

An outline, with a progress report, of the photo-identification experiments on southern baleen whales conducted during the Japanese Whale Research Programme Under Special Permit in the Antarctic

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**ABSTRACT**

In this note we summarise the activities related with the experiments of photo-identification on southern baleen whales being conducted by the Institute of Cetacean Research (ICR) in co-operation with the Western Australian Museum. The ICR has been involved in the taking of photographs on natural markings in three species- the humpback, the right and the blue whales- in Antarctic Areas IV and V. Pictures have been obtained during the cruises of the Japanese Whale Research Programme Under Special Permit in the Antarctic (JARPA). We pointed out the objectives of the photo-ID study, described the methodology used, and summarise the number of individuals and pictures obtained up to the date. Visual analysis of pictures taken on the humpback whale within and between survey seasons, in a same management area has been carried out, however, no matching of the same individual has been achieved. An outline of the future research plan on photo-ID is given.

**INTRODUCTION**

The JARPA began with two feasibility studies conducted in 1987/88 and 1988/89 in management Areas IV and V, respectively (Kato *et al.*, 1989, 1990). Since the austral summer season of 1989/90, Japan has been conducting annually full-scale research surveys in these areas. Up to the date three of them have been conducted in Area IV, in 1989/90 and 1991/92 (Fujise *et al.*, 1990, 1993a), and in 1993/94 (Nishiwaki *et al.*, 1994). Two research surveys have been conducted in Area V, in 1990/91 and 1992/93 (Kasamatsu *et al.*, 1993; Fujise *et al.*, 1993b).

The JARPA in Areas IV and V has a main lethal research component that involves the random catch of minke whales distributed in these areas and the systematic attainment of biological sam-

ples of the individuals caught. The main research objectives of this research component are outlined in Government of Japan (1987). The JARPA has also and a non-lethal research component, with secondary research objectives, which includes the systematic sighting surveys for abundance estimation of cetacean species, the taking of pictures of natural markings for individual identification (photo-ID) and of biopsy samples for genetic and pollution studies in some species of baleen whales, biotelemetry for studies of migration and stock identity and the attainment of oceanographic data for studies of whale distribution.

In this note we describe the objectives of the photo-ID study being conducted by the Institute of Cetacean Research (ICR) in co-operation with the Western Australian Museum, and summarize the data related with this subject obtained up to the date. It should be emphasized that the purpose of this note is informative.

#### OBJECTIVES OF THE PHOTO-ID STUDY

The main objectives of the photo-ID study are the following:

- a) To study the "fidelity" of animals to certain areas of the feeding grounds by comparing photographs of natural markings obtained at more than one feeding season within management Areas IV and V.
- b) To study the short term movement pattern within the feeding grounds of Areas IV and V by comparing pictures of natural markings obtained within a particular feeding season.
- c) To study the patterns of migration between the feeding grounds of Areas IV and V and waters of lower latitudes.

Analysis of pictures related to objectives a) and b) are being conducted at the ICR while those related with objective c) are being conducted at this institute in co-operation with the Western Australian Museum.

Identification of biological stocks, their pattern of movement and mixing can be investigated, if the photo-ID information is analyzed in combination with genetic data. For this reason the JARPA also include the collection of biopsy samples from Areas IV and V from the same species being targeted for natural markings, from which both nuclear and mitochondrial DNA can be extracted and analyzed. It should be indicated here that 20 biopsy samples from the humpback whale and 5 from the right whale were obtained during the 1993/94 JARPA cruise in Area IV (Nishiwaki *et al.*, 1994).

#### TARGET SPECIES FOR NATURAL MARKINGS

The humpback (*Megaptera novaeangliae*), right (*Eubalaena australis*) and the blue whale (*Balaenoptera musculus*) are the target species in our photo-ID study. These species were selected given

their priority character in the comprehensive assessment of southern baleen whales by the Scientific Committee of the IWC, and because the use of photographic technique to identify individuals from the natural markings has been well established in these species, specially in the humpback and right whales.

After the summer feeding season in the Antarctic Area IV, humpback whales are believe to migrate along the coast of Western Australia to wintering grounds off the northwest coast of Australia. Whales in the feeding ground of Area V migrate to wintering areas along two major corridors one of which is along the coast of eastern Australia (Baker, et al., 1993). The same authors found significant differences in mtDNA haplotype frequencies between whales from the eastern and western Australia. Kaufman et al. (1990) show photographic evidences of the migratory movement of a humpback whale between eastern Australia and Antarctic Area V. Although pictures of natural markings of this species are being obtained for several research organizations along the eastern and western coast of Australia, there is scarce photographic material from the Antarctic Areas IV and V.

Most of the pictures of natural markings of the right whale in the Southern Hemisphere have been obtained from coastal areas, and there is scarce data from off-shore areas. Most of the pictures in offshore areas have been obtained during the annual IWC/IDCR cruises in the Southern Hemisphere. Ohsumi and Kasamatsu (1986) published pictures of natural markings on the right whales in Areas I and II derived from that source. This could be the first case of natural marking of southern right whales in off-shore waters.

To our knowledge, there is not studies on photo-ID on the southern blue whales. These studies have been concentrated in the Northern Hemisphere.

#### METHODOLOGY USED

Photographs of natural markings of the species mentioned above are obtained by researchers on-board of the sampling/sighting vessels operating in the JARPA surveys. Because the time restrain, only some of the schools sighted are approached for photographic experiment. Thus, the overall time given to this experiment vary from year to year.

Schools of humpback, right or blue whale sighted on the designed track, are approached in normal closing mode. The time given to the photographic experiment in each case is determined by the researcher in consultation with the captain.

Ancillary data of each school photographed are recorded in data form designed for this purpose (see Appendix I). Although photographic experiment for natural markings began in the season 1989/90, the data form shown in Appendix I began to be used from the season 1990/91. Personal field notes are also used to complement the information recorded in the data form.

In each vessel a 35mm auto-focus camera equipped with motor drive is available. Two camera models are used: Minolta 7Xi and Minolta 7700i both equipped with 100-300mm lens. Until the season of 1991/92 only color slides were used for the three species. Following the recommendation derived from the Workshop on Individual Recognition and the Estimation of Cetacean Population Parameters (IWC, 1990), from the 1992/93 summer season black and white films are being used for humpback and blue whales (Ilford HP5 push-processed to 400 ASA) and color slide for right whale (Ektachrome 200).

A catalog containing the picture (s) of each identified whale has been constructed at the ICR. Also a list containing information on each picture of the catalog is available on a data-base.

The catalog contains 122 pictures of 52 humpback whales identified, 63 pictures of 13 right whales identified and 33 pictures of 9 blue whales identified.

Slides and black and white prints (18\*13cm) are analyzed at the laboratory visually. Slides are examined with the help of a photo video camera Sony model PHV-A7.

#### **NATURAL MARKINGS USED FOR INDIVIDUAL IDENTIFICATION**

##### **Humpback whale**

Two main natural markings are targeted in this species, markings in the ventral surface of the tail flukes and lateral body markings (lateral pigmentation). The former has been appointed as the best character in where there is enough variation in natural markings that can be used for individual identification. Carlson *et al.* (1990), however, showed evidences of changes in the ventral fluke pattern on the time. On the other hand, the chance of riding of tail flukes out of sea surface is seldom in the Antarctic. For these reasons, we try to obtain pictures of more than one natural marking from the same individual.

Lateral pigmentation, specially those around the dorsal fin also are targeted. Kaufman *et al.* (1987) discussed the use of body lateral pigmentation patterns for photographic identification of East Australian humpback whales. They suggested that this character is useful in studies of individual identification.

Lillie (1915) illustrated the types of body color pattern found in the Southern Hemisphere humpback whale. According to this author there are four types depending of the extension and shape of the black dorsal pigmentation and the pigmentation of the flippers. We also try to record in pictures the overall color pattern of the body and the color pattern of flippers.

Other characters such as the shape and color pattern of the dorsal fin and body scars are targeted when it is possible.

### **Right whale**

The natural marking targeted in this species are the callosities patterns of the head. Key characters are the presence/absence and extend of the lip patches and the presence and pattern of rostral islands. Other callosities such as bonnet, post blowhole island, lower lip and coaming are always present so that these characters are not useful for individual identification. Payne et al. (1983) and Bannister (1990) have demonstrated the persistence of callosities pattern over time, and then the validity of this character in studies of individual recognition in this species.

In addition to the head callosities patterns, other natural markings such as white dorsal blazes, partial albinism and grey dorsal blazes are used for identifying individual over time (Best, 1985). These natural markings are also targeted in our investigation.

### **Blue whale**

According to our knowledge, there is no previous research on natural markings in the Southern Hemisphere blue whale. Such kind of studies have been concentrated in the Northern Hemisphere blue whale (Sears et al., 1990; Calambokidis et al., 1990).

The mottled pigmentation patterns characteristic of the species is unique to each individual. Sears et al. (1990) classified the pigmentation pattern of the body in different categories. In our research the pattern of this mottled pigmentation of the body is targeted.

Other natural markings such as the shape of the dorsal fin and occurrence of scars are also targeted and used as secondary characters for this species.

## **PREVIOUS RESULTS**

Tables 1, 2 and 3 summarise the number of individuals humpback, right and blue whales photographed for photo-ID, by natural markings and seasons in which the photographs were obtained. The time available for photographic experiment vary from year to year, thus a comparison among years of the number of pictures taken is not possible from these tables.

With regard the humpback whale (Table 1), the total number of individuals identified is 52 (122 pictures in total). The pattern of pigmentation of ventral flukes is rarely recorded. The most common natural marking recorded in this species is the lateral pigmentation (in total 39 cases, some of them in combination with other natural markings). It should be mentioned here that the lateral pigmentation has been used successfully as natural marking in a study of pattern of migration of this species in Area V (Kaufman et al., 1990).

Fig. 1 shows the geographical distribution of humpback whales individuals photographed in Areas IV and V for natural markings in four seasons, two in Area IV and two in Area V. In Area IV

there is not a marked difference in distribution between surveys. Whales are distributed mainly in the western sector between 80°E and 105°E. The latitudinal range is from 55°S and 65°S. In Area V the humpback whales photographed for natural markings in 1990/91 are distributed between 165°E and 175°E and those photographed in 1992/93 are distributed between 130°E and 170°E. The latitudinal range is further south than the whales marked in Area IV. Up to the date no matching of the same individual has been reached within and between two survey seasons in a same area.

The number of individuals photographed for natural markings in the right whale is 13 (Table 2) (63 pictures in total), a lower figure than in the humpback whale. The natural markings more frequently recorded are the callosities pattern of the head (12 cases, one of them in combination with dorsal white blaze). One individual was identified by its dorsal white blaze only.

Fig. 2 shows the distribution of right whales identified by their natural markings in Areas IV and V in two survey seasons, one in Area IV and one in Area V. According to this figure, in Area IV the whales are distributed between 90°E and 110°E and between 60°S and 65°S. One individual was photographed for natural markings at 41°46'S. Three individuals marked in Area V are distributed in the western sector on the 60°S latitude.

Only nine individuals of the blue whale have been identified for their natural markings (Table 3) (33 pictures in total). All of them were photographed in Area V in the 1992/93 survey season. Most of the natural markings have been the pattern of the mottled pigmentation of the body (seven cases, five of them in combination with the shape of the dorsal fin). In one case the individual was identified by a mutilation of the dorsal fin.

Fig. 3 shows the distribution of blue whales photographed for natural markings in Area V in one survey season. According to this figure the whales are distributed between 130°E and 180° and between 64°S and 70°S.

As it was pointed out above, pictures obtained within Antarctic Areas IV and V have been analysed visually in order to attain objectives a) and b) but, no matching of the same individual neither within a season nor between seasons has been obtained up to the date.

#### FUTURE RESEARCH PLAN

We will continue the systematic taking of pictures of natural markings of the three baleen whale species mentioned above, as part of the non-lethal component of the JARPA. All the pictures obtained each year will be examined and those considered to be useful for individual identification will be added into our catalog.

Analysis of the pictures will be conducted in co-operation with the Western Australian Museum. With this purpose, copy of each

picture considered useful for photo-ID studies, will be sent to this institution as it has been the procedure until now. Furthermore ancillary information on each whale photographed for natural markings in the Antarctic Areas IV and V will continue being sent to the Secretariat of the IWC.

Further analysis of the pictures for possible matching of individuals will be carried out visually and, if possible, a computerized system for analysis of photographs will be incorporated into the analysis.

#### ACKNOWLEDGMENTS

We wish to thank Dr. S. Ohsumi, The Institute of Cetacean Research for useful comments and suggestions.

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**Table 1:** Number of individuals humpback whales photographed in the photo-ID experiments, by season and natural marking.

Season	Natural markings						Total
	A	B	C	D	E	F	
89/90	5	1	4			1	11
90/91		1	1	2	1		5
91/92	4		10				14
92/93	2	1	15	4			22
<b>Total</b>	<b>11</b>	<b>3</b>	<b>30</b>	<b>6</b>	<b>1</b>	<b>1</b>	<b>52</b>

A = Shape of the dorsal fin  
 B = Lateral pigmentation  
 C = Lateral pigmentation + shape of the dorsal fin  
 D = Lateral pigmentation + pattern of pigmentation of ventral flukes  
 E = Pattern of pigmentation and shape of ventral flukes  
 F = Shape of flukes

**Table 2:** Number of individuals right whales photographed in the photo-ID experiments, by season and natural marking.

Season	Natural markings			Total
	A	B	C	
91/92	9			9
92/93	2	1	1	4
<b>Total</b>	<b>11</b>	<b>1</b>	<b>1</b>	<b>13</b>

A = Callosities pattern of the head  
 B = Callosities pattern of the head + dorsal white blaze  
 C = Dorsal white blaze

**Table 3:** Number of individuals blue whale photographed in the photo-ID experiments, by season and natural marking.

Season	Natural markings			Total
	A	B	C	
92/93	2	5	1	8

A = Pattern of the mottled pigmentation of the body

B = Pattern of the mottled pigmentation of the body + shape of the dorsal fin

C = Mutilation of the dorsal fin

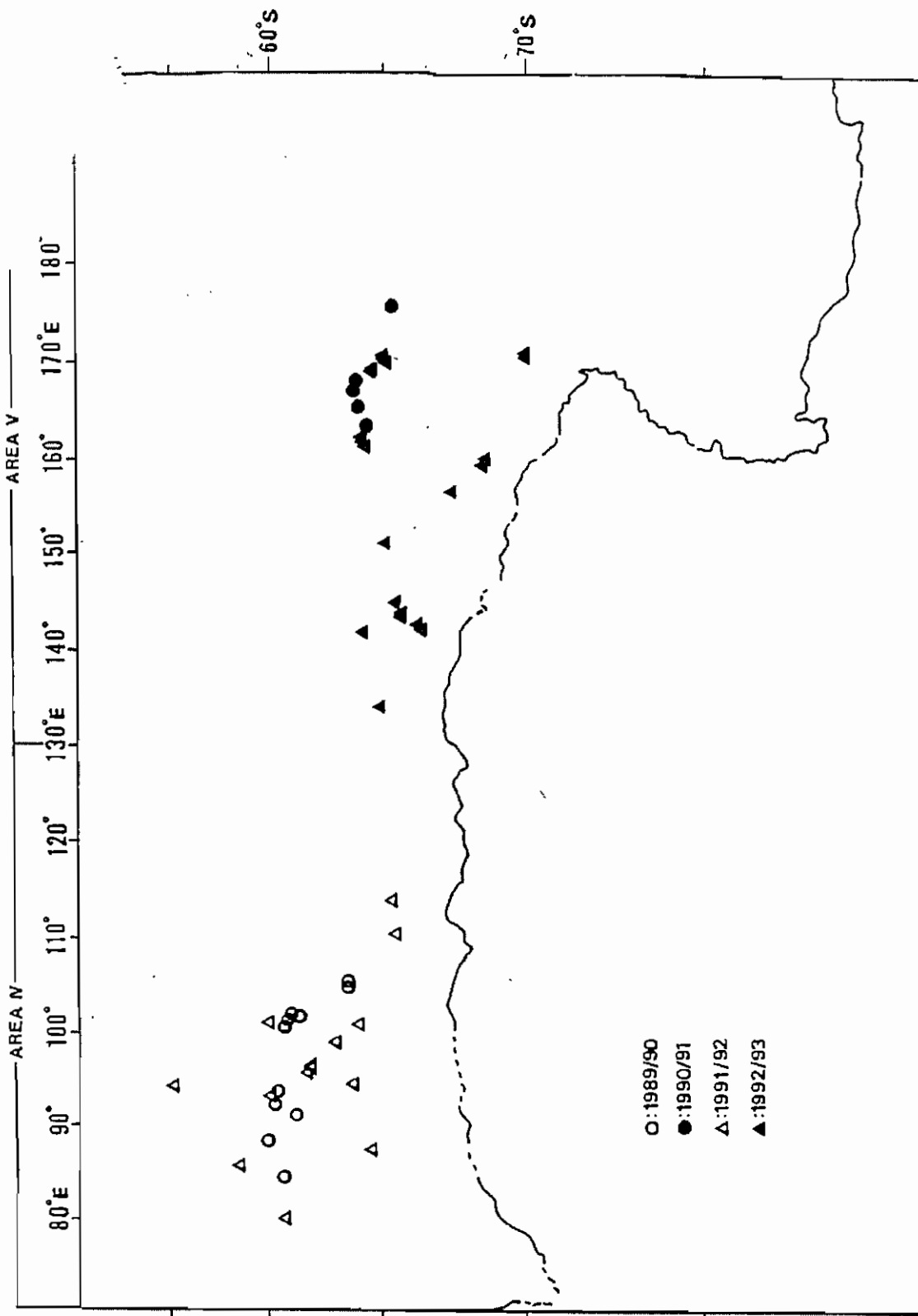


Fig. 1: Geographical distribution of humpback whales photographed for natural markings in four survey seasons.

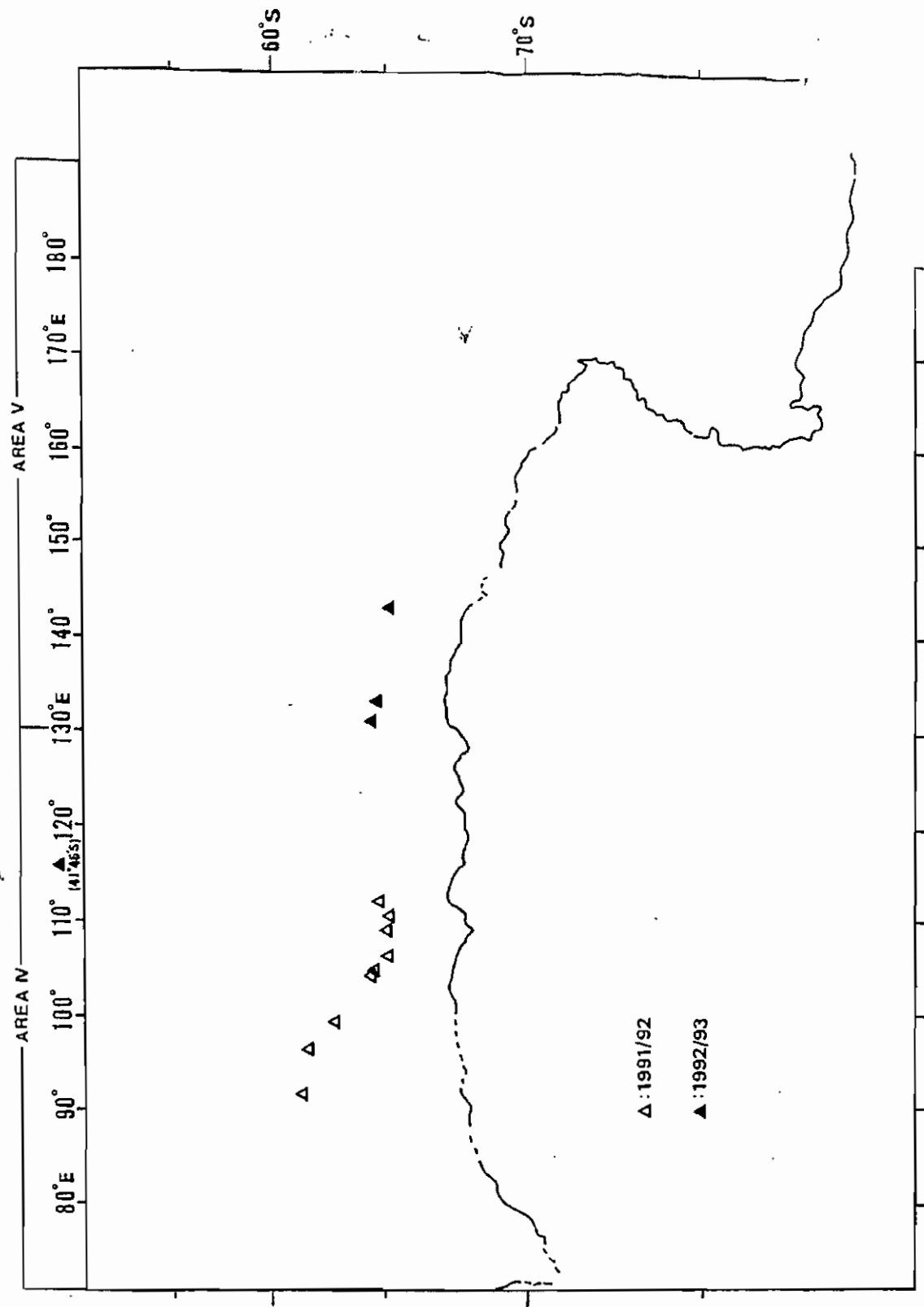


Fig. 2: Geographical distribution of right whales photographed for natural markings in two surveys seasons.

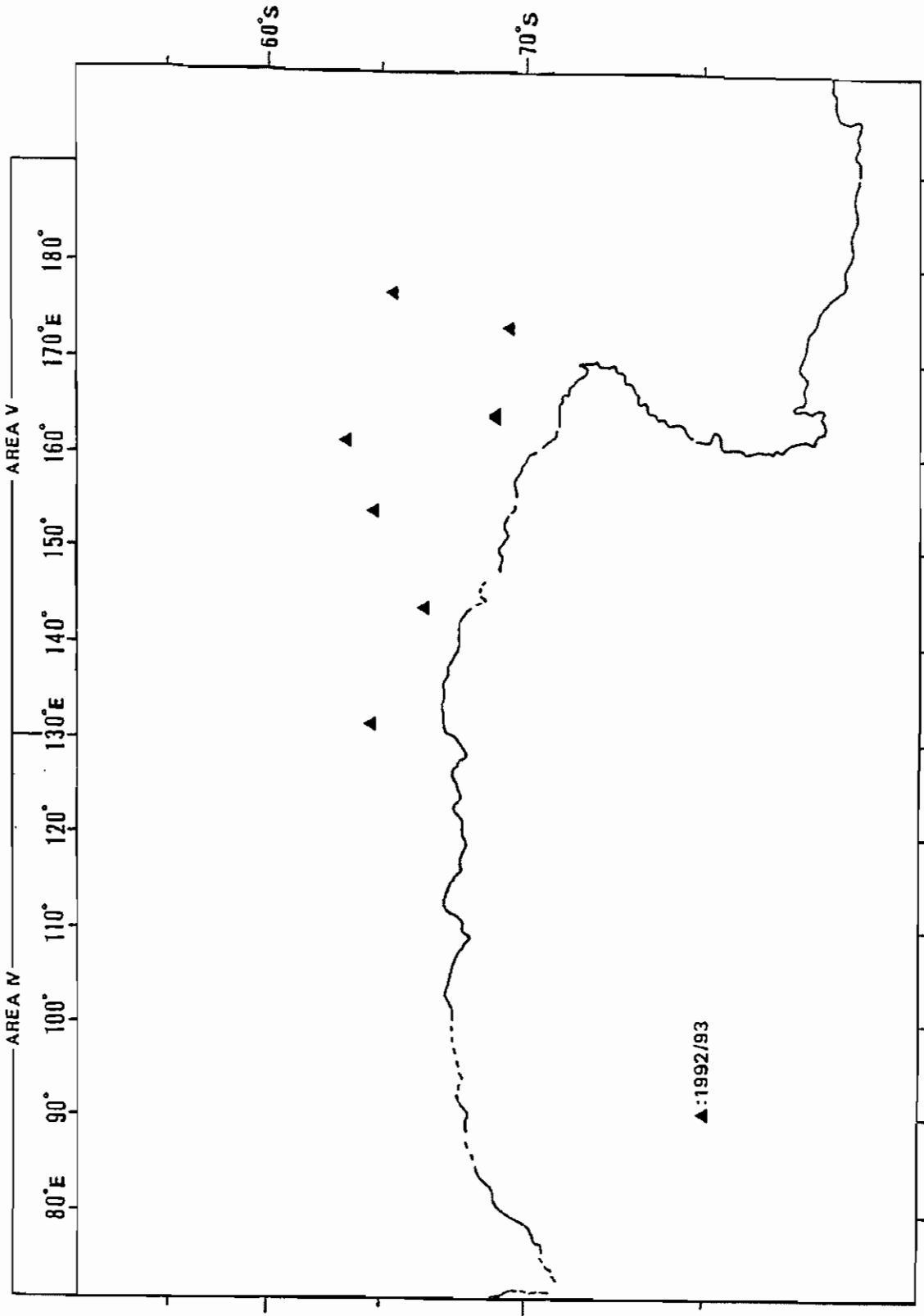


Fig. 3: Geographical distribution of blue whales photographed for natural markings in one survey season.

Appendix I: Data form used for collecting ancillary info on each whale photographed for natural markings during cruises of the JARPA.

1992/93 JARPA CRUISE, NATURAL MARKING RECORD

1992/93年鯨類目撃調査調査  
自然標識記録用紙

Vessel 船名			Date Year 日 Month 付 Day 年 月 日				Page シート番号				
1	2	3	4	5	6	7	8	9	10	11	
Sight No. 目視番号			Species 鯨種名			Code コード		鯨種 Number 群れサイズ			
12	13	14				15	16	17	18	19	20
Roll No. ロール番号		Frames フレーム番号 From To		Ind. Target No. position 個体番号 標的部位		Film フィルム 種類		Remarks リマーク			
21	22	23	24	25	26	27	28	29	30	31	

Conditions

Min. close Distance 状 No. of Individ.  
最近距離 態 個体数

32	33	34	35	36
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