conclusions was that a declining rare population might go extinct before a significant decline could be detected, because statistical power declines with population size.

Therefore, a conservation goal that only ensures population growth is inadequate. This indicates again the importance of establishing a specific and meaningful conservation goal in making evaluations of the conservation status of small cetaceans.

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Appendix 3

CRITERIA FOR ASSESSING THE STATUS OF HARBOUR PORPOISES IN THE NORTH SEA AND ADJACENT WATERS: A SUGGESTED WAY FORWARD

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In 1995, the Small Cetacean sub-committee considered criteria for 'raising a flag of concern' when assessing the status of North Atlantic harbour porpoise stocks subject to bycatch. The sub-committee noted that there was some arbitrariness in its current criterion of bycatch above 1% of estimated abundance, and recommended further discussion. The sub-committee agreed that the PBR approach (Wade, 1998) was useful and represented an advance over the existing criterion. However, no consensus was reached on whether blanket application of criteria designed for US law, would be most appropriate in the context of the IWC's assessment of harbour porpoise stocks in and around the North Sea. We suggest that a way forward would be to conduct case-specific simulations incorporating the particular sources of uncertainty (such as stock structure) encountered in the North Sea area, where there are fairly good data. Implementation trials for commercial whaling have tried to account for hard-to-quantify uncertainties on a case-by-case basis, by specifying plausible hypotheses consistent with what is known, within a simulation framework. This paper suggests how such a simulation framework might be developed for harbour porpoises in the area of the North Sea and adjacent waters.

Our primary intention is that the simulation exercise should appraise current status, rather than test the application of some particular management procedure over a long period. The proposed exercise would provide a probability of abundance decline over a relatively short period (taken from repeated simulations) under a continuation of the present level and pattern of mortality, together with indications of the possible magnitude of any rate of decline or increase. This paper attempts to describe some of the ingredients and approaches needed to set up a usefully realistic but reasonably parsimonious simulation trial. The discussions below are not intended to be comprehensively detailed, and further data analyses would be needed to fully specify the simulations. Preliminary analyses may allow certain elements to be simplified, as discussed below.

There are five main components to the simulation:

(1) a population model, governing the time trajectory of population numbers;
(2) a range of plausible hypotheses about the spatial structure of stocks;
(3) a model governing within- and between-year movements for the stocks;
(4) a space-and-time model specifying bycatch mortality; and
(5) measures of performance describing how the population(s) respond to the specified pattern of bycatch over time.

(1) Population model

A reasonable starting point would be the age- and sex-structured approach used in the RMP implementation trials (IWC, 1993). Fully age-structured models would not be necessary for harbour porpoises, and would be hard to parameterise, but a stage-structured model with two or three life history stages should be feasible and adequately realistic. Uncertainty in parameters can be accommodated through random choices of maximum population growth rate, and of reproductive parameters, in each simulation. Given the lack of information on stage-specific survival, the model would presumably require an assumed probability distribution on maximum population growth rate. The choice of this distribution is liable to be key in driving the simulation outputs. Sex structure may be important, even if there is no difference in vital rates between the sexes, because there is genetic evidence that males may be more mobile than females, and may therefore be subject to different bycatch mortalities as they move between fishing areas.

An important parameter is the initial ratio of current abundance to carrying capacity. Some constraints on possible values for this parameter might be obtained from data on reproduction (i.e. how close the animals are to the maximum rate of reproduction). Historical data on levels of gillnet effort might also be used to investigate how far abundance might have been reduced through bycatch mortality.

(2,3) Stock structure and seasonal movements

Stock structure in and around the North Sea is uncertain, and a range of plausible hypotheses would need to be incorporated in the simulations. There is a considerable body of genetic and morphological evidence for distinctions between stocks (see e.g. IWC, 1995), but the discreteness of stocks on any particular space and time scale has not been fully resolved, and the extent of seasonal mixing remains uncertain. A reasonable model would therefore incorporate several stocks with some degree of interannual mixing. The extent of mixing would depend on the spatial extent of the stocks used, with larger areas having lower mixing rates. When modelling stock structure and seasonal movements, a set of randomly-parameterised models might be used, each being checked for compatibility with existing data. One constraint on such models is provided by the SCANS information on spatial distribution in summer.

(4) Bycatch mortality

Since the context is the assessment of current status, it is not necessary to design a complicated *CLA*-type rule to be tested in simulation trials, but simply to devise a way of maintaining the level and pattern of recent average bycatch mortality. A reasonable approach would be to randomly select a 'true' bycatch from the distribution of possible bycatches, randomly select a 'true' abundance in the same way, and compute a *per capita* mortality from the ratio, to be held constant during that run of the simulations. Practical implementation would be more complicated, since this calculation would need to be done for each 'stock' in the model, which might require accounting for seasonal movements and mixing.

Partial estimates of bycatch mortality in the North Sea are already available (Vinther, 1994), and ongoing observer programmes should allow these to be extended to other fisheries and other years in the near future. There are data on bycatch age distributions, which would allow estimates to be made for each life history stage in the population model. To develop a model of bycatch mortality, these estimates would need to be extended to significant fisheries where estimates have not been made and are not expected soon, such as small-boat gillnet fisheries. It may be necessary to extrapolate such estimates based on catch rates in other better-studied fisheries in the same area. Clearly there will be considerable uncertainty in extrapolations, but as long as some plausible range can be established, the uncertainty can be accommodated in the simulations.

It should be noted that there is likely to be year-to-year variability in the space and time patterns, and overall level, of bycatch mortality. To date, there are only a few years' data, which may not be representative of the true recent average. Data on fishing patterns might be used to investigate the likely range of deviation of the true recent average from its estimate.

(5) Performance measures

It would be appropriate to summarise the simulation results in terms of the probability of abundance decline for any stock in the model, over a fairly short period. For current bycatches to be judged sustainable, this probability needs to be low. In addition, the distribution of rates of abundance change needs to be summarised and considered. Even if the overall probability of decline were to be low, it would clearly be unreasonable to give a clean bill of health to an area if there still was a significant possibility of very fast decline in abundance. The precise level at which probabilities and/or rates of change should cause a flag of concern to be raised, remains unspecified for now. If our approach is applied in a specific case the results may turn out to be so clear-cut that the question of appropriate thresholds can be bypassed for the moment.

The time period of the simulations is not critical in determining probabilities or rates of abundance change, and in fact shorter time periods offer some advantages: there is less need to devote the same amount of attention to hard-to-quantify phenomena such as changes in carrying capacity, or the extent of mixing between stock units.

Anticipated scale of the exercise

The time and effort required for this exercise is potentially large, at least of the order of many man-months. In particular, the construction of plausible models for stock structure and seasonal mixing, and the tuning of such models to make them consistent with available information, could become a major exercise. We envisage that a three-stage approach might be used to minimise superfluous exertion:

(1) gathering and examining data in order to specify plausible hypotheses;
(2) determining more precisely how much sophistication in the models is relevant;
(3) actually constructing the models in the simulation, in as simplified a form as the first two stages dictate.

For example, given a particular duration of the simulations and a spatial scale for the stock structure, genetic data may determine that interannual mixing between stocks is negligible and can be left out of the simulations.

Other applications of the simulation framework

The simulation framework proposed here could also be very valuable outside the IWC and for areas other than the North Sea and adjacent waters. It is particularly relevant for ASCOBANS, which has conservation and management interests in northern European waters. However, several changes would probably be required outside the IWC in a management context. In particular, the criteria suggested here for assessing status - probabilities and magnitudes of short-term stock decline - may be insufficient for specific conservation or management objectives of other organisations. There are potential difficulties associated with the use of absolute declines/increases as objectives, in terms of both the burden of monitoring, and the long-term implications for abundance and degree of depletion.

If this simulation framework were to be used outside the IWC in a management context, there might be a need to examine different models of how bycatch changes over time, incorporating feedback from monitoring (akin to the role of the *CLA* within the RMP). In deciding what an appropriate bycatch model might be, another layer of simulation testing could be used to evaluate the response of the population to different bycatch models.

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Appendix 4

OCCURRENCE OF SMALL CETACEAN SPECIES IN THE AFRICAN REGION

Confirmed presence of small cetacean species in the African region. Key: P = present, A = absent, N = no information (could be present); sp = either this species or the other in the genus.

AREA COUNTRY	*S. bredan.*	*S. teuszii*	*S. chin.*	*L. obsc.*	*T. trunc.*	*S. atten.*	*S. front.*	*S. longir.*	*S. clym.*	*S. coerul.*	*D. delphis*	*D. cap.*	*L. hosei*	*O. orca*	*P. crass.*	*F atten.*	*G. griseus*	*P. electra*	*G. macro.*	*G. melas*	*L. peronii*	*C. heav.*	*K. simus*	*K. breviceps*	*P. phoc.*
Zone 1																									
Morocco (Atlantic)	N	N	A	A	P	N	N	N	N	P	P	N	N	P	P	N	P	N	N	P	A	A	N	N	P
Canary Islands	P	A	A	A	P	N	P	N	N	P	P	N	P	P	P	N	N	N	P	P	A	A	P	P	A
Western Sahara	N	P	A	A	P	N	N	P	N	N	N	N	N	N	N	N	N	N	N	N	A	A	N	N	P
Mauritania	P	P	A	A	P	N	P	N	P	P	P	N	N	P	N	N	P	P	P	P	A	A	P	P	P
Senegal (North)	P	N	A	A	P	P	P	P	P	P	P	P	N	P	N	P	P	P	P	N	A	A	P	P	P
Zone 2																									
Senegal (South)	P	P	A	A	P	P	P	P	P	P	P	P	N	P	N	P	P	P	P	N	A	A	P	P	N
Cape Verde Islands	P	A	A	A	P	P	N	P	N	P	sp.	sp.	N	P	N	P	P	P	P	N	A	A	N	N	A
The Gambia	N	P	A	A	P	N	N	N	P	N	N	N	N	N	N	N	N	N	N	N	A	A	N	N	N
Guinea-Bissau	N	P	A	A	P	N	N	N	N	N	N	N	N	N	N	N	N	P	N	N	A	A	N	N	H
Saõ Tomé & Principé	N	P	A	A	N	N	N	N	N	N	sp.	sp.	N	P	N	N	N	N	N	N	A	A	N	N	A
Guinea	N	P	A	A	N	N	N	N	N	N	sp.	sp.	N	P	N	N	N	N	N	N	A	A	N	N	A
Sierra Leone	N	N	A	A	N	N	N	N	N	N	sp.	sp.	N	N	N	N	N	N	N	N	A	A	N	N	A
Liberia	N	N	A	A	N	N	N	P	N	N	N	N	N	P	N	N	N	N	N	N	A	A	N	N	A
Ivory Coast	N	N	A	A	P	P	N	P	N	P	sp.	sp.	N	P	P	N	P	N	P	N	A	A	N	N	A
Ghana	P	N	A	A	N	P	N	N	N	N	sp.	sp.	N	P	N	N	N	N	N	N	A	A	N	N	A
Togo	N	N	A	A	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	A	A	N	N	A
Benin	N	N	A	A	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	A	A	N	N	A
Nigeria	N	N	A	A	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	A	A	N	N	A
Cameroon	N	P	A	A	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	A	A	N	N	A
Equatorial Guinea	N	N	A	A	N	N	N	N	N	N	N	N	N	P	N	P	N	N	N	N	A	A	N	N	A
Gabon	N	N	A	A	N	N	N	N	N	N	P	P	N	P	P	N	N	N	N	N	A	A	N	N	A
Congo	N	N	A	A	N	N	N	N	N	N	N	P	N	N	N	N	N	N	N	N	A	A	N	N	A
Congo Republic (Zaire)	N	N	A	A	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	A	A	N	N	A
Angola (N. of Benguela)	N	N	A	N	N	N	N	N	N	N	P	P	N	N	N	N	N	N	N	N	N	N	N	N	A
Zone 3																									
Angola (S. of Benguela)	N	N	A	P	N	P	N	P	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	A
Namibia	P	A	A	P	P	A	N	N	N	N	N	N	N	P	N	N	N	N	N	N	P	P	A	P	A
S. Africa (W. of Cape)	A	A	N	P	P	A	A	A	A	A	P	A	A	P	P	P	P	A	A	P	N	P	A	P	A
Zone 4																									
S. Africa (E. of Cape)	P	A	P	A	P**	P	A	P	A	P	P	A	P	P	P	P	P	P	P	P	A	A	P	P	A
Mozambique	P	A	P	A	P***	P	A	P	A	P	P	N	N	N	P	N	N	P	N	N?P	A	A	N	P	A
Madagascar + Islands	P	A	P	A	P	P	A	P	A	P	P	N	N	P	P	P	P	P	P	P	N	A	N	P	A
Tanzania	N	A	N	A	P***	N	A	N	A	N	N	N	N	N	N	N	N	P	N	N	N	A	N	N	A
Kenya	N	A	P	A	P***	P	A	P	A	N	N?	N	N	N	N	N	N	N	N	N	N	A	N	N	A
Somalia (S. of Horn)	P	A	P	A	P***	N	A	P	A	P	N	N	N	N	P	P	P	N	P	P	N	A	P	N	A
Zone 5																									
Somalia (Gulf of Aden)	N	A	P	A	P***	P	A	P	A	P	P*	A	N	P	P	N	P	P	P	A	A	A	N	N	A
Dijbouti	N	A	P	A	P***	P	A	P	A	N	P*	A	N	P	P	N	P	N	P	A	A	A	N	N	A
Red Sea	P	A	P	A	P***	P	A	P	A	N	P*	A	N	P	P	N	P	N	N	A	A	A	N	N	A

** both *truncatus* and *aduncus* forms * *D. tropicalis* form only? ****aduncus* form only?

Appendix 5

SMALL CETACEAN CATCHES 1993-1996

All information was taken from National Progress reports unless otherwise stated. Catches are presented by nation, rather than ocean area, except in the case of the data submitted by the IATTC for the eastern tropical Pacific (ETP). In this case, the submitted estimated catches are not broken down by country and a summed total incidental catch for the participating countries is given. The reported catch columns include catches reported by observer programmes, from interviews with fishermen and incidental reports (e.g. stranded whales determined to have died in nets). Catches are tabled according to the calendar year in which they were taken. All direct and incidental removals (including live captures) are recorded but not stranded animals.

	1993					1994					1995					1996				
	Direct		Indirect		Live	Direct		Indirect		Live	Direct		Indirect		Live	Direct		Indirect		Live
Species	Rep.	Est. total	Rep.	Est. total	Rep.	Rep.	Est. total	Rep.	Est. total	Rep.	Rep.	Est. total	Rep.	Est. total	Rep.	Rep.	Est. total	Rep.	Est. total	Rep.
Argentina																				
Franciscana	-	-	-	237[a]	-	-	-	-	+[a]	-	-	-	-	+[a]	-	-	-	-	-	-
Dusky dolphin	-	-	-	105-200[b]	-	-	-	-	86-136[e]	-	-	-	-	50-100[g]	-	-	-	-	-	-
Commerson's dolphin	-	-	12[d]	20[c]	-	-	-	28[f]	10[d]	-	-	-	91[d]	20[h]	-	-	-	-	-	-
Peale's dolphin	-	-	0[d]	-	-	-	-	3[d]	-	-	-	-	1[d]	-	-	-	-	-	-	-
Australia																				
Bottlenose dolphin	-	-	3	-	-	-	-	11	-	-	-	-	5	-	-	-	-	4	-	-
Common dolphin (?sp.)	-	-	5	-	-	-	-	8	-	-	-	-	5	-	-	1	-	6	-	-
Irrawaddy dolphin	-	-	-	-	-	-	-	-	-	-	-	-	3	-	-	-	-	-	-	-
Unidentified dolphin	-	-	22-57	-	-	-	-	11-14	-	-	-	-	18-26	-	-	-	-	1	-	-
Brazil																				
Killer whale	-	-	-	1[a]	-	-	-	-	-	1[n]	-	-	-	-	-	-	-	-	-	-
False killer whale	-	-	1[b]	-	-	-	-	-	-	-	-	-	-	-	1[n]	-	-	-	-	-
Long-finned pilot whale	-	-	6[c]	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Spinner dolphin	-	-	3[d]	-	-	-	-	1-3[x]	-	-	-	-	1[y]	-	-	-	-	-	-	-
Dwarf sperm whale	-	-	-	-	-	-	-	1[i]	-	-	-	-	-	-	-	-	-	-	-	-
Bottlenose dolphin	-	-	1[b]	-	-	-	-	1[i]	-	-	-	-	-	-	-	-	-	-	-	-
Short-beaked common d.	-	-	-	-	-	-	-	3[j]	-	-	-	-	1[o]	-	-	-	-	-	-	-
Franciscana	-	-	98[e]	-	-	-	-	205[k]	157-283[w]	-	-	-	129[p]	-	-	-	-	15[A]	413-624[B]	-
Tucuxi	-	-	66[f]	-	-	-	-	29[l]	-	-	2[q]	-	41[r]	-	-	2[C]	-	20[D]	-	-
Common dolphin (?sp.)	-	-	1[g]	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Atlantic spotted dolphin	-	-	1[g]	-	-	-	-	-	-	-	-	-	1[s]	-	-	-	-	-	-	-
Pantropical spotted d.	-	-	-	-	-	-	-	-	-	-	-	-	1[u]	-	-	-	-	-	-	-
Risso's dolphin	-	-	-	-	-	-	-	-	-	-	-	-	1[o]	-	-	-	-	-	-	-
Rough-toothed dolphins	-	-	-	-	-	-	-	-	-	-	-	-	2[t]	-	-	-	-	2[E]	-	-
Inia geoffrensis	-	-	-	-	-	-	-	-	-	-	4[q]	-	22[q]	-	-	11[C]	-	3[C]	-	-
Unidentified dolphin	-	-	84[h]	-	-	-	-	1[m]	-	-	-	-	5[v]	-	-	-	-	-	-	-
Canada																				
Narwhal	a	-	-	-	-	a	-	-	-	-	a	-	-	-	-	-	-	-	-	-
White Whale	a	-	-	-	-	a	-	-	-	-	a	-	-	-	-	-	-	-	-	-
Harbour porpoise	-	-	35[b]	222-424[g]	-	-	-	18[c]	80-120[d]	-	-	-	-	-	-	-	-	-	-	-
Dall's porpoise	-	-	-	-	-	-	-	-	-	-	-	-	1[e]	-	-	-	-	-	-	-
Long-finned pilot whale	-	-	14[f]	-	-	-	-	3[f]	-	-	-	-	9[f]	-	-	-	-	6[f]	-	-
Atlantic white sided d.	-	-	2[f]	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1[f]	-	-
Unidentified dolphin	-	-	10[f]	-	-	-	-	1[f]	-	-	-	-	-	-	-	-	-	2[f]	-	-
Unid./other cetacean	-	-	4[f]	-	-	-	-	2[f]	-	-	-	-	-	-	-	-	-	-	-	-
Denmark																				
Harbour porpoise	-	-	-	4,449[a]	-	-	-	-	4,449[a]	-	-	-	-	-	-	-	-	-	-	-

continued...

Appendix 5 Table cont.

	1993					1994					1995						1996				
	Direct		Indirect		Live	Direct		Indirect		Live	Direct		Indirect		Live	Direct		Indirect		Live
Species	Rep.	Est. total	Rep.	Est. total	Rep.	Rep.	Est. total	Rep.	Est. total	Rep.	Rep.	Est. total	Rep.	Est. total	Rep.	Rep.	Est. total	Rep.	Est. total	Rep.
Ecuador																				
Short-beaked common d.	-	-	186[a]	b	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Short-finned pilot whale	-	-	20[a]	b	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Bottlenose dolphin	-	-	-	-	-	-	-	1[d]	227[d]	-	-	-	-	-	-	-	-	-	-	-
Spotted dolphin	-	-	5[a]	b	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Dwarf sperm whale	-	-	2[a]	b	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Unspecified dolphin	-	-	4[a]	3,741[c]	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
ETP																				
Pacific white-sided d.	-	-	-	-	-	-	-	16[b]	e	-	-	-	-	-	-	-	-	-	-	-
Bottlenose dolphin	-	-	24[a]	e	-	-	-	13[b]	e	-	-	-	48[c]	48[c]	-	-	-	11[d]	11[d]	-
Pantropical spotted d.	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Northeastern	-	-	-	1,139[a]	-	-	-	-	935[b]	-	-	-	952[c]	952[c]	-	-	-	818[d]	818[d]	-
Western-southern	-	-	-	757[a]	-	-	-	-	1,226[b]	-	-	-	859[e]	859[e]	-	-	-	545[d]	545[d]	-
Coastal	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Spinner dolphin (? stock)	-	-	-	24[a]	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Eastern	-	-	-	810[a]	-	-	-	-	743[b]	-	-	-	654[c]	654[c]	-	-	-	450[d]	450[d]	-
Whitebelly	-	-	-	399[a]	-	-	-	-	619[b]	-	-	-	445[c]	445[c]	-	-	-	447[d]	447[d]	-
Central	-	-	18[a]	e	-	-	-	11[b]	e	-	-	-	17[c]	17[c]	-	-	-	11[d]	11[d]	-
Striped dolphin	-	-	17[a]	e	-	-	-	11[b]	e	-	-	-	34[c]	34[c]	-	-	-	5[d]	5[d]	-
Common dolphin (?sp.)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Northern	-	-	-	81[a]	-	-	-	-	101[b]	-	-	-	9[c]	9[c]	-	-	-	77[d]	77[d]	-
Central	-	-	-	230[a]	-	-	-	-	151[b]	-	-	-	192[c]	192[c]	-	-	-	51[d]	51[d]	-
Southern	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	30[d]	30[d]	-
Melon headed whale	-	-	2[a]	e	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Rough-toothed dolphin	-	-	1[a]	e	-	-	-	-	-	-	-	-	2[c]	2[c]	-	-	-	-	-	-
Risso's dolphin	-	-	-	-	-	-	-	-	-	-	-	-	1[c]	1[c]	-	-	-	-	-	-
Whitebelly dolphin	-	-	14[a]	e	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Unspecified dolphin	-	-	41[a]	161	-	-	-	237[b]	321	-	-	-	61[c]	61[c]	-	-	-	102[d]	102[d]	-
Faroes																				
Long-finned pilot whale	a	-	-	-	-	1,201[b]	-	-	-	-	228[c]	-	-	-	-	-	-	-	-	-
Atlantic white-sided d.	a	-	-	-	-	258[b]	-	-	-	-	151[c]	-	-	-	-	-	-	-	-	-
Bottlenose dolphin	a	-	-	-	-	8[b]	-	-	-	-	-	-	-	-	-	-	-	-	-	-
France																				
Long-finned pilot whale	-	-	19[a]	c	-	-	-	2	d	-	-	-	2[e]	-	-	-	-	2[ef]	-	-
Pygmy sperm whale	-	-	1[a]	c	-	-	-	-	d	-	-	-	-	-	-	-	-	-	-	-
White-beaked dolphin	-	-	-	-	-	-	-	1	d	-	-	-	-	-	-	-	-	-	-	-
Bottlenose dolphin	-	-	9[a]	c	-	-	-	5	d	-	-	-	4[e]	-	-	-	-	1[ef]	-	-
Striped dolphin	-	-	247[a]	1,152[b]	-	-	-	1	d	-	-	-	1[e]	-	-	-	-	7[ef]	-	-
Common dolphin (?sp.)	-	-	100[a]	419[b]	-	-	-	9	d	-	-	-	9[e]	-	-	-	-	15[ef]	-	-
Risso's dolphin	-	-	7[a]	c	-	-	-	2	d	-	-	-	-	-	-	-	-	-	-	-
Cuvier's beaked whale	-	-	-	-	-	-	-	1	d	-	-	-	-	-	-	-	-	-	-	-
Unidentified dolphin	-	-	5[a]	-	-	-	-	36	d	-	-	-	2[e]	-	-	-	-	5[ef]	-	-
Unid./other cetacean	-	-	5[a]	183[b]	-	-	-	1	d	-	-	-	-	-	-	-	-	1[ef]	-	-
Germany																				
Harbour porpoise	-	-	12	-	2	-	-	18	-	-	-	-	8	-	-	-	-	6	-	-
Long-finned pilot whale	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	8	-	-
Greenland																				
Narwhal	-	741[a]	-	-	-	847[b]	-	-	-	-	-	-	-	-	-	-	-	-	-	-
White whale	-	475[a]	-	-	-	488[b]	-	-	-	-	-	-	-	-	-	-	-	-	-	-

continued...

Appendix 5 Table cont.

Species	1993					1994					1995						1996				
	Direct		Indirect		Live	Direct		Indirect		Live	Direct		Indirect		Live		Direct		Indirect		Live
	Rep.	Est. total	Rep.	Est. total	Rep.	Rep.	Est. total	Rep.	Est. total	Rep.	Rep.	Est. total	Rep.	Est. total	Rep.		Rep.	Est. total	Rep.	Est. total	Rep.
Greenland (cont.)																					
Long-finned pilot whale	-	20[a]	-	-	-	-	-	-	-	-	-	-	-	-	-		-	-	-	-	-
Harbour porpoise	-	-	-	-	-	1,716[b]															
Ireland																					
Common dolphin	-	-	3[a]	321[a]	-	-	-	-	-	-	-	-	-	-	-		-	-	-	-	-
Harbour porpoise	-	-	14[a]	1,497[a]	-	-	-	-	-	-	-	-	-	-	-		-	-	-	-	-
Japan																					
Baird's beaked whale	54	-	-	-	-	54	-	-	-	-	54	-	-	-	-		54	-	-	-	-
False killer whale	2	-	1	-	18	-	-	-	-	-	43	-	-	-	6		35	-	-	-	5
Short-finned pilot whale[a]	337	-	-	-	-	196	-	-	-	-	238	-	1	-	1		482	-	-	-	2
Pacific white-sided d.	-	-	1	-	1	-	-	-	-	6	-	-	-	-	2		-	-	4	-	19
Bottlenose dolphin	171	-	-	-	44	310	-	-	-	52	890	-	-	-	85		280	-	-	-	34
Pantropical spotted d.	565	-	-	-	-	449	-	-	-	-	105	-	-	-	-		67	-	-	-	-
Striped dolphin	544	-	-	-	-	535	-	3	-	10	537	-	80	-	2		303	-	-	-	-
Short-beaked common d.	-	-	-	-	-	-	-	1	-	-	-	-	2	-	-		-	-	3	-	-
Common dolphin (?sp.)	4	-	1	-	-	-	-	6	-	-	2	-	-	-	-		-	-	-	-	-
Northern right whale d.	-	-	-	-	-	-	-	2	-	-	-	-	-	-	-		-	-	-	-	-
Risso's dolphin	497	-	-	-	8	312	-	-	-	-	405	-	7	-	-		369	-	5	-	3
Dall's porpoise	14,318	-	5	-	-	15,947	-	4	-	-	12,396	-	-	-	-		16,100	-	2	-	-
Finless porpoise	-	-	6	-	1	-	-	5	-	-	-	-	7	-	-		-	-	3	-	-
Unidentified dolphin	8	-	-	-	-	-	-	-	-	-	-	-	-	-	-		-	-	-	-	-
Unidentified species	-	-	3	-	-	-	-	3	-	-	-	-	-	-	-		-	-	2	-	-
Mexico																					
Vaquita	-	-	14[b]	-	-	-	-	-	-	-	-	-	0[d]	-	-		-	-	-	-	-
Bottlenose dolphin	-	-	-	-	-	-	-	-	-	-	-	-	-	-	12[c]		-	-	-	-	12[e]
Netherlands																					
Long-finned pilot whale	-	-	2	-	-	-	-	15	-	-	-	-	-	-	-		-	-	16	-	-
Atlantic white-sided d.	-	-	8	-	-	-	-	90	-	-	-	-	10	-	-		-	-	27	-	-
Bottlenose dolphin	-	-	-	-	-	-	-	3	-	-	-	-	-	-	-		-	-	-	-	-
Common dolphin (?sp.)	-	-	1	-	-	-	-	9	-	-	-	-	-	-	-		-	-	2	-	-
Harbour porpoise	-	-	4	-	-	-	-	-	-	-	-	-	1	-	-		-	-	-	-	-
Unidentified dolphin	-	-	5	-	-	-	-	1	-	-	-	-	-	-	-		-	-	3	-	-
New Zealand																					
Long-finned pilot whale	-	-	1[a]	-	-	-	-	7[b]	-	-	-	-	-	-	-		-	-	-	-	-
Bottlenose dolphin	-	-	1[a]	-	-	-	-	21[b]	-	-	-	-	-	-	-		-	-	-	-	-
Common dolphin (?sp.)	-	-	27[a]	-	-	-	-	9[b]	-	-	-	-	-	-	-		-	-	2[c]	-	-
Hector's dolphin	-	-	3[a]	-	-	-	-	8[b]	-	-	-	-	-	-	-		-	-	-	-	-
Killer whale	-	-	1[a]	-	-	-	-	-	-	-	-	-	-	-	-		-	-	-	-	-
Dusky dolphin	-	-	1[a]	-	-	-	-		-	-	-	-	-	-	-		-	-	1[e]	-	-
Gray's beaked whale	-	-	2[a]	-	-	-	-	-	-	-	-	-	-	-	-		-	-	-	-	-
Unidentified dolphin	-	-	-	-	-	-	-	2[b]	-	-	-	-	-	-	-		-	-	-	-	-
Peru																					
Short-finned pilot whale	-	-	1[a]	b	-	-	-	-	-	-	-	-	-	-	-		-	-	-	-	-
Dusky dolphin	-	-	452[a]	b	-	-	-	668[d]	1,272[d]	-	-	-	-	-	-		-	-	-	-	-
Bottlenose dolphin	-	-	56a	b	-	-	-	37[d]	42[d]	-	-	-	-	-	-		-	-	-	-	-
Long-beaked common d.	-	-	447[a]	b	-	-	-	120[d]	45[d]	-	-	-	-	-	-		-	-	-	-	-
Risso's dolphin	-	-	2[a]	b	-	-	-	-	-	-	-	-	-	-	-		-	-	-	-	-
Burmeister's porpoise	-	-	306[a]	b	-	-	-	185[d]	224[d]	-	-	-	-	-	-		-	-	-	-	-

continued ...

Appendix 5 Table cont.

Species	1993					1994					1995					1996				
	Direct		Indirect		Live	Direct		Indirect		Live	Direct		Indirect		Live	Direct		Indirect		Live
	Rep.	Est. total	Rep.	Est. total	Rep.	Rep.	Est. total	Rep.	Est. total	Rep.	Rep.	Est. total	Rep.	Est. total	Rep.	Rep.	Est. total	Rep.	Est. total	Rep.
Peru (cont.)																				
Ziphiids	-	-	2[a]	b	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Unidentified dolphin	-	-	-	b	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Unspecified species	-	-	8[a]	3,752[e]	-	-	-	6[d]	-	-	-	-	-	-	-	-	-	-	-	-
South Africa																				
Bottlenose dolphin	-	-	34[a]	-	-	-	-	48[a]	-	-	-	-	59[c]	-	-	-	-	62[a]	-	-
Common dolphin (?sp.)	-	-	38[a]	-	-	-	-	115[a]	-	-	-	-	26[d]	-	-	-	-	32[a]	-	-
Indo-Pacific Humpbacked d.	-	-	9[a]	-	-	-	-	2[a]	-	-	-	-	9[a]	-	-	-	-	4[e]	-	-
Dusky dolphin	-	-	1[b]	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Heaviside's dolphin	-	-	5[b]	-	-	-	-	-	-	-	-	-	1[b]	-	-	-	-	-	-	-
Risso's dolphin	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1[a]	-	-
Unidentified dolphin	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1[a]	-	-
Spain																				
Striped dolphin	-	-	-	-	-	-	-	2	-	-	-	-	-	-	-	-	-	-	-	-
Common dolphin (?sp.)	-	-	-	-	-	-	-	1	-	-	-	-	1	-	-	-	-	3	-	-
Long-finned pilot whale	-	-	-	-	-	-	-	2	-	-	-	-	-	-	-	-	-	-	-	-
Cuvier's beaked whale	-	-	-	-	-	-	-	-	-	-	-	-	1	-	-	-	-	-	-	-
False killer whale	-	-	-	-	-	-	-	-	-	-	-	-	1	-	-	-	-	-	-	-
Harbour porpoise	-	-	-	-	-	-	-	-	-	-	-	-	1	-	-	-	-	-	-	-
Sweden																				
Harbour porpoise	-	-	-	-	-	-	-	25	-	-	-	-	11[a]	53[a]	-	-	-	17[b]	-	-
UK																				
Bottlenose dolphin	-	-	1[a]	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
White-beaked dolphin	-	-	-	-	-	-	-	1	-	-	-	-	2c	-	-	-	-	-	-	-
Striped dolphin	-	-	-	-	-	-	-	1	-	-	-	-	29[b]	104[j]	-	-	-	-	-	-
Common dolphin(?sp.)	-	-	7[a]	-	-	-	-	9[f]	54[k]	-	-	-	19[h]	61[j]	-	-	-	-	-	-
Risso's dolphin	-	-	1[a]	-	-	-	-	-	-	-	-	-	1[d]	-	-	-	-	2[m]	-	-
Harbour porpoise	-	-	38[ae]	740[i]	-	-	-	23[g]	740[i]	-	-	-	19[c]	-	-	-	-	11[l]	-	-
USA																				
Baird's beaked whale	-	-	-	-	-	-	-	2	11	-	-	-	-	-	-	-	-	-	-	-
White whale	-	396[c]	-	-	-	-	413	-	-	-	-	247[r]	-	-	-	-	399-466[v]	-	-	-
Killer whale	-	-	1[bd]	-	-	-	-	-	-	-	-	-	1[s]	6[s]	-	-	-	-	-	-
Pygmy sperm whale	-	-	1[be]	7	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Dwarf sperm whale	-	-	-	-	-	-	-	-	-	-	-	-	1[t]	1[t]	-	-	-	-	-	-
Long-finned pilot whale	-	-	10[bf]	31	-	-	-	18[x]	22[x]	-	-	-	21[x]	31[x]	-	-	-	-	-	-
Short-finned pilot whale	-	-	11[be]	81	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Pacific white-sided d.	-	-	2[be]	15	-	-	-	3	17	-	-	-	1[s]	6[s]	-	-	-	3[w]	25[w]	-
Atlantic white-sided d.	-	-	9[bg]	208	-	-	-	12[y]	422[y]	-	-	-	2[n]	80[n]	-	-	-	-	-	-
Bottlenose dolphin	-	-	7[bh]	107	-	-	-	15[z]	17[z]	-	-	-	14[δ]	22[δ]	-	-	-	-	-	-
Pantropical spotted d.	-	-	-	-	-	-	-	29[μ]	30[μ]	-	-	-	-	-	-	-	-	-	-	-
Spinner dolphin	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Striped dolphin	-	-	13[b]	21	-	-	-	13	19	-	-	-	2[α]	2[α]	-	-	-	-	-	-
Short-beaked common d.	-	-	5[be]	37	-	-	-	10	55	-	-	-	31[s]	190[s]	-	-	-	27[w]	319[w]	-
Long-beaked common d.	-	-	-	-	-	-	-	1	-	-	-	-	11[s]	68[s]	-	-	-	1[w]	12[w]	-
Common dolphin (?sp.)	-	-	136[bi]	443	-	-	-	159[y]	257[y]	-	-	-	89[z]	231[z]	-	-	-	-	-	-
Northern right whale d.	-	-	7[be]	52	-	-	-	7	39	-	-	-	9[s]	55[s]	-	-	-	5[w]	27[w]	-

continued...

Appendix 5 Table cont.

	1993					1994					1995					1996				
	Direct		Indirect		Live	Direct		Indirect		Live	Direct		Indirect		Live	Direct		Indirect		Live
Species	Rep.	Est. total	Rep.	Est. total	Rep.	Rep.	Est. total	Rep.	Est. total	Rep.	Rep.	Est. total	Rep.	Est. total	Rep.	Rep.	Est. total	Rep.	Est. total	Rep.
USA (cont.)																				
Risso's dolphin	-	-	6[bj]	44	-	-	-	2[ε]	8[ε]	-	-	-	12[φ]	45[φ]	-	-	-	-	-	-
Harbour porpoise	-	-	56[bk]	1,414	-	-	-	105[p]	2,098[p]	-	-	-	69[t]	1,408[t]	-	-	-	-	-	-
Dall's porpoise	-	-	15[bl]	75	-	-	-	13[q]	11+?	-	-	-	1[β]	6[β]	-	-	-	2[w]	24[w]	-
Cuvier's beaked whale	-	-	3[be]	22	-	-	-	6	33	-	-	-	6[s]	31[s]	-	-	-	-	-	-
Unidentified dolphin	-	-	1[bn]	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Unidentified species	-	-	8[bo]	21	-	-	-	7[κ]	22[κ]	-	-	-	9[λ]	9[λ]	-	-	-	-	-	-

Argentina: (a) SC/46/SM25 estimate, Southern Buenos Aires province. Not monitored in 1994 or 1995 but the estimated effort and catch are probably similar to 1993. (b) 55-100 estimated catch in midwater trawling fishery off Patagonia (SC/48/SM22) + 50-100 from other trawls off Patagonia (Crespo, Unpublished).(c) 10 from shore-based robalo nets in Tierra del Fuego (Goodall, Unpublished) + 10 from midwater trawls off Patagonia (Crespo, Unpublished). (d) Shore-based robalo nets in Tierra del Fuego (Goodall, Unpublished). (e) 36 estimated catch in midwater trawling fishery off Patagonia (SC/48/SM22) + 50-100 from other trawls off Patagonia (Crespo, Unpublished). (f) 18 from shore-based robalo nets in Tierra del Fuego (Goodall, Unpublished) + 10 from midwater trawls off Patagonia (Crespo, Unpublished). (g) 0 estimated catch in midwater trawling fishery off Patagonia (SC/48/SM22) + 50-100 from other trawls off Patagonia (Crespo, Unpublished). (h) 20 from shore-based robalo nets in Tierra del Fuego (Goodall, Unpublished) + 0 from midwater trawls off Patagonia (Crespo, Unpublished).

Brazil: Note: All the information for the 1995 catches was taken from the revised Prog.Rep. Brazil except for the 44 strandings of franciscana in Southern Brazil (pers. Comm. M.C.Pinedo).
Killed in gillnets in the southern coast of Rio Grande do Sul (SC/46/SM10). (b) pers.comm. S.Siciliano. (c) 3 pers.comm. M.C.Pinedo. + 3 caught off Santa Catarina State, Southern Brazil (pers. Comm. E.R. Secchi). (d) Killed in shark nets between Ubatuba, northern Sao Paulo and Cabo Frio (SC/46/SM10). (e) 20 caught in a four month period from 10% of the southern coast regional gillnet fleet (SC/46/Prog.Rep.Brazil) + 50 caught in gillnets off Rio Grande do Sul (SC/46/SM12) + 10 (pers. comm. S. Siciliano) + 14 from Paranaguá Bay, Paraná Feb 93 - Feb 94 (pers. comm. R.C. Zanelatto) + 3 in beach seine nets from Bertioga, Sao Paulo (SC/46/SM10) + 1 from off Ponta do Itaipu, Sao Paulo (SC/46/SM10). (f) 60 from Paranaguá Bay, Paraná Feb. 93 - Feb. 94 (pers. comm. R.C. Zanelatto) + 1 from Taíba, Ceará (SC/46/SM10) + 1 from Abrolhos Bank, Bahia (SC/46/SM10) + 2 from Sepetiba Bay, Rio de Janeiro (SC/46/SM10) + 2 from Guriri, Espírito Santo (SC/46/SM10) . (g) Caught off Santa Catarina State, southern Brazil (pers. Comm. E.R. Secchi). (h) 1 from Sepetiba Bay, Rio de Janeiro (SC/46/SM10) + 2 from off Ponta do Itaipu, Sao Paulo (SC/46/SM10) + 81 pers. comm. S. Siciliano. (i) Paraná (j) 2 killed in southern oceanic fleet gillnets (Sechhi *et al.* unpublished data) + 1 caught in Rio Grande do Sul State coast (E. Secchi, pers. comm.). (k) 58 from southern Rio Grande do Sul + 39 from northern Rio Grande do Sul + 2 from Rio de Janeiro + 9 from Paraná + 97 by coastal gillnet boats in Rio Grande do Sul, southern coast (about 25% of fleet) (SC/48/SM12). (l) 13 from Paraná + 16 from Santa Catarina. (m) Caught in nets from Sepetiba Bay, Rio de Janeiro (SC/46/SM10) (n) Caught in a monofilament longline set for tuna and swordfish fisheries in southeastern and southern Brazil (Secchi & Dalla Rosa, unpublished data). (o) Caught in Rio Grande do Sul State coast (E.Secchi, pers. comm.). (p) 10 from Rio Grande port by about 20% of the total coastal gillnet fleet + 4 caught in gillnets set for gadids & sciaenids from northern Rio Grande (May 1995 - April 1996) + 40 caught in gillnets in northern Rio Grande (May 1995 - April 1996) + 1 caught in fishing nets in Pontal do Sul, Paraná + 18 caught in Rio de Janeiro + 12 caught in Cabo de Santa Marta, Santa Catarina State (4 observed + 8 reported by fishermen) + 44 strandings from a long-term monitoring program in southern Brazil, assumed to be caught in gillnets (M.C. Pinedo). (q) Caught in the Mamirauá system. (r) 8 caught in fishing nets in Pontal do Sul, Paraná + 7 caught in Rio de Janeiro + 2 strandings, 1 with net marks and another with knife cuts + 8 taken in fishing nets + 16 in the Mamirauá system. (s) Stranded with net marks on the body. (t) Taken in fishing nets. (u) Caught in Cabo de Santa Marta, Santa Catarina State. (v) 4 from Rio de Janeiro + 1. (w) Estimate 220-283 Poisson model, 157-230 Geometric model and 199-267 non-parametric model. (SC/49/SM37). (x) Taken off the coast of Cabo Frio. (y) Taken off the coast of Rio Grande do Sul (SC/49/SM7).
(A) 7 (FURG) + 8 taken in coastal gillnet fisheries. (B) Estimated at 157-283 annually kill in southern coast of Rio Grande do Sul (MORG) + a preliminary annual mortality of 256-341 was estimated for 2 fisherman communities of northern Rio Grande do Sul (GEMARS). (C) Taken in the Mamirauá system and Tefé area (SCM). (D) 1 taken in gillnet (UERJ) + 18 (GECC) + 1 in the Mamirauá system and Tefé area (SCM). (E) GECC

Canada: (a) No information. (b) 2 caught off the west.coast of Canada (SC/46/O 5) + 33 killed in Bay of Fundy herring weirs (SC/47/SM18). (c) Figure composed of 1 killed in chum salmon gillnet (SC/47/O6) + 17 killed in Bay of Fundy herring weirs (SC/47/SM18). (d) E.A. Trippel 1995. Harbour porpoise bycatch in the Bay of Fundy gillnet fishery. Project summary, Fisheries and Oceans, Canada pp4. (e) SC/48/O2. (f) SC/49/O5. (g) Canadian Bay of Fundy sink gillnet fishery (NOAA Technical Memorandium NMFS - SEFSC - 363 pp108)

Denmark: (a) Bycatch in turbot and cod fisheries (preliminary estimates).

Ecuador: (a) SC/46/06, bycatch for 2 ports (Puerto López and Santa Rosa) Dec. 2 - Dec. 93. (b) See under unspecified dolphins. (c) SC/46/06, estimated bycatch for four ports (Puerto López, Santa Rosa, Manta and Anconcito). Total national bycatch may be 2-3 times higher. (d) SC/47/SM38.

ETP: (a) SC/46/SM4. The following catches are included: Mexico 1,909 dolphins (unspecified) (SC/47/ProgRep Mexico); USA 50 common, 33 pantropical spotted, 26 spinner, 5 striped and 1 bottlenose dolphin (SC/46/SM2). b) SC/47/SM1. The following catches are included: Mexico 1472 dolphins (unspecified) (SC/47/ProgRep Mexico), USA 68 pantropical spotted dolphins + 38 spinner dolphins (SC/47/SM4). (c) SC/48/SM4. (d) SC/49/SM4. (e) Included in unspecified dolphins.

Faroes: (a) Faroes data withheld (b) NAMMCO Annual Report 1995: Faroe Islands Progress Report 1994. (c) NAMMCO Annual Report 1996: Faroe Islands Progress Report 1995.

France: (a) Includes incidental catch in fishing gear (pers. comm. A. Collet): 1 pilot whale, 1 striped dolphin, 8 common dolphins and 5 unidentified dolphins and observed catch in tuna driftnet fishery (Prog. Rep. France + corrections pers. Comm. A. Collet): 18 pilot whales, 9 bottlenose dolphins, 246 striped dolphins, 92 common dolphins, 7 Risso's dolphins, 1 pygmy sperm and 5 unidentified cetaceans. (b) Estimated catch in tuna driftnet fishery. (c) Included in unidentified/other cetacean. (d) No information on the tuna driftnet fishery in 1994. (e) Includes those found stranded with marks indicating that they had been most probably caught in fishing gear. (f) pers. comm. A. Collet

Greenland: (a) NAMMCO Annual Report 1995: Greenland Prog Rep 1993. (b) NAMMCO Annual Report 1996: Greenland Prog Rep 1994.

Ireland: (a) Bycatch by the Celtic Sea gillnet fleet between March 1993 - January 1994 (The estimated catch is considered to be an over estimate).

Japan: (a) Northern & Southern forms.

Mexico: (a) See the ETP table for catches taken in the Eastern Tropical Pacific. They are not included here. (b) SC/46/SM8 (23/1/93 - 31/12/93). (c) Permits issued by SEMARNAP. The animals are being kept in captivity at recreational facilities. (d) Two out of three main fishing towns in the Upper Gulf of California (Puerto Peñasco, Sonora and San Felipe, Baja California) were monitored during December, observing 122 gillnet settings. Fishing activities in the Upper Gulf of California were not monitored during other months. Besides, there were no other reports from other field researchers working in the area. (e) The animals were live captured at locations in the Gulf of California under permits issued by SEMARNAP. They are being kept in captivity at recreational facilities.

Appendix 5 Table cont.

New Zealand: (a) Catch during the period April 1993 - March 1994. (b) Catch taken during the period April 1994 - March 1995. (c) pers. comm. M. Donoghue
Peru: (a) SC/46/SM16. Numbers as follows: short-finned pilot whale, 1 (northern coast); dusky dolphin, 1 (northern coast), 395 (Cerro Azul), 44 (other central ports), 12 (southern coast); bottlenose dolphin, 13 (Chimbote), 6 (other northern ports), 77 (Cerro Azul), 30 (other central coastal ports); long beaked common dolphin, 54 (Chimbote), 186 (other northern ports), 31 (Cerro Azul), 4 (other central coast ports), 2 (southern coast); Risso's dolphin, 2 (other northern ports); Burmeister's porpoise, 119 (Chimbote), 95 (other northern ports), 79 (Cerro Azul), 8 (other central coast ports), 5 (southern coast); ziphiids, 2 (other northern ports); unidentified species, 1 (Chimbote), 1 (other northern ports), 2, (Cerro Azul), 4 (other central coast ports). (b) Estimated catch of this species from Chimbote and Cerro Azul are included under unspecified species. (c) Figure composed of: 1,927 1992/93 at Cerro Azul + 1,825 at Chimbote (SC/46/SM16). (d) SC/47/SM38. All take is mixed incidental and directed. Catches are for the period Jan. - Aug. 1994 from Cerro Azul and from shorter surveys throughout the year at 16 other ports and are composed as follows (estimated catch is given first, followed by the observed catch in brackets: dusky dolphin, 1,272 (597) caught in gillnet fishery off Cerro Azul, (71) from 16 other ports; bottlenose dolphin, 42 (17) caught in gillnet fishery off Cerro Azul, (20) from 16 other ports; long beaked common dolphin, 45 (17) caught in gillnet fishery off Cerro Azul, (103) from 16 other ports; Burmeister's porpoise, 224 (91) caught in gillnet fishery off Cerro Azul, (94) from 16 other ports; Unspecified species, from 16 ports other than Cerro Azul.
South Africa: (a) Annual catch of small cetaceans in shark nets (SC/49/SM34). (b) Fishery-related mortalities (excluding live-fishery) (SC/49/SM34). (c) Figure composed as follows: 57 in shark nets + 2 fishery-related mortalities (SC/49/SM34). (d) Figure composed as follows: 25 in shark nets + 1 fishery-related mortality (SC/49/SM34). (e) Figures composed as follows: 3 in shark nets + 1 fishery-related mortality (SC/49/SM34).
Sweden: (a) SC/48/SM25. bycatch in the Swedish codfish gillnet fishery in ICES area 4456. Reported catch taken during a total of 95 observer days at sea. (b) The bycatch observer schemes reported 6 harbour porpoises in the Skagerrak Sea and 8 in the Kattegat Sea . An additional 3 animals were collected in the Skagerrak Sea from the driftnet fishery during the satellite telemetry study.
UK: (a) Catch during the period April 1993 - March 1994. (b) Bycatch from Biscay driftnets. (c) Bycatch determined from strandings post-mortems (England and Wales). (d) Bycatch determined from strandings post-mortems (Scotland). (e) Figure composed of: 25 observed bycatch from Celtic Sea gillnets + 13 determined from strandings post-mortems (England and Wales). (f) Figure composed of: 1 observed bycatch from Celtic Sea gillnets + 8 determined from strandings post-mortems (England and Wales). (g) Figure composed of: 2 observed bycatch from Celtic Sea gillnets + 21 determined from strandings post-mortems (England and Wales). (h) Figure composed of: 17 observed bycatch from Biscay driftnets + 2 determined from strandings post-mortems (England and Wales). (i) From observer programme 1992-1994 and average fishing effort over 1993-94. Estimate of bycatch for a 12 month period between 1993 and 1994. (j) Estimate of bycatch from Biscay driftnets. From observation of 28% of effort for Biscay driftnets only (observed bycatch 17). (k) Estimate of bycatch from Celtic Sea gillnets (observed bycatch 1). (l) Figure composed of: 3 from bottom set gillnets + 8 determined from strandings post-mortems (7 from England and Wales + 1 from Scotland). (m) Bycatch determined from strandings post-mortems (Scotland).
USA: (a) See the ETP table for catches taken in the Eastern Tropical Pacific. They are not included here. (b) SC/47/Prog.Rep (c) Including 84 struck and lost; (d) J.Breiwick, pers.comm. (Alaska and Bering Sea groundfish trawl fisheries). (e) SC/46/SM2. Washington California shark/swordfish drift gillnet fisheries. (f) May include some short-finned pilot whales; Atlantic swordfish drift gillnet. In the following notes the estimated catch is given, followed by observed catch in brackets (g) Figure composed as follows: 3 (2) in Atlantic swordfish drift gillnet + 205 (7) in New England groundfish sink gillnet fisheries (h) Figure composed as follows: 22 (6) in Atlantic swordfish drift gillnet + 85 (?) in Atlantic tuna trawl + ? (1) in New England groundfish sink gillnet fisheries (i) Figure composed as follows: 238 (113) in Atlantic swordfish drift gillnet + 35 (?) in Atlantic tuna trawl + 170 (23) in Washington/California shark/swordfish drift gillnet fisheries (j) Figure composed as follows: 14 (2) in Atlantic swordfish drift gillnet + 30 (4) in Washington/California shark/swordfish drift gillnet fisheries; (k) Figure composed as follows: 1,400 (53) in New England groundfish sink gillnet + 2 (1) in Atlantic swordfish drift gillnet + 12 (2) in California halibut/angel shark set gillnet fisheries; (l) Figure composed as follows: 67 (9) in Washington/California shark/swordfish drift gillnet + 8(6) in Alaska/Bering Sea trawl fisheries; (m) Caught in Atlantic swordfish drift gillnet fishery. (n) Caught in New England groundfish sink gillnet fishery. (o) Figure composed as follows: 7 (1) in Washington/California shark/swordfish drift gillnet + 2 (1) in Alaska / Bering Sea trawl fisheries + 12 (5) in Atlantic swordfish drift gillnet + ? (1) in Washington/Oregon/California whiting trawl fishery. (p) Figure composed as follows: 2,070 (99) in New England groundfish sink gillnet (SC/49/SM35) + 13 (1) in California halibut set gillnet (SC/45/O5) + 15 (1) in Puget Sound, Washington sockeye salmon drift gillnet + (4) in N.Washington marine set gillnet. (q) Figures composed as follows: 11 (2) in California drift gillnet (SC/47/O5) + (2) in Washington/Oregon/California whiting trawl fishery + (9) in Alaska groundfish trawl fishery. (r) Including 84 struck and lost. (s) SC/48/SM11 (t) Figures composed as follows: 1,383 (43) in New England groundfish sink gillnet (SC/49/SM35) + 25 (0) in California halibut set gillnet (SC/48/SM11) + (20) in N. Washington marine set gillnet (SC/48/SM10) + (6) in mid-Atlantic coastal sink gillnet. (u) Caught in Cabo de Santa Marta. (v) Including 94-148 struck and lost. (w) SC/49/SM2. California swordfish/shark drift gillnet fishery. (x) May include some short-finned pilot whales; Atlantic swordfish drift gillnet and pair trawl fisheries. (y) Figure composed as follows: 163 (142) in New England pelagic drift gillnet (SC/49/SM35) + 94 (17) in California shark/swordfish drift gillnet (SC/48/O5). (z) Figure composed as follows: 83 (82) in New England pelagic drift gillnet (SC/49/SM35) + 6 (3) in New England pelagic pair trawl (SC/49/SM35) + 142 (3) in N. Atlantic bottom trawl (SC/49/SM35) + (1) in mid-Atlantic coastal gillnet (α) New England pelagic drift gillnet (SC/49/SM35). (β) Figure composed as follows: 6 (1) in California shark/swordfish drift gillnet (SC47/O5) + 13 (12) in New England pelagic drift gillnet (SC/49/SM35). (χ) Figure composed as follows: 13(12) in New England pelagic drift gillnet (SC/49/SM35) + 4 (2) in New England pelagic pair trawl (SC/49/SM35) + (1) in mid-Atlantic coastal sink gillnet (δ) Figure composed as follows: 5 (5) in New England pelagic drift gillnet (SC/49/SM35) + 17 (9) in New England pelagic pair trawl (SC/49/SM35). (ε) Figure composed as follows: 2 (1) in New England pelagic drift gillnet (SC/49/SM35) + 6 (1) in California shark/swordfish drift gillnet (SC47/O5). (φ) Figure composed as follows: 4 (4) in New England pelagic drift gillnet (SC/49/SM35) + 4 (9) in New England pelagic pair trawl (SC/49/SM35) + 6 (1) in California shark/swordfish drift gillnet (SC47/O5). (γ) Figure composed as follows: 240 (10) in New England groundfish sink gillnet (SC/49/SM35) + 182 (2) in N. Atlantic bottom trawl (SC/49/SM35). (η) Figure composed as follows: 80 (2) in New England groundfish sink gillnet (SC/49/SM35). (ι) New England pelagic drift gillnet (SC/49/SM35). (κ) Figure composed as follows: 5 (4) in New England pelagic drift gillnet (SC/49/SM35) + 17 (3) in California shark/swordfish drift gillnet (SC/48/O5). (λ) New England pelagic drift gillnet (SC/49/SM35). (μ) New England pelagic drift gillnet (SC/49/SM35).

Annex N
Resources Required for Conduct of Oversight of Abundance Estimates Under the RMP/RMS

Members: Smith (Convenor), Borchers, Butterworth, Miyashita, Palka, Polacheck, Skaug.

The following is a summary of resources required to ensure completion of six recommended RMP/RMS oversight activities:

(1) arrangements for participation in two Japanese cruises;
(2) analysis work on earlier Japanese sighting survey data and survey planning;
(3) simulation evaluation of line transect abundance estimation methodology;
(4) continuing work of the Steering Group to address the questions posed by the Committee last year about the northeast Atlantic sighting survey estimator;
(5) development of methods for combining survey data over years;
(6) re-analysis of Southern Hemisphere minke whale abundance estimates.

It is recommended that these activities can be best handled as outlined below.

1. NORTH PACIFIC SURVEY STEERING GROUP (ACTIVITIES 1 AND 2)

This group will work with Japanese scientists in the design, conduct and analysis of the minke whale and Bryde's whale surveys to address oversight activities (1) and (2). Intersessionally, analyses of previous survey data will be prepared and reviewed, especially for their implication for survey design. A contract study may be required (£5,000) for analysis assistance. Survey plans to be circulated by Japanese scientists in January 1998 will be reviewed intersessionally, and qualifications required for participation in surveys on behalf of the Scientific Committee will be agreed based on those survey plans. Review of data and analysis will continue intersessionally after the survey. Particular attention may be required to develop methods for combining survey data over the years. Results will be reviewed during the following Annual Committee meeting.

Costs will be travel (£3,000), salary (£6,600), and shipboard costs (£1,940) for each survey participant (total (£23,080).

Total cost: £28,080

2. NORTHEAST ATLANTIC MINKE WHALE STEERING GROUP (ACTIVITY 4)

This group will continue work begun last year, with guidance given by the Abundance Estimation sub-committee. Steering Group members (Polacheck (Chair), Cooke, Laake, Øien, Palka, Schweder, Skaug and other interested Scientific Committee members) will design further analyses and review results prepared by Norwegian and other Steering Group members. The Steering Group Chairman will require funds for computer programmer time for modifications to the simulation program TRANSIM to implement specification of additional simulation trials (CSIRO, £2,000).

Total cost: £2,000

3. ABUNDANCE ESTIMATION METHODOLOGY STEERING GROUP (ACTIVITIES 3 AND 5)

This group will continue work conducted over the last year evaluating the statistical properties of estimation methods, and of proposed methods for combining survey data over years. The Steering Group members (Palka (Chair), Borchers, Butterworth, Cooke, Miyashita, Polacheck, Skaug, Smith and other interested Scientific Committee members) will complete the simulation experiment begun last year, which focused on harbour porpoise and North Atlantic minke whales, and will conduct new simulations for sighting surveys conducted under conditions in the North Pacific for minke and North Pacific Bryde's whales. Computer support of £4,000 is anticipated for modification of the program TRANSIM for the conditions of these surveys, and for computer support for method developers to conduct simulation trials. Future work is planned to test methods accounting for dive patterns of larger schools, reactive movements, estimation of variance of encounter rates and for determining duplicate sightings.

Total cost: £4,000

4. ACTIVITY 6

In discussion with the Chairman of the Abundance Estimation sub-committee after the end of that sub-committee's meeting, Activity 6 under the terms of RMP oversight was not considered. The implications of that recommendation will be presented to the Plenary by others.

5. SUMMARY

Implications of the Committee's Survey Guidelines (IWC, 1997) were also noted. The Guidelines require that verified survey data used in the RMP will be submitted to the Secretariat, who will audit the verification done. Also, they require that the Secretariat validate computer programs implementing new estimation procedures. These two activities are required to be conducted relative to the data and analysis methods for the NILS-89/90 and NILS-95 data from

the previous North Pacific Bryde's whale surveys. These activities will require both Secretariat time and potential monetary costs.

Total cost: £34,080. Additional costs are implicit in the Committee's Survey Guidelines for validation of data and computer programs.

REFERENCE

International Whaling Commission. 1997. Report of the Scientific Committee, Annex K. Requirements and Guidelines for Conducting Surveys and Analysing Data within the Revised Management Scheme. *Rep. int. Whal. Commn* 47:227-35.

Annex O
Research Items Arising out of Sub-Committee Discussions Related to Analyses of Sightings Data, Particularly as Regards DESS

D.S. Butterworth and D.L. Borchers

I. Items for which there are proposals to address for the 1998 Scientific Committee meeting, and for which funding would be required (pertinent to 1997/98 financial year)

(1) DESS (see Appendix 1)*
- (a) Documentation £ 897
- (b) Streamlining extraction and analysis £3,587
- (c) MapInfo plotting £1,793
- (d) Minor changes £ 897

Total £7,174

(2) Southern Hemisphere Humpback (Annex G) and Other Great Whale (Annex H) analyses (see Appendix 2, part 1)
- (a) Humpbacks: abundance from IDCR and JSV data
- (b) Blue, right, sperm: distribution plots and abundance from IDCR and JSV data £3,000

(3) Analysis of 1996/97 SOWER survey (see Appendix 3, Item 1)
Estimation of minke whale abundance £3,800

(4) Spatial modelling (see Appendix 3, Item 2; also Annex E)
Further development of SC/49/O 15 approach £7,900

(5) Funding to attend 1998 Scientific Committee meeting (see Appendix 3, concluding note)
Attendance by RUWPA staff to present results of analysis £ ?

(6) DESS - Secretariat training £1,000

* Much of this work (about £5,000) is a prerequisite for the work under Item 2.

II. Items for which there are proposals to address for the 1999 Scientific Committee meeting, and for which funding would be required (pertinent to 1998/9 Financial Year)

(1) Southern Hemisphere humpback, blue, right and sperm whales (see Appendix 2, part 2a)
Possible extension of abundance estimation to include JARPA data in DESS £ ?

(2) *Southern Hemisphere minke whales (see Appendix 2, part 2b)
Recalculation of abundance estimates and 'like-minke investigations £ ? *

(3) IO data analysis (see Appendix 3, Item 3; also IWC, 1997, p.152, Item 12 and Annex E)
Development of detection function forms for logistic regression approach £21,780

* To be advised at 1998 meeting (see comments in Appendix 2).

III. Items which have been earmarked for attention at this or previous meetings, but for which there are as yet no specific proposals to address

(1) Development of objective duplicate identification methods for IWC/IDCR Antarctic minke survey data (IWC, 1997, p.152, Item 5)

(2) Estimation of trends in abundance using the IWC/IDCR Antarctic minke whale survey data (IWC, 1997, p.152, Item 7)

(3) Development of methods for combining survey data collected over different years

(4) Adaptation of existing IDCR/SOWER validation programs for DESS

(5) Validation and incorporation in DESS of:
- (i) 'before/after' IDCR survey data
- (ii) dedicated Southern Hemisphere survey data

IV. Items planned to be addressed for which no funding is requested.

(1) Level of possible double counting of minke whales in Southern Hemisphere I/O mode surveys (Butterworth) (IWC, 1997, p.152, Item 3).

(2) Review of data to estimate minke whale swimming speeds (Brown) (IWC, 1997, p.152, Item 4).

REFERENCE

International Whaling Commission. 1997. Report of the Scientific Committee. Annex E. Report of the sub-committee on Southern Hemisphere baleen whales. *Rep. int. Whal. Commn* 47:128-52.

Appendix 1

PROPOSED IMPROVEMENTS TO THE IWC DATABASE AND ESTIMATION SOFTWARE SYSTEM (DESS)

D. Borchers

Some suggestions for improving and streamlining DESS have arisen from the use of DESS for estimation of Southern Hemisphere humpback whales by Butterworth and Brown and from discussions between the developers and the IWC. These are listed below, together with costs for the Research Unit for Wildlife Population Assessment at the University of St Andrews to implement them. All costs include 17.5% VAT.

Starred items are those necessary to streamline DESS for estimation of Southern Hemisphere whale abundance from IDCR data by the 1998 Scientific Committee meeting. These will be completed by January 1998. The remaining items will be completed by the 1998 Scientific Committee meeting.

Documentation [£897]

1*. Addition of a glossary of terms used in the manual, including explanations of all DISTANCE software terms used, (e.g. 'sample' and 'cluster') and IDCR-specific terms (e.g. 'corrected angle' and 'unbiasing').

2*. Expansion of the documentation on methods of school size estimation, on specification 'multi-level stratification' (i.e. of pooling options for different levels of pooling for estimation of encounter rate, effective strip width, and mean school size); on how 'unbiasing' of IDCR estimated distance and angle data is effected; on installation instructions; on defaults chosen by DESS; and a number of other small items.

Streamlining data extraction and analysis methods [£3,587]

3*. Redesign the IDCR/SOWER survey data extraction method to allow selection of multiple strata/vessels/years/Areas in one step, with the ability to edit the resulting list of datasets and to select a subset of strata/vessels/years/Areas for analysis. Also include a few minor options to clear the list of selected strata in one step and to turn off warnings about deleting and overwriting files.

4*. Revise the IDCR/SOWER survey data extraction method to automate whale abundance estimation using IO mode survey data for estimation of encounter rates and effective strip width, but using confirmed school sizes from closing mode survey to estimate mean school size. (This is the method currently used to convert IO mode estimates of school abundance into estimates of whale abundance.) In its current form, DESS requires separate extractions and runs for IO mode and closing mode data, followed by a run to combine the results of the two earlier runs. The revision will streamline the process and reduce the risk of errors being made in combining the results from IO and closing mode data.

5. Write the relevant options used in extracting the data into the DISTANCE files created by DESS. This will help the user keep track of what the files created by DESS are.

6. Add drop-down menus listing activity codes, species names, etc. when selecting options for extraction.

MapInfo plotting [£1,793]

7. Add a user-friendly facility to plot Lat-lon grids at any chosen resolution.

8. Create a map layer of previously constructed *Small Management Areas* (*SMA*s) with the *SMA* number to help the user keep track of the *SMA*s created up to that point.

9. Create IDCR/SOWER ice-edge data for plotting. (Currently the ice edge data are present only as the southern boundaries of the southern survey strata so that the ice edge cannot currently be plotted without plotting the associated southern strata.)

Other minor changes [£897]

10*. Addition of extraction option for 'SE' effort code to distinguish closing mode search effort in early years from that in later years because the 'SE' effort is not identical to the closing mode effort ('BC' effort code) used in later years.

11*. Revise the program which combines DISTANCE output files to effect multi-level stratification so that it uses a more accurate approximation for the coefficient of variation of whale abundance.

12*. Investigate the apparent survey by the V34 and V36 south of the ice edge; consult the IWC on action if resolution is not trivial.

13*. Set and document default strata for IDCR/SOWER surveys in cases where there is more than one stratum definition (i.e. for early years where there was an unsurveyed stratum to the south of a surveyed stratum, and for the 1986/87 survey in which sub-sections of strata were covered by different vessels and some sub-sections were surveyed by more than one vessel.)

Appendix 2

SIGHTINGS DATA ANALYSES FUNDING PROPOSALS

M. Brown and D. Butterworth

(1) 1997/8 Financial Year

(a) Humpbacks (Southern Hemisphere) (ref: Annex G)
  (i) Complete estimation of abundance from IDCR data to 1995/6 cruise using DESS.
  (ii) Extend (i) to incorporate lower latitudes by use of JSV data.

(b) Blue, right and sperm whales (Southern Hemisphere) (ref: Annex H)
  (i) Compile plots of distributions of sightings from IDCR data using DESS.
  (ii) Estimate abundance as possible from IDCR data to 1995/96 cruise using DESS.
  (iii) Extend (ii) to incorporate lower latitudes by use of JSV data as possible.

TOTAL COST: £3,000

Notes: (I) Above to be completed in time for report to 1998 IWC Scientific Committee meeting.
(II) Deadline in (I) is conditional on updates/ corrections to DESS package being effected by 1 January 1998.

(2) 1998/9 Financial Year

(a) Southern Hemisphere humpback, blue, right and sperm whales (ref: Annexes G and H)
  (i) Investigate and if possible extend calculation of abundance estimates above to utilise the JARPA data input thus far to DESS.

(b) Southern Hemisphere minke whales (ref: Annex E)
  (i) Re-calculate all minke whale abundance estimates from IDCR cruises to 1995/6 using DESS for planned review at 1999 IWC Scientific Committee meeting.
  (ii) Investigate the implications for abundance assessments of changing proportions of 'like-minke' sightings over time.

Notes: (I) No budget is submitted at this time. Rather this will be submitted to the 1998 Scientific Committee meeting for the 1998/99 financial year, in the light of better estimates of the time/resources required from pursuing (1) above.

Appendix 3

SOME IWC SCIENTIFIC COMMITTEE WORK ITEMS WHICH RUWPA IS INTERESTED IN CONDUCTING UNDER CONTRACT

D. Borchers

In addition to the items relating to changes in the IWC Database and Estimation Software System and work relating to the modification of 'TRANSIM', the Research Unit for Wildlife Population Assessment (RUWPA) would be interested in conducting the following items of work under contract. Timing and costs are shown for each item (including 17.5% VAT).

(1) Analysis of the 1996/97 SOWER survey data. (May be recommended by the 1997 Scientific Committee?) RUWPA cost: £3,800. Timing: complete and present results to the 1998 Scientific Committee meeting, providing data are available before February 1998.

(2) Further development of the spatial modelling approach presented in SC/49/O 15. This work was recommended by the Abundance Estimation Working Group and the Standing Working Group on Environmental Concerns. RUWPA cost: £7,900. Timing: progress to be reported to the 1998 Scientific Committee meeting, final report to the 1999 Scientific Committee meeting. (Note that the development of these methods to date has been effected by the IWC funding two years of Sharon Hedley's PhD studies at the University of St Andrews. The cost of £7,900 represents the cost of the third year of the PhD.)

(3) Development of detection function forms for logistic regression approach to abundance estimation from IO survey data, as detailed in SC/49/O 16. This work was recommended by the Abundance Estimation Working Group. RUWPA cost: £21,780. Timing: first stage of work to be presented to 1998 Scientific Committee meeting for review and comment; project to be completed for presentation to the 1999 Scientific Committee meeting.

Note: Separate funding would be required for the attendance of any RUWPA staff member(s) to attend the 1998 Scientific Committee meeting to present the results of analyses.

Annex P
E-mail Correspondence Groups (with Current Membership)

Other interested members of the Scientific Committee can join these groups by contacting the Chairman.

(1) Aboriginal Subsistence Whaling Management Procedure (SC Report Item 11.1)
DeMaster (Chair), Allison, Barner Neve, Born, Breiwick, Donovan, George, Givens, Punt, Walløe, Zeh.

(2) Abundance Estimation Methodology Steering Group (SC Report Item 7.1)
Palka (Chair), Allison, Borchers, Butterworth, Cooke, Miyashita, Polacheck, Skaug, Smith.

(3) *Ad hoc* Bowhead Assessment Group (SC Report Item 11.2)
Buckland (Chair), Allison, Breiwick, Butterworth, DeMaster, George, Givens, Okamura, Poole, Punt, Raftery, Schweder, Smith, Wade, Walløe, Zeh.

(4) Development of revised RMP programme (SC Report Item 7.2)
Hammond (Chair), Allison, Butterworth, Cooke, Givens, Punt, Smith, Walløe.

(5) Japanese incidental catch of minke whales (SC Report Item 8.1.2)
Brownell (Chair), Allison, Kato, Miyashita, Yagi.

(6) Long-term SOWER (SC Report Item 10.5)
Kato (Chair), Best, Borchers, Brown, Butterworth, Ensor, Findlay, Nishiwaki, Reilly, Thiele, Yagi.

(7) Northeast Atlantic Minke Abundance Estimation Steering Group (SC Report Item 8.2.1)
Polacheck (Chair), Allison, Butterworth, Cooke, Hammond, Laake, Palka, Schweder, Skaug, Zeh.

(8) North Pacific Bryde's *Implementation Simulation Trials* (SC Report Item 8.4)
Punt (Chair), Allison, Butterworth, Hammond, Hatanaka, Kato, Oshumi, Palka, Pastene, Perrin, Smith, Yagi.

(9) North Pacific Survey Steering Group (SC Report Item 7.1.2, 8.4)
Smith (Chair), Borchers, Butterworth, Hatanaka, Kato, Miyashita, Øien, Palka, Polacheck.

(10) Right Whale Intersessional Workshop Steering Group (SC Report Item 10.3)
Brownell (Chair), Best, Swartz.

(11) RMP documentation (SC Report Item 7.5)
Donovan (Chair), Butterworth, Cooke, Hammond.

(12) Sighting surveys on multi-disciplinary cruises (SC Report Item 6.2.3)
Reilly (Chair), Ichii, Kato, Urbán Ramirez.

(13) Sperm Whale Intersessional Steering Group (SC Report Item 10.4)
Brownell (Chair), Bannister, Best, Kato, Leaper, Oshumi, Perrin, Taylor.

(14) SOWER 2000 (SC Report Item 6.2.1)
Reilly (Chair), Borchers, Brown, Butterworth, Findlay, Hammond, Ichii, Kato, Perrin, Simmonds, Swartz, Thiele.

(15) Sonogram Database (SC Report Item 10.4)
Fox (Chair), Clark, Leaper, Ljungblad, Swartz.

(16) Working Group on Collection of Behavioral Data during Biopsy Sampling (SC Report Item 7.1)
Clapham (Chair), Ensor, Findlay, Thiele, Swartz, Taylor, Urbán Ramirez.

Annex Q
Report of the Working Group on Proposed Specifications for a Norwegian DNA Database Register for Minke Whales

Members: Baker (Chairman), Archer, Brownell, Cipriano (rapporteur), Clapham, Goto, Haug, Olaisen, Pastene (rapporteur), Perrin, Rojas Bracho, Smith, Schweder, Urbán Ramirez, Walløe, Yagi.

The Working Group was asked to consider and, if possible, offer scientific advice on the proposed DNA database under development by Norway. As stated in SC/49/NA1, the proposal is to develop

> 'a control system aiming at *inter alia* detecting any attempts at illegal trade in products from other stocks of minke whales or other species of baleen whales.'

The proposed methods to be evaluated for development of the registry included DNA profiling by microsatellite Simple Tandem Repeat (STR) analysis, haplotype analysis of mtDNA by sequence variation, and allelic identification of Y-chromosomes by STRs.

The primary objective of the proposal is the development of a searchable, digital registry of DNA profiles to serve control and forensic purposes by providing individual identification of all minke whales killed by Norway during legal hunting. Secondarily, the registry could provide information useful for understanding stock structure, abundance and other aspects of North Atlantic minke whales. It was acknowledged that the primary objectives relate to observation and inspection and were, thus, outside the specific purview of the Scientific Committee.

The Norwegian registry would include all individual whales taken from the 1996 season onward. Initially, the size of the whale DNA profile registry would be similar to that of the Norwegian human forensic registry, scheduled for initiation in early 1998 and expected to grow at a rate of about 500 individuals a year. Olaisen commented that the human forensic registry of the UK is growing at a rate of 150,000 individuals a year. The proposed genetic profiling would be contracted out to competent laboratories and the DNA registry would be held by a suitable Norwegian Governmental Agency. A pilot study to select suitable genetic markers was expected to require about four months and the implementation of the system was expected to proceed directly afterwards. Walløe commented that the Norwegians plan to organise a workshop to review progress and seek further technical advice in early 1998. Further consultation with the Scientific Committee about the specific requirements of the registry was not anticipated.

Walløe noted that the registry would have international implications. For example, a questionable whale product could be analysed in a suitable local laboratory using the specified STR primers. If the sample amplified successfully with the primers, the resulting profile could be compared to the Norwegian registry. A match between the profile of the questionable sample and the registry would demonstrate that the product had originated from the legal Norwegian catch. The lack of a match would demonstrate the opposite, that the product had a different origin.

Yagi expressed appreciation of the Norwegian proposal and confirmed that Japan was also considering a system similar to that proposed here. He noted, however, that Japan, like Norway, considers the IWC as an organisation regulating whaling, not market activities.

PRIMARY OBJECTIVE - INDIVIDUAL IDENTIFICATION OF NORTH ATLANTIC MINKE WHALES

For the purposes of individual identification of North Atlantic minke whale products, the group agreed that the proposed methods were sound. Use of STRs for individual identification of whales has been recommended previously (Dizon and Perrin, 1995) and has been used effectively for population studies of pilot whales (Amos *et al.*, 1993) and North Atlantic humpback whales (Palsbøll *et al.*, 1997). Given the size of the proposed registry, the group agreed that the proposed use of a set of tetranucleotide STRs providing a probability of a match, by chance, of less than 10^{-11}, would be adequate for individual identification. Olaisen suggested this probability of a match would require about eight highly polymorphic STRs (heterozygosity > 0.8). This set of eight is to be selected by screening available STR primers developed for other cetaceans. Olaisen noted that about 30 cetacean STR primers were available from publications or through personal communication and that the properties of these were, at present, under investigation in his laboratory.

The following comments were made in relationship to the screening and choice of STRs for individual identification:

(1) Amplification of STRs by PCR should be robust and repeatable from one laboratory to another. Pastene commented on his use of some of the primers under consideration for the registry and noted that optimisation was required. Archer commented that the availability of reference DNA samples from individual whales with a range of known STR alleles was considered desirable to assure consistency of methods in independent laboratories. It was noted that international transfer of this 'reference' DNA would require CITES permission.

(2) It was noted that the available STR primers have been derived from other cetaceans, not from minke whales. Problems, such as null alleles, have been reported with the use of such 'heterologous' STR primers. Consideration should be given to the trade-off in time required to develop minke whale specific primers, compared to screening and optimising heterologous primers.