locations were reported to within a 5 or 10-degree square, the midpoint of that square was used. In most cases, the exact number of right whales sighted or killed was available, but in some instances only a range was given; in these cases, the midpoint of the range was plotted. In some instances, location information was insufficient to allow a record to be plotted, and such records were therefore excluded.

The 20th century dataset already included all locations of right whales reported by Japanese sighting surveys. However, additional data on the effort involved in most of those surveys (those from 1964 to 1990) were taken from the maps provided by Miyashita *et al.* (1995) in order to show areas where search effort existed but no sightings of right whales were made.

RESULTS

Figs 1 to 12 show the reported locations of right whales for the months of January to December, respectively. Fig. 13 shows additional 20th century records for which information was available for location but not month of sighting. A general narrative summary of distribution by month (as well as of areas in which there was search effort but no right whale sightings) is given in Table 2.

DISCUSSION

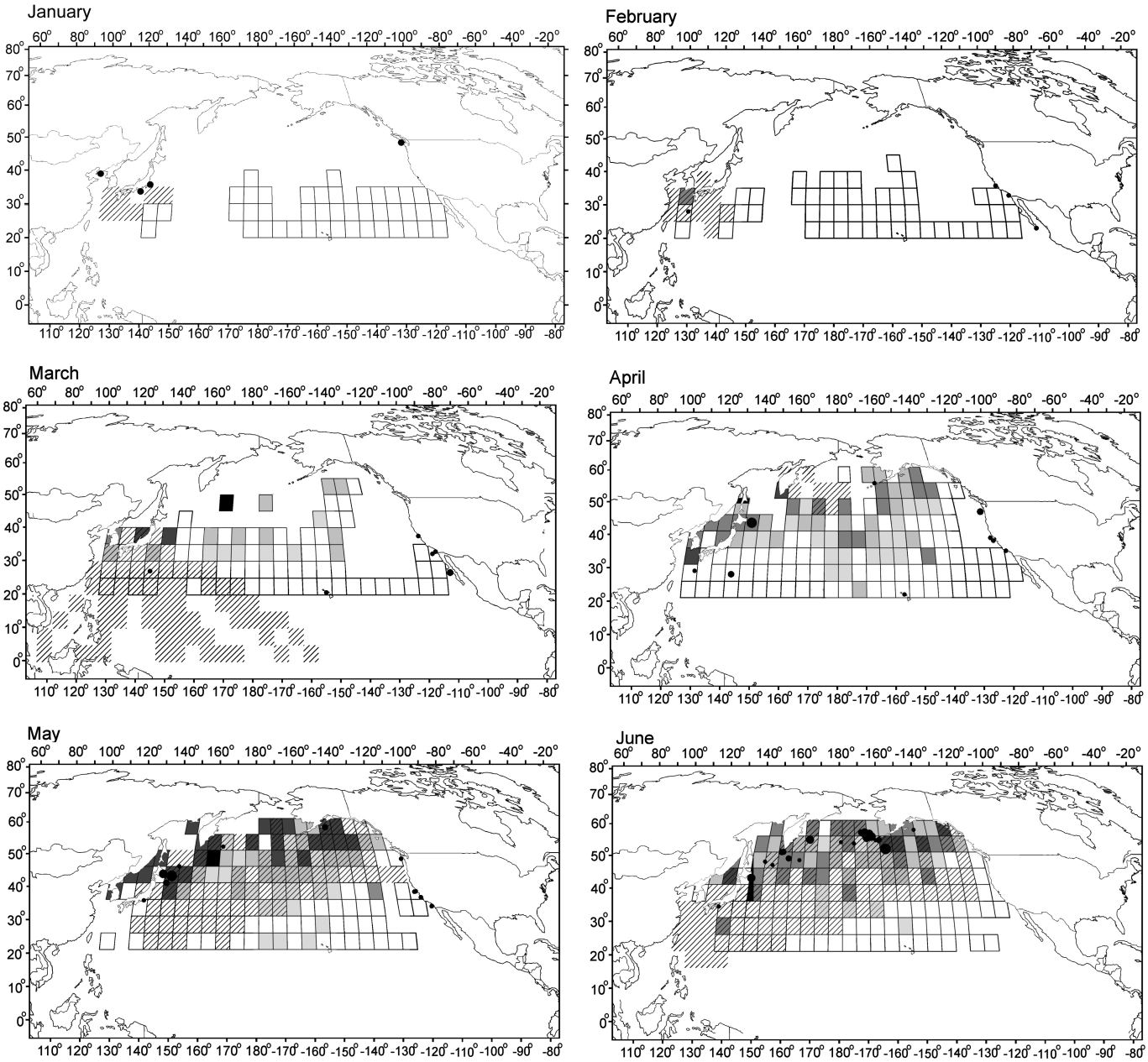
Overview

From the data presented here, several observations can be made. First, the historic distribution of right whales as shown by the Maury data was often different from that seen in the 20th century plots. For example, the historic data show that

Table 2

Summary of right whale distribution, by month, as shown in Figs 1 to 12. A distinction is made between data from Maury's charts (termed here 'historic', i.e. 19th century) and data from the 20th century (termed here 'modern').

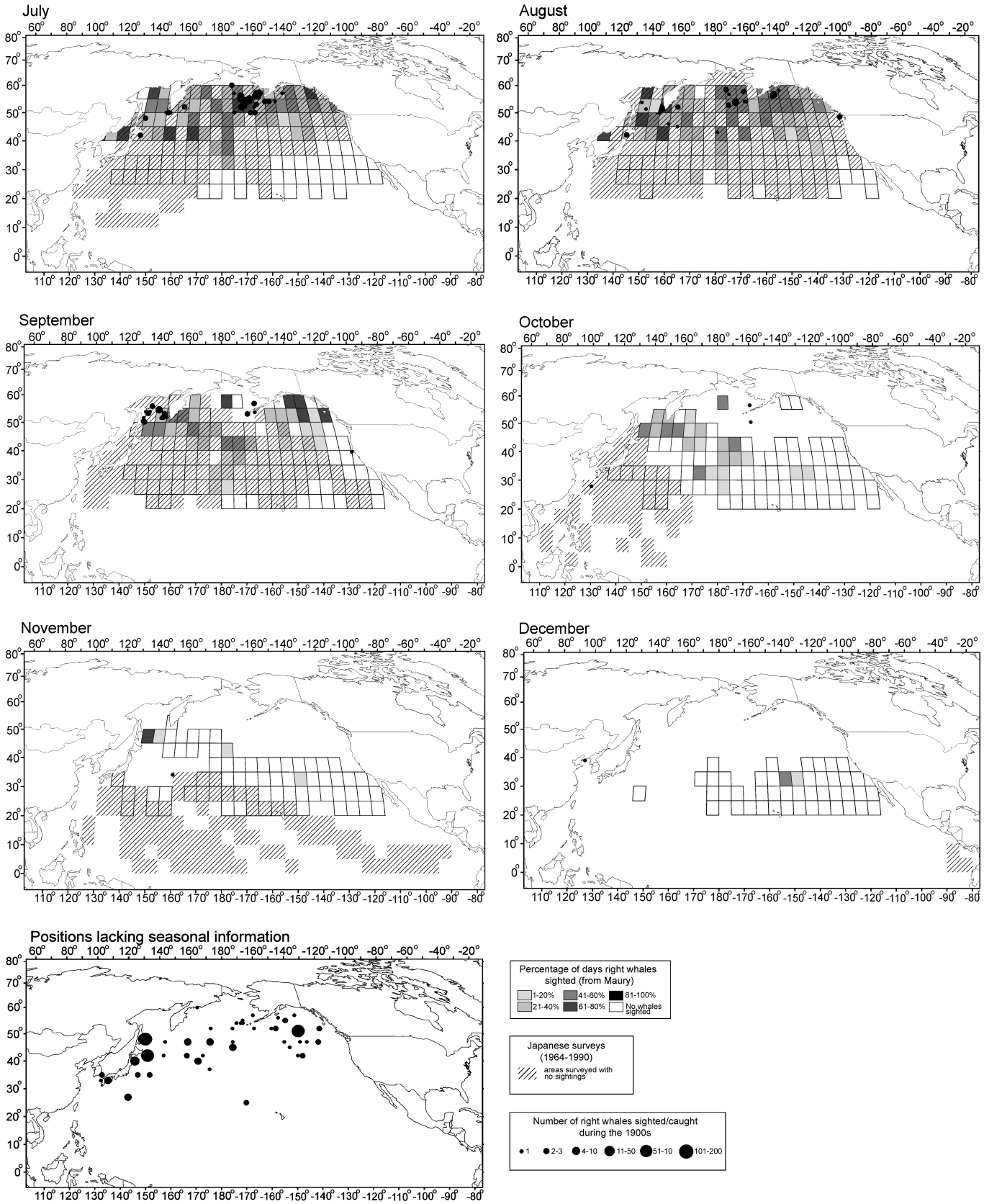
Month	Sightings	Search effort but no sightings
Jan	Very few sightings, all modern: Japan, Yellow Sea, British Columbia.	Broad band 20-35°N
Feb	Very few sightings, mostly modern: southern Japan, California, Baja.	Broad band 20-40°N
Mar	Many more sightings, mostly historic: Japan, Korea, offshore 30-40°N, Gulf of Alaska and south of Aleutians.	Broad band 20-30°N (and south of this)
Apr	Many sightings, mostly historic: Japan, Sea of Japan, northern Kurils, broad band 35°N to Aleutians and Gulf of Alaska, some SE Bering Sea; a few modern sightings off west coast of USA.	Broad band 20-35°N, central Aleutians
May	Many sightings, mostly historic: Sea of Japan, northern Kurils, Sakhalin Island; many sightings in broad band north of 40°N, many in eastern Bering Sea and Gulf of Alaska.	Broad band 20-35°N
Jun	Many sightings: historic records in Okhotsk Sea, but most in broad band north of 40°N and throughout Bering Sea and Gulf of Alaska; many modern sightings in SE Bering Sea.	Almost complete band 20-40°N
Jul	As June, plus more modern sightings in western Gulf of Alaska.	As June
Aug	As June.	As June
Sep	Many sightings: most modern records from Okhotsk Sea, with diminishing numbers in eastern Aleutians and SE Bering Sea; many historic sightings in Gulf of Alaska and in broad band from 40° to 60°N (but diminishing relative to summer).	Broad band 20-40°N
Oct	Sightings diminished further; significant historic numbers south of 40°N, also in NE Pacific and Okhotsk Sea; very few in eastern North Pacific, and very few modern sightings anywhere.	Much effort and no sightings 20-30°N, many zeroes 30-40°N
Nov	With one exception, the only sightings are a handful of historics: Okhotsk Sea and North Pacific far offshore in mid latitudes.	Broad band 0-40°N, also NE Pacific
Dec	Historic sightings in only two squares, 30-35°N/145-155°W; only one modern sighting.	Eastern North Pacific 20-35°N



Figs 1-12. Reported distribution of North Pacific right whales by month from January to December, respectively. Sources are 19th century whaling records (Scarff, 1991, from Maury, 1852), and 20th century sighting and whaling catch data (Brownell *et al.*, 2001). Note that because of the different nature of the source information, 19th and 20th century records are represented by different measures (percentage of search days on which right whales were recorded, and number of right whales recorded, respectively). All 20th century sightings are indicated by circles of varying size depending on number of whales seen (see key). Nineteenth century records were summarised by 5-degree square and plotted using different degrees of shading (see key). Outlined squares with no shading in them indicate squares for which there was known 19th century search effort but in which no right whale sightings were recorded. Hatching indicates squares that were surveyed by Japanese sighting surveys from 1964-1990, but where no right whale sightings were made (Miyashita *et al.*, 1995). Blank areas with no border or incomplete borders indicate no sightings and no search effort of any kind in either the Maury data or the Japanese sighting surveys. Fig. 13. Reported distribution of North Pacific right whales in the 20th century from records for which there was information on location but not the month of sighting. Data from Brownell *et al.* (2001).

virtually the entire Gulf of Alaska seems to have been used as a summering ground, together with adjacent waters off the coasts of British Columbia, the Alaska Peninsula and the southeastern Bering Sea. Similarly, right whales were once abundant in the Sea of Japan, an area from which they are largely absent today.

Overall, the geographic distribution of the species in the North Pacific was considerably greater in the 19th century than it appears to be in modern times (Scarff, 1991). This is not surprising since most of the species was removed by whaling. The remaining animals appear to constitute two relatively discrete remnant populations (Brownell *et al.*, 2001). The size of the western population, much of which is believed to summer in the Okhotsk Sea, is not clear. Data from Japanese minke whale sighting surveys in the Okhotsk Sea in 1989, 1990 and 1992 were used to calculate an estimate of abundance of 922 (CV = 0.433; IWC, 2001, p.22), although both positive and negative potential biases were identified in the survey methodology. Noting the wide confidence intervals associated with this survey, we do not believe that an abundance in the high hundreds is consistent with other sighting data on this population (see Brownell *et al.*, 2001), and suggest that the western population's size is likely to be smaller than this.



Figs 1-13. *Continued.*

Following catches of 372 right whales by Soviet pelagic whaling operations (primarily in the 1960s; Doroshenko, 2000), the eastern North Pacific population is believed to contain fewer (perhaps far fewer) whales than the western population (LeDuc *et al.*, 2001). Recent surveys, photo-identification and genetic studies suggest that this population may number in the tens of animals.

During much of the year, the historic distribution had a large offshore component in deep water far from the coast. By contrast, most of the 20th century sightings were relatively close to land, notably off the Aleutian Islands and in the Bering and Okhotsk Seas. Given the extensive coverage of Japanese sighting surveys, this recent absence of right whales in deep water cannot be wholly attributed to

lack of effort (see for example May, Fig. 5). Scarff (1991) noted this offshore component of the Maury data and suggested that North Pacific right whales may have wintered and calved far offshore, rather than in the coastal habitats which many North Atlantic right whales (*E. glacialis*) and southern right whales (*E. australis*) are known to inhabit during winter (Kraus *et al.*, 1986; Best, 1990; Payne *et al.*, 1990). This is discussed further below.

Seasonal distribution

Overall movements

Seasonal movements of right whales are apparent in the data presented here. To some extent these may reflect survey and whaling effort rather than real migratory movement, and the apparent movements summarised here must be considered with that caveat in mind.

There were very few sightings of right whales anywhere in January and February despite a certain amount of historical effort, notably in offshore areas (Figs 1 and 2). There are also few recent sightings of right whales in coastal waters at this time, despite considerable whalewatching effort in some locations (e.g. California and Baja California). In March, most whale sightings appeared in the Maury data in a latitudinal band between 30 and 40°N, reflecting that in March over 90% of the whaling effort occurred south of 40°N. Other (though fewer) sightings occur further to the north; in the Maury data, the area north of 45°N had consistently high encounter rates even at this time of year, albeit with small sample sizes.

By April, right whales were widely distributed from 35°N and had penetrated the Bering Sea; by May and June there were large numbers of sightings in both the Bering Sea and the Gulf of Alaska. This pattern continued in July and August, primarily north of 40°N, in both the Maury and the 20th century datasets. In September, the beginnings of a southward movement were evident; current data suggest that the last right whales leave the southeastern Bering Sea in October. By October, right whales were primarily seen in mid latitudes (30-50°N), and they largely disappear from the records in November and December.

The movements that can be inferred from the combined Maury and 20th century data are similar to those evident in the seasonal distribution of North Pacific right whales shown by Townsend (1935). Townsend's maps show right whales abundant in the Gulf of Alaska and adjacent areas (the Northwest Ground) between May and August, with smaller numbers in April and September (presumably reflecting whales moving into and out of the area). Right whales were also abundant both south and north of the Aleutians in May and June, as well as in the Bering Sea in summer and early autumn. Townsend's maps show concentrations of whales from the eastern coast of Kamchatka to the offshore waters of the northwestern North Pacific from May to September, with additional concentrations in the Okhotsk Sea in spring and summer. Numerous records in the Sea of Japan in spring, but far fewer in February and March, probably reflect a northward migration towards the Sea of Okhotsk and Kuril Islands; scattered catch positions in February in the Taiwan Strait and the entrance to the Yellow Sea are indicative of a northward migration from unknown wintering grounds (see below). With the exception of a few records at the entrance to the Yellow Sea in October, there is no indication in the Townsend data of a parallel southward migration.

Overall, the north-south migratory movements evident in all three datasets (Maury, Townsend and Brownell *et al.*) provide support for the idea that two largely discrete populations of right whales exist in the eastern and western North Pacific.

Additional details of the apparent patterns of seasonal movement are given below.

Eastern North Pacific

Right whales were rarely caught in the coastal whaling fisheries along the western coast of North America (Scarff, 1986) and so there is less information on the seasonal movements of this species than in the western regions of the North Pacific Ocean. As noted above, the plots (notably those from Maury's data) show a general movement northward in spring and south again in autumn. Major concentrations of summering whales occurred in the Gulf of Alaska and eastern Bering Sea, and numerous animals were also recorded in offshore waters for much of the year. The historical importance of these offshore areas may never be known, and the persistence of the species there today is questionable given the great reduction in the size of the population.

Western North Pacific

Omura (1986) postulated that there were two distinct populations of right whales in the western North Pacific: the 'Sea of Japan' and 'Pacific' stocks (taken here to mean 'sub-populations'). Historical catch data from Japanese coastal whaling villages indicate that both populations moved south in autumn and north again in the spring, with the peak months being September to December and February to April, respectively. The two putative populations were kept apart during migration by the Japanese islands, with the Sea of Japan stock moving along the western coasts, and the Pacific stock travelling off the eastern coasts of the archipelago. Omura (1986) suggested that the Pacific population summered in the Kuril Islands, with some animals moving further northeast and entering the Bering Sea. In contrast, he suggested that the feeding grounds for the Sea of Japan population lay primarily in the Okhotsk Sea, although he recognised that there was little direct evidence to support this belief.

As expected, the data presented here support the idea of a southward movement in the autumn and a return migration north in spring. Many whales moved into the Okhotsk Sea during early summer, an event that presumably coincided with the breakup of ice cover in the area. The Maury data show significant numbers of right whales entering the western Bering Sea by June, and remaining there until September or October, when a general southward movement is again evident in the sightings. However, it is important to reiterate that during the entire period of spring to autumn, right whales were also consistently dispersed in offshore waters across a broad region of the North Pacific. This prominent aspect of the right whale's distribution in the 19th century is largely absent in the modern records, further emphasising the considerable diminution of the species' range.

Whether there were (or are) two distinct sub-populations of right whale in the western North Pacific remains unclear. Catches of right whales by Japanese net whalers at Kawajiri (a whaling village in Yamaguchi Prefecture on the Sea of Japan) dropped sharply after 1859, a situation which Omura (1986) attributes to 'the operation of American whale ships'. This may be a rather simplistic interpretation; presumably the demise of the right whale in the Sea of Japan was due to a combination of Yankee and coastal whaling, with 20th century recovery inhibited to an unknown extent by illegal Soviet catches on the feeding grounds in the Okhotsk Sea.

Wintering/calving grounds

Where North Pacific right whales go in mid-winter, and where they calve (presumably at this time of year), remains unknown. For the putative Pacific and Sea of Japan populations in the western North Pacific, Omura (1986) suggested that the calving grounds probably lay to the south of Japan; specifically, he proposed that right whales calved around or near the Ryukyu Islands (with the implication being that the two populations may have mixed there). There is no reliable evidence with respect to the location of coastal or insular wintering grounds in the eastern North Pacific. Scarff (1986) speculated that right whales from the Gulf of Alaska might migrate to calve 'near the coast of Kamchatka or further south'. We do not believe that any of the Kamchatka coast could have been a calving ground; rather, this area appears to represent a summer feeding habitat, with sightings made in summer or early autumn.

Indeed, there are few data with which to further examine this question. In the western North Pacific, the southernmost sightings from Townsend (1935) are off Taiwan (7 records) and at around 30°N off the Chinese coast (20 records); all are from February or March. A few recent sightings have also been reported from Chichi-jima (Bonin Islands, at 27°N) in March and April (Brownell *et al*., 2001). In the eastern North Pacific, the situation is even more obscure. There, the data from winter are confined to a handful of 20th century sightings from the western coast of North America, and some sporadic offshore records in the Maury data. As noted by Scarff (1986; 1991), there is no evidence from either historical whaling records or archaeological investigations of aboriginal hunting peoples that the coastal waters of western North America ever contained a calving ground for this species.

Our interpretation of the plots in this regard is that serious consideration should be given to Scarff's (1986; 1991) contention that North Pacific right whales wintered and calved primarily in offshore, not coastal, waters. Indeed, the record is conspicuously marked by a paucity of right whale sightings from *any* nearshore area in winter, despite the considerable likelihood of search effort from 19th century (and earlier) coastal whaling communities in both Japan and North America. In contrast, the apparent historical abundance of right whales in offshore waters (in both Maury and Townsend's data) is too obvious to ignore. In light of this, Scarff (1986, p.57) concludes:

> The recent concentrations of scientific investigations on nearshore populations of right whales off South America, South Africa, eastern North America and Australia may have led to an exaggerated view of the species' coastal tendencies.

We agree that the offshore distribution of right whales has been little studied. We suggest that researchers consider the use of satellite telemetry to locate the many whales that go 'missing' in winter, a question which exists even for the well-studied North Atlantic right whale.

Future work

The analyses presented here provide some direction regarding future work on this species. In light of the small size and highly endangered status of both the eastern and western populations, establishing the present distribution of right whales, and assessment of anthropogenic threats in the habitats where they currently exist, should be a top priority for management. Existing data suggest that the Bering Sea, Okhotsk Sea, the Kuril Islands and the coast of Kamchatka are the areas with the greatest likelihood of finding right whales today. New surveys (including both photo-identification and biopsy components) of these and other regions of the North Pacific should be funded and conducted in the near future.

ACKNOWLEDGMENTS

We are grateful to Richard Merrick and Fred Serchuk for their reviews of this paper.

REFERENCES

Bannister, J.L. and Mitchell, E. 1980. North Pacific sperm whale stock identity: distributional evidence from Maury and Townsend charts. *Rep. int. Whal. Commn* (special issue) 2:219-30.

Best, P.B. 1990. Trends in the inshore right whale population off South Africa, 1969-1987. *Mar. Mammal Sci.* 6(2):93-108.

Brownell, R.L., Clapham, P.J., Miyashita, T. and Kasuya, T. 2001. Conservation status of North Pacific right whales. *J. Cetacean Res. Manage.* (special issue) 2:269-86.

Doroshenko, N.V. 2000. Soviet whaling for blue, gray, bowhead and right whales in the North Pacific Ocean, 1961-1979. pp. 96-103. *In:* A.V. Yablokov and V.A. Zemsky (eds.) *Soviet Whaling Data (1949-1979).* Center for Russian Environmental Policy, Moscow. 408pp.

International Whaling Commission. 2001. Report of the Workshop on the Comprehensive Assessment of Right Whales: A worldwide comparison. *J. Cetacean Res. Manage.* (special issue) 2:1-60.

Kraus, S.D., Prescott, J.H., Knowlton, A.R. and Stone, G.S. 1986. Migration and calving of right whales (*Eubalaena glacialis*) in the western North Atlantic. *Rep. int. Whal. Commn* (special issue) 10:139-44.

LeDuc, R.G., Perryman, W.L., Gilpatrick, J.W.J., Hyde, J., Stinchcomb, C., Carretta, J.V. and Brownell, R.L., Jr. 2001. A note on recent surveys for right whales in the southeastern Bering Sea. *J. Cetacean Res. Manage.* (special issue) 2:287-9.

Maury, M.F. 1851. Whale Chart (Preliminary Sketch). *Series F*. National Observatory, Washington DC.

Maury, M.F. 1852 *et seq. Whale Chart of the World*. Series F (Wind and Current Charts) Sheet 1 (Washington, 1852), sheets 2-4 (no date).

Maury, M.F. 1853. A chart showing the favourite resort of the sperm and right whale by M.F. Maury, LLD Lieut. US Navy. Constructed from Maury's Whale Chart of the World, by Robert H. Wyman, Lieut. USN by Authority of Commo: Charles Morris USN Chief of Bureau of Ordnance and Hydrography, Washington. 1 sheet.

Miyashita, T., Kato, H. and Kasuya, T. (eds.). 1995. *Worldwide Map of Cetacean Distribution Based on Japanese Sighting Data*. National Research Institute of Far Seas Fisheries, Shimizu, Japan. 140pp.

Omura, H. 1986. History of right whale catches in the waters around Japan. *Rep. int. Whal. Commn* (special issue) 10:35-41.

Payne, R., Rowntree, V., Perkins, J.S., Cooke, J.G. and Lankester, K. 1990. Population size, trends and reproductive parameters of right whales (*Eubalaena australis*) off Peninsula Valdes, Argentina. *Rep. int. Whal. Commn* (special issue) 12:271-8.

Scarff, J.E. 1986. Historic and present distribution of the right whale (*Eubalaena glacialis*) in the eastern North Pacific south of 50°N and east of 180°W. *Rep. int. Whal. Commn* (special issue) 10:43-63.

Scarff, J.E. 1991. Historic distribution and abundance of the right whale (*Eubalaena glacialis*) in the North Pacific, Bering Sea, Sea of Okhotsk and Sea of Japan from the Maury Whale Charts. *Rep. int. Whal. Commn* 41:467-89.

Scarff, J.E. 2001. Preliminary estimates of whaling-induced mortality in the 19th century North Pacific right whale (*Eubalaena japonicus*) fishery, adjusting for struck-but-lost whales and non-American whaling. *J. Cetacean Res. Manage.* (special issue) 2:261-8.

Townsend, C.H. 1935. The distribution of certain whales as shown by logbook records of American whaleships. *Zoologica (NY)* 19(1-2):1-50+6 maps.

Yablokov, A.V. 1994. Validity of Soviet whaling data. *Nature, Lond.* 367(6459):108.