International Commission on Whaling

(Constituted under the International Whaling Convention signed at Washington on 2nd December, 1946)

SEVENTEENTH REPORT OF THE COMMISSION

(covering the seventeenth fiscal year 1st June, 1965 to 31st May, 1966)

(*As approved by the Commission at its Eighteenth Meeting in London, June,* 1966, *and authorised to be printed*)

LONDON
Issued from the Office of the Commission
1967

International Commission on Whaling

(Constituted under the International Whaling Convention signed at Washington on 2nd December, 1946)

SEVENTEENTH REPORT OF THE COMMISSION

(covering the seventeenth fiscal year 1st June, 1965 to 31st May, 1966)

(As approved by the Commission at its Eighteenth Meeting in London, June, 1966, and authorised to be printed)

LONDON
Issued from the Office of the Commission
1967

CONTENTS

LIST OF MEMBERS OF THE COMMISSION

Argentina	Mr. J. M. FIGUERERO-ANTEQUEDA
Australia	Mr. C. G. SETTER
Brazil	(not yet appointed)
Canada	Dr. W. M. SPRULES
Denmark	Mr. J. NORGAARD
France	Mr. P. GRIBELIN
Iceland	His Excellency Mr. H. SV. BJORNSSON
Japan	Mr. I. FUJITA
Mexico	Mr. H. CARDENAS-RODRIGUEZ
The Netherlands	MR. T. J. TIENSTRA
New Zealand	Mr. G. L. O'HALLORAN
Norway	Mr. K. HOLLER
Panama	Mr. R. R. ALEMAN
South Africa	Mr. B. VAN DYK DE JAGER
U.S.S.R.	Mr. M. N. SUKHORUCHENKO (*Chairman*)
United Kingdom	Mr. W. C. TAME (*Vice-Chairman*)
U.S.A.	Dr. REMINGTON KELLOGG

R. S. WIMPENNY,
Secretary.

Office of the Commission,
Whitehall Place,
London, S.W.1

International Whaling Commission

1. *Meetings* This report refers to the Seventeenth Meeting of the Commission held in London from 28th June to 2nd July, 1965 under the Chairmanship of Mr. M. N. Sukhoruchenko, to subsequent developments during the year, and to the meeting of the Scientific Committee held in London from 20th to 22nd June, 1966 under the Chairmanship of Dr. D. G. Chapman. Reports of these meetings are contained in Appendices III and IV respectively.

2. *Catch Limitation* As reported in the Chairman's Report of the Seventeenth Meeting, the Commission agreed at the Special Meeting held in May 1965 to a catch limit for the 1965/66 season of 4,500 blue whale units. The Schedule was amended accordingly at the Seventeenth Meeting. The total catch in the 1965/66 season was 4,089 units.

3. *The 1965/66 Catch* A total of 10 expeditions were operated in the Antarctic. This compared with 15 expeditions in 1964/65:—

	1964/65	1965/66
Japan	7	5
Norway	4	2
U.S.S.R.	4	3
	15	10

128 catcher boats operated in the 1965/66 season compared with 172 in 1964/65. These were distributed as follows:—

	1964/65	1965/66
Japan	71	52
Norway	36	21
U.S.S.R.	65	55
	172	128

The total baleen whale catch by the three countries in 1965/66 was as follows:

	1965/66									
	Blue		*Fin*		*Humpback*		*Sei*		*Units*	
Japan ...	—	(—)	910	(4,781)	—	(—)	11,310	(10,405)	2,340	(4,125)
Norway ...	1	(—)	435	(701)	1	(—)	3,662	(5,538)	829	(1,273)
U.S.S.R. ...	—	(20)	973	(1,826)	—	(—)	2,611	(3,931)	920	(1,588)

The figures in brackets show the comparative catch in the 1964/65 season.

The number of sperm whales caught by the Antarctic pelagic expeditions south of 40° South Latitude totalled 4,538 compared with 4,211 in 1964/65.

The total Antarctic pelagic baleen catch was 2,897 units less than in the 1964/65 season.

The opening and closing dates of the 1965/66 Antarctic season are shown in para. 4 below.

The total oil output for the 1965/66 Antarctic pelagic season, including sperm oil, was 678,708 barrels. Total oil production in 1964/65 amounted to 1,017,611 barrels. The average catch per catcher's day's work by pelagic expeditions was 0·31 blue whale units compared with 0·40 in the previous season.

The average fin whale size was 65·75 feet compared with 65·5 and the average size of sei whales 48·04 feet in 1965/66 compared with 49·3 in 1964/65. The sperm whale size average was 45·34 feet compared with 45·6 in the preceding season.

The geographical distribution of the catch in blue whale units, with comparative figures for 1964/65 was as follows:

	Area I (120°–60°W)	*Area II* (0°–60°W)	*Area III* (0°–70°E)	*Area IV* (70°–130°E)	*Area V* (130°–170°W)	*Area VI* (170°–120°W)
1965/66 ...	14	2,439	963	106	361	202
1964/65 ...	40	4,918	687	658	749	—
Decrease	26	2,479	—	552	388	—
Increase	—	—	276	—	—	202

At South Georgia whaling operations were carried out from the land station at Leith Harbour during the 1965/66 season. The total catch amounted to 239 whales (218 fin, 4 sei and 17 sperm) and the total oil production amounted to 9,964 barrels. These figures compare with a total of 1,150 whales taken by two land stations which were operating in 1964/65 from which 45,805 barrels of oil were produced.

Outside the Antarctic, 26 land stations and 7 factory ships were in operation in 1965 and a total of 29,736 whales were caught. In addition, 2,219 sperm whales were caught by the Antarctic pelagic expeditions north of 40° south latitude in 1965 bringing the total number of whales taken outside the Antarctic to 31,955. Total oil production amounted to 929,194 barrels. The comparable figures for 1964 were 33,059 whales (including 4,316 sperm whales taken by Antarctic pelagic expeditions north of 40° south latitude) and 887,722 barrels of oil.

4. *Antarctic Pelagic Whaling Season* The baleen season opened on 12th December for the taking of fin and sei whales. Objections to Article 6(3) of the Schedule concerning the taking or killing of blue whales in the waters south of 40° south latitude were withdrawn before the commencement of the season and only one blue whale was taken for scientific purposes. The season closed on 7th April, 1966. The Japanese and Russian factory ships ceased operations gradually as the stipulated quotas were reached. The first Japanese factory ship ended the baleen whale catch on 5th March and the last on 23rd March, 1966. The first Russian factory ship ended the baleen whale catch on 25th March and the last on 7th April, 1966. The two Norwegian factory ships did not reach the stipulated quotas and ceased operations at the end of the season on 7th April, 1966. The period of whaling for all expeditions taken together averaged 103 days compared with 104 days in 1964/65.

5. *Amendments to the Schedule* As stated under paragraph 4 the objections to paragraph 6(3) of the Schedule lodged by the Governments of Japan, Norway, the United Kingdom and the Soviet Union were withdrawn and the amendment therefore comes into effect for all the Contracting Governments. The amendment bans the killing of blue whales in the waters south of 40° South Latitude.

Objections were received from the Governments of Japan, Norway and the

Soviet Union to the amendment contained in para. 6(5) of the Schedule which forbids the use of a whale catcher attached to a factory ship for the purpose of killing or attempting to kill sperm whales in the waters between 40° South Latitude and 40° North Latitude.

No objections were received to the amendments proposed to paragraphs 4(1), 6(4), 8(a) and 8(c) and these amendments became binding, therefore, on all Contracting Governments. Under these amendments it is forbidden to kill or to attempt to kill blue whales in the North Pacific Ocean and its dependent waters north of the Equator for five years beginning with the 1966 season, it is also forbidden to kill or to attempt to kill humpback whales in the North Pacific Ocean and its dependent waters north of the Equator during the 1966 season. Paragraph 8(a) was amended to show the 1965/66 catch limit of 4,500 blue whale units and extended to embody the resolution adopted at the meeting that there shall be further reductions for the years 1966/67 and 1967/68 that will assure that the total catch for 1967/68 will be less than the combined sustainable yields of the fin and sei stocks as determined on the basis of more precise scientific evidence.

6. *Scientific Investigation of the whale stocks* The Joint IWC/FAO Stock Assessment Review Group met in Seattle from 26th January to 2nd February 1966, to review the state of Antarctic Whale Stocks which has developed since the submission of the Committee of Four Scientists' final report in June, 1964. The report of this group is set out in Appendix III.

7. *International Observer Scheme* No progress was made at the Seventeenth Meeting in putting this Scheme into operation. The Soviet Government maintained that a satisfactory revision of the national quotas was a pre-requisite to their implementation of the International Observer Scheme.

8. *Finance* The Commission reviewed their financial position at the Seventeenth Meeting and approved, subject to audit, the statement of income and expenditure for the financial year ended 31st May, 1965. Two budgets for the year 1965/66 were also approved, an ordinary budget and an extra-ordinary budget relating to the scientific whale stock assessment work.

The cost of the scientific investigation work in 1965/66 was estimated to be approximately £2,000 which with the balance in hand in the extra-ordinary budget plus a contribution of £850 from the ordinary budget was expected to leave a small deficit. Expenditure in the ordinary budget was estimated to total £5,567. Since this expenditure would be in excess of income from annual contributions at the existing level, the Commission agreed to a recommendation raising the amount of its contributions by £50 to £350 p.a. This would give a total estimated income of £5,950 leaving a balance in hand at 31st May, 1966 of £2,012.

A copy of the audited accounts for 1965/66 is shown at Appendix V.

The ordinary budget actual expenditure was £5,903 compared with £5,556 in 1964/65 (excluding the cost of the Special Meeting) resulting in a balance at the end of the year of £47.

Actual expenditure in the extra-ordinary budget amounted to £998. The balance brought forward from 1964/65 was £1,032 and this together withthe £850 contribution from the ordinary budget produced a balance at 31st May, 1966 of £884.

9. *Infractions* Infractions of the Convention reported by Contracting Governments in respect of the 1965/66 Antarctic season and the 1965 season in waters outside the Antarctic are summarised in Appendix VI of this report.

10. *Permits to take whales for Scientific Purposes* The Commission was notified during the year of the following permits granted under Article VIII of the Convention:

Canada Reissue of a permit first granted in 1964, reissued in 1965, but not yet invoked, for the taking of up to 20 undersized and/or lactating sperm whales in order to provide data to further knowledge of sperm whale stocks found off the west coast of Canada in the North Pacific Ocean.

Japan A permit to the Whales Research Institute, Tokyo for the taking of herds of sperm whales in the North Pacific from 18th June to 30th November, 1965.

Norway A permit authorised for the taking of one blue whale and one humpback whale for the purposes of scientific research.

United States Authorized the issue of a permit for the taking of not more than twelve whales of any species, except right whales, for the purpose of continuing a research project in whale biology initiated in 1963. A permit to investigate the behaviour of gray whales in the eastern Pacific Ocean and to attach a harpoon carrying an electronic tracking device to not more than three gray whales; gray whales may not be killed as part of the investigation. A permit for the killing of not more than 50 sperm and 40 gray whales including lactating whales and whales below the length limitations normally applicable since a similar permit issued in 1965 was not invoked. Lastly, a permit was issued to take, transport and maintain in captivity not more than two minke whales for purposes of public display and scientific studies.

Union of Soviet Socialist Republics Grant of a permit to the Soviet whaling fleet in the Southern Hemisphere for the taking of a total of 19 whales for research purposes; 6 sei, 3 blue, 4 Bryde and 6 fin whales, the catch to be made up to the commencement and after the conclusion of the 1965/66 season.

11. *Meetings of Committees* The Commission recommended at its Seventeenth Meeting that delegates of the four North Pacific countries meet early in 1966. It was also recommended that the Working Group of Scientists on North Pacific Whale Stocks and the Sperm Whale Sub-Committee also meet at this time. The meeting of the delegates of the four North Pacific Countries was accordingly held from 14th February to 17th February, 1966 (See Appendix III); the Working Group met from 7th February to 12th February, 1966 and the Sperm Whale Sub-Committee met from 10th February to 18th February 1966. (See Appendix IV). All these meetings took place in Honolulu.

A further meeting of the North Pacific Commissioners took place from 23rd to 27th June, 1966 (see Appendix III) and of the North Pacific Working Group from 16th June to 17th June, 1966. The Scientific Committee met on 20th June until 24th June, 1966. (See Appendix IV which also includes the reports of the North Pacific Working Group). These meetings took place in London prior to the Commission's Eighteenth Annual Meeting. In addition, at its Seventeenth Meeting, the Commission recommended the formation of a Special Group to

consider the regulation of the catch of whales from land stations situated south of 40° South Latitude and in other parts of the Southern Hemisphere. The Special Group so formed met in London from 20th June to 21st June, 1966 prior to the Commission's Annual Meeting (see Appendix III).

12. *Withdrawal from the Convention* During the year the Government of Brazil notified their intention of withdrawing from the Convention to take effect as from 30th June, 1966. The Government of Panama also notified their intention of withdrawing but their attention was drawn to Article XI of the Convention and a request made that they notify the Depository Government of their intention.

13. *Officers* The Chairman, Mr. M. N. Sukhoruchenko (U.S.S.R.) completed the second of a three-year term of office at the Seventeenth Meeting. Following the resignation of Mr. H. Gardner (U.K.) as Vice-Chairman of the Commission the question of a successor was considered at the meeting and Mr. W. C. Tame (U.K.) was unanimously elected Vice-Chairman for the ensuing year.

The constitution of the Commission at the Seventeenth Meeting is shown in Appendix I and that of the Technical, Scientific, and Finance and Administration Committees in the Chairman's Report of the meeting at Appendix III.

R. S. WIMPENNY,
Secretary to the Commission.

ADDENDUM TO THE SEVENTEENTH REPORT OF THE COMMISSION

General Recommendations of the Scientific Committee

At their meeting in June, 1966, the Scientific Committee made several general recommendations besides those applying in particular to the Antarctic and North Pacific Regions.

Having no additional analyses on sperm whale stocks except those reported on by the North Pacific Group they recommended that the F.A.O. Assessment Group be asked to make an assessment of sperm whale stocks, particularly in respect to those on pelagic grounds, and that national research groups begin or continue analyses. They reaffirmed the need for additional working, particularly of sperm and sei whales, and recommended the initiation or continuation of studies to ensure standardization of age readings for sperm, fin, sei, and humpback whales. The taking of gray whale and entire schools of sperm whales under special permits for scientific studies should be encouraged.

The Committee recommended also that biological data for the Antarctic since 1961/62, and for sperm whales, be submitted as soon as possible to the F.A.O. Assessment Group, and annually in future, and that such data be available for exchange between national groups on request.

Additional recommendations were that the sightings programme of S.C.A.R. research ships be continued for at least one more year, that a further census of gray whales be taken, and that the prohibition of the catching of blue whales be extended to the whole of the Southern Hemisphere.

The Committee reaffirmed that a national scheme of management requires separate quotas for each species, but they concurred with the proposal of the North Pacific Working Group that "a combination of blue whale units and specific catch limits [for some stocks] could provide protection where required while providing greater flexibility."

Antarctic Stocks

The best estimate of the present sustainable yields for the whole Antarctic is: Fin Whales, 4,500; Sei Whales, 4,500–7,500; or a total of 3,000–3,500 in terms of B.W.U.

The Committee attached particular importance to allowing the fin whale stocks to begin to rebuild, for the scientific evidence indicates that the fin whale stocks could be the most productive in terms of numbers and economic value. With this in mind they recommended that the Commission consider the suggestion of the F.A.O. Assessment Group that complete protection be given immediately and for some time in the future to fin whales to allow this valuable stock to rebuild. This would imply that during such protection the total burden of catches would fall on the sei whale stock, but calculations suggest that the sei whale stocks are probably large enough to provide an annual quota of 2,000 B.W.U. or possibly 2,500 B.W.U., until the fin whale stock is large enough to provide these annual quotas and still increase at a reasonable rate.

On the understanding that the Commission will carry out its intention of bringing the catch to a level that "will be less than the combined sustainable yield of the fin and sei stocks as determined on the basis of more precise scientific evidence" the Committee saw no reason for closing the Sanctuary. The Committee again preferred to see no earlier opening date to the season than the one in force now, and saw no reason for recommending any change in the closing date.

North Pacific Stocks

The Scientific Committee endorsed the recommendations of the North Pacific Working Group, namely, (i) that the taking of ***humpbacks*** should be prohibited for at least one more year; (ii) that no change should be made in the present five year closure on ***blue whales***; (iii) that the catches of ***fin whales*** should be held below the estimated sustainable yield of 1,800 for the entire North Pacific, and as far as possible below the respective sustainable yields within stock areas; and that the catches of fin whales should not be permitted to rise above these levels until there has been a corresponding rise in sustainable yields verified by further research; and (iv) that the catch of ***female sperm whales*** should not be permitted to rise significantly above the present level.

No recommendations were made (v) on the taking of ***sei whales*** or ***male sperm whales***; but (vi) it was recommended that studies on the state of the stocks of all species should be continued to refine the estimates and to provide a basis for additional recommendations as conditions allow.

APPENDIX I

List of Commissioners and Advisers attending the Seventeenth Meeting of the Commission, June 1965

Chairman: Mr. M. N. Sukhoruchenko (U.S.S.R.)

	Commissioners or Delegates	*Advisers*
ARGENTINA ..	Mr. J. M. Figuerero-Antequeda	Mr. A. von der Becke
AUSTRALIA ..	Mr. C. G. Setter	Mr. R. A. Sherwin
		Mr. S. M. Reilly
		Mr. W. Saleeba
		Mr. R. L. Hunt
BRAZIL	Not represented	
CANADA	Dr. W. M. Sprules	Dr. R. R. Logie
		Mr. K. R. Allen
		Mr. G. C. Pike
		Mr. G. E. Woollam
DENMARK	Mr. J. C. Bogstad	
FRANCE	Mr. P. Gribelin	Mr. R. A. Lagarde
		Dr. P. Budker
ICELAND	H.E. Mr. H. Sv. Bjornsson	
JAPAN	Mr. I. Fujita	Mr. K. Yoshida
		Mr. T. Kamenaga
		Mr. K. Hoketsu
		Mr. K. Yanagi
		Dr. H. Omura
		Mr. M. Kato
		Mr. Y. Uchimura
		Dr. T. Doi
		Capt. K. Nakao
		Capt. J. Osoegawa
MEXICO	Mr. H. Cardenas-Rodriguez	
NETHERLANDS ..	Mr. T. J. Tienstra	Prof. E. J. Slijper
NEW ZEALAND ..	Mr. R. B. Atkins	Mr. K. W. Piddington
NORWAY	Mr. K. Holler	Prof. J. T. Ruud
		Mr. W. G. Solberg
		Mr. G. K. Thestrup
		Mr. E. Moe
		Mr. H. Th. Knudtzon
		Mr. E. Vangstein
		Mr. F. Bettum
		Mr. E. Haugen
PANAMA	Not represented	
SOUTH AFRICA ..	Dr. B. V. D. de Jager	Mr. F. J. Cronje
		Mr. H. M. Knudsen
UNITED KINGDOM	Mr. R. G. R. Wall	Mr. A. J. Aglen
		Mr. J. Graham
		Mr. J. S. W. Henshaw
		Mr J. A. Gulland
		Dr. N. A. Mackintosh
		Mr. S. G. Brown
		Mr. R. Gambell
		Mr. G. H. Elliott

U.S.A.	Dr. J. L. McHugh	Mr. S. Blow Dr. D. G. Chapman Mr. D. W. Rice Capt. C. I. Steele
U.S.S.R.	Mr. I. F. Denisenko	Dr. V. G. Lafitsky Dr. M. V. Ivashin Dr. S. G. Fedorov Mr. L. M. Zheltov

Observers

F.A.O.	Mr. S. J. Holt
I.C.E.S...	Mr. A. J. Aglen
Chile Permanent Commission for South Pacific	Captain Patricio Carvajal Senor Don Santiago Benadava
Portugal	Commander L. Cardoso
Italy	Signor U. Padovan
Universities Federation for Animal Welfare	Mr. J. Hillaby
World Wildlife Fund	Mr. P. Scott Mr. A. S. Bourne
Fauna Preservation Society	Mr. J. Fisher
International Society for Protection of Animals	Mr. T. H. Scott
Peru	Senor C. Gamarro
Secretariat	Mr. R. S. Wimpenny (Secretary) Miss J. M. Kirby Miss P. J. Blacklock Mr. W. Robson The Palantype Organisation

APPENDIX II

AP XVII 26th April, 1965

Sir,

Circular letter to all Commissioners
Agenda: Seventeenth Meeting 1965

I enclose, in duplicate, a copy of the Agenda for the Seventeenth Meeting of the Commission to be held at the offices of the Civil Service Commission, Burlington House, Burlington Gardens, London, W.1 from 28th June to 2nd July 1965. The opening session will begin on Monday, 28th June at 10 a.m.

The Agenda has been drawn up in the light of comments which have been received on the draft provisional agenda circulated with my letter of 11th January 1965.

Copies of the financial statements, referred to under Item 4, will be circulated as soon as possible after the end of the current financial year on 31st May, 1965; they will include a statement of income and expenditure (subject to audit) in the ordinary and extra-ordinary budgets in 1964/65 and an estimate of income and expenditure for 1965/66. The report of the Special Meeting in May (Item 5 of this Agenda) will be circulated as soon as possible after the end of that meeting.

With regard to the International Observer Scheme, Item 6 of the Agenda, the Antarctic pelagic whaling countries were unable to agree upon the implementation of the scheme in the 1964/65 season. The Commission may wish to consider and discuss at the Seventeenth Meeting the prospects for the operation of the scheme in the 1965/66 season and in the light of any further information arising out of the Special Meeting of the Commission in May 1965.

Item 8 refers to the annual report of the Scientific Committee in connection with the normal assessment of the results of the whaling season just ended. A meeting of the Scientific Committee has been convened in the week preceding the Seventeenth Meeting i.e. from 21st–25th June and their report will not therefore be available until the beginning of the Commission's meeting.

With regard to Item 9, the Commission was advised after the Sixteenth Meeting that F.A.O. were not willing to collaborate on future stock assessment work, although they would make available to the Commission an analysis of the 1964/65 Antarctic season catch and its effect on the stocks. This analysis is being presented to the Commission at the Special Meeting on 3rd May. Further discussion on the analysis and on the future of stock assessment work will no doubt depend upon the outcome of the Special Meeting.

Item 10 has been included at the request of the Government of Norway.

At earlier meetings the Commission requested that further scientific studies should be made on, respectively, sperm whales and the stocks of all species in the North Pacific. Both studies are continuing and Items 11 and 12 of the Agenda have been included to enable the Commission to consider these questions further in the light of the scientific evidence in the reports of the Scientific Committee and the Working Group on the North Pacific stocks which are expected to be available at the time of the meeting. Items 17(f) and (g) have been included in case the Commission should wish to consider any particular protective measures, arising from the reports of the scientists, for sperm whales or for any species in North Pacific waters.

Item 17(f) (i) relating to sperm whales has been included at the request of the Government of Australia.

The report on infractions, Item 13, will be circulated at a later date when the information relating to the last season has been received from Contracting Governments.

With regard to Item 17, I have referred above to 17(f), f(i) and (g). No other proposals for amendment of the Schedule have been received from Contracting Governments. The position of the Sanctuary, Item 17(a), is now subject to annual review. The proposal under Item 17(b) (ii) would appear to be the logical outcome of the Commission's decision at the Sixteenth Meeting to prohibit the taking of blue whales in the Antarctic. The other Items have been included to allow the Commission to consider any changes in the Schedule which might arise from the review of the previous season's catch statistics, the FAO analysis of those statistics and their effect on the stocks and the report of the Scientific Committee.

A copy of the Agenda and of this covering letter are being sent to each Contracting Government. Further copies may be obtained on application.

I should be glad to be informed by the 18th June, or earlier if possible, of the names of all those who will be present at the Seventeenth Meeting on behalf of your Government.

I am, Sir,

Your obedient Servant,

R. S. WIMPENNY,

Secretary to the Commission.

AGENDA FOR THE SEVENTEENTH MEETING TO BEGIN AT 10 A.M. ON MONDAY 28TH JUNE, 1965, AT THE CIVIL SERVICE COMMISSION, BURLINGTON GARDENS, LONDON, W.1.

1. Address of welcome.
2. Arrangements for meeting and adopting of Agenda.
3. Appointment to Committees.
4. Finance and Administration:
   (a) Review of the Commission's financial position (accounts for 1964/65 covering the ordinary and extraordinary budget and estimate for 1965/66 to be circulated with Paper IWC/17/2).
   (b) Provision for financing (1) stock assessment work and (2) blood typing work on sperm whales (Paras. 15 and 21 of the Chairman's Report of the 16th Meeting).
   (c) Review of the present level of contribution from Contracting Governments and consideration of increase.
5. (a) Chairman's Report of Special Meeting, May 1965 (to be circulated as Paper IWC/17/6).
   (b) Matters arising from the Special Meeting.
6. The International Observer Scheme.
7. Review of previous season's catches.
8. Report of the Scientific Committee (Report to be circulated as Paper IWC/17/3).
9. Special scientific investigation of the whale stocks (Paras. 7 and 21 of the Chairman's Report of the 16th Meeting):
   (a) Points arising out of the 1964/65 season.
   (b) Arrangements for continuation of the stock assessment work.
10. The taking of whales at land stations in South Georgia.
11. Sperm whale stocks, including proposals for blood typing work (Paras. 11 and 15 of the Chairman's Report of the 16th Meeting).
12. North Pacific whale stocks (Para. 14 of the Chairman's Report of the 16th Meeting and report of the Working Group).
13. Infractions (Infractions Report to be circulated as Paper IWC/17/4).
14. Report of the Technical Committee.
15. Report of the Finance and Administration Committee.
16. Sixteenth Annual Report (a draft will be circulated as Paper IWC/17/5).
17. Amendments of the Schedules:
   (a) Schedule Paragraph 5 —Position of the Sanctuary.
   (b) Schedule Paragraph 7(a)—(i) Opening date of Antarctic pelagic baleen season.
   (ii) Deletion of words "and no such whale catcher shall be used for the purpose of killing or attempting to kill blue whales before 14th February in any year."

(c) Schedule Paragraph 8(d)—Closing date of Antarctic pelagic baleen season.

(d) Schedule Paragraph 8(a)—(i) Blue whale unit catch limit in the Antarctic.

(e) Schedule Paragraph 8(c)—(ii) Limit for daily notification of catch to the Bureau of International Whaling Statistics.

(f) Provision for the restriction of the catch of sperm whales.

(i) Add new sub-paragraph to paragraph 6:—"It is forbidden to use a whale catcher attached to a factory ship for the purpose of killing or attempting to kill sperm whales in the waters between 40° South Latitude and 40° North Latitude."

(g) Provision for the restriction of the catch of whales in the North Pacific.

18. Election of Vice-Chairman for the ensuing year.

19. Date and place of next meeting (Rule XVII of the Rules of Procedure refers to meetings outside London).

20. Arrangements for Press Release.

21. Any other business.

APPENDIX III

CHAIRMAN'S REPORT OF THE SEVENTEENTH MEETING

1. *Date and Place* The Seventeenth Meeting of the International Whaling Commission was held at Burlington House, Burlington Gardens, London, W.1, from 28th June to 2nd July, 1965. The proceedings were conducted by the Chairman Mr. M. N. Sukhoruchenko (U.S.S.R.).

2. *Representation* Commissioners and Delegates of Contracting Governments represented Argentina, Australia, Canada, Denmark, France, Iceland, Japan, Mexico, the Netherlands, New Zealand, Norway, the Republic of South Africa, the United Kingdom, the United States and the Union of Soviet Socialist Republics. Observers also attended from Chile, Italy, Portugal, Peru, the Food and Agriculture Organization of the United Nations, the International Council for the Exploration of the Sea, the Permanent Commission of the South Pacific, the Universities Federation for Animal Welfare, the World Wildlife Fund, the Fauna Preservation Society and the International Society for the Protection of Animals.

3. *Address of Welcome* At the opening session an address was given by the Minister of State for Scotland, Mr. E. G. Willis. Mr. Willis said that conservation had not yet been sufficient to maintain the whale stocks at a satisfactory level and that conservation demanded immediate sacrifices if whaling were to survive and give an economic return. The agreement at the Special Meeting that the Antarctic catch limit should be reduced to 4,500 blue whale units for the next season and that reductions should be made in the following two years to a level which would allow the stocks to recover was, therefore, a very gratifying one. Mr. Willis concluded by saying that he hoped all concerned would accept the full implications of the situation and support the further reductions necessary if the stocks were to be rebuilt from their present depleted conditions. He trusted that, as a result, the foundations of a prosperous future might be laid.

4. *Adoption of Agenda* The Agenda's adoption was moved by the Commissioner for the Union of Soviet Socialist Republics. This was seconded by the Commissioner for the United States of America and accepted without dissent.

5. *Review of Previous Season's Catch* It was pointed out by Mr. Vangstein that he had little to add to the oral report made to the Special Meeting, but he emphasized that, because reports from seven factory ships and two land stations had not been received until the 3rd June, it had not been possible to complete the usual surveys of catch and production in the Antarctic last season. To remedy such a state of affairs expeditions should send in their reports to the Bureau of International Whaling Statistics not later than the 15th of May. An important change in last season's catches referred to those of the sperm whale made by factory ships on their way to and from the Antarctic whaling grounds but actually outside the Antarctic limits. Last season this catch was 5,595 whales compared with 3,600 in 1963/64.

6. *Scientific Investigations* The Scientific Committee met during the week before the Commission's meeting but was unable to elect a Chairman. However, Doctor D. G. Chapman (U.S.A.) agreed to act as Rapporteur so that relevant comments and recommendations from this Committee could be put forward. A number of these are embodied in the succeeding paragraphs of this report. During the meeting of the Commission Dr. Chapman was elected Chairman of the Scientific Committee. The proceedings of the Scientific Committee are set out in Appendix IV.

7. *Stock Assessments* An offer from the Director-General of the Food and Agriculture Organization of the United Nations that, provided adequate conservation plans were in train, he would help in a co-operative programme of stock assessment in connection with Antarctic and other whales, was discussed. On a proposal of the Commissioner for Australia seconded by the Commissioners for Canada and the Union of Soviet Socialist Republics the Commission agreed that the Secretary should be asked to resume arrangements with F.A.O. similar to those intended prior to the Sixteenth Meeting.

8. *Economic Assessment* There had been a recommendation from the Scientific Committee that a group of economists expert in the types of problem involved in the whaling industry but not currently employed in the industry should be established to study whaling problems from an economic point of view. The Commissioner for Australia proposed that this idea should be borne in mind during the year so that it could be considered more closely at the Eighteenth Meeting. The Commissioner for the Union of Soviet Socialist Republics supported this view with which all present agreed.

9. *Protection of Blue Whales* The Commission agreed without dissent that in Paragraph 4 of the Schedule it would be forbidden to kill or attempt to kill blue whales in the Pacific Ocean and its dependent waters north of the equator for five years beginning with the 1966 season. The proposal was made by the Commissioner for Canada and seconded by the Commissioner for the United States of America.

10. The taking of blue whales in the area south of 40° South Latitude is forbidden but this provision in the Schedule was objected to after the Sixteenth Meeting by all the Antarctic pelagic whaling countries. The result is that blue whales are still unprotected in Antarctic waters north of 55° South Latitude from 0° eastwards to 80° East Longitude. Acting on a resolution proposed by the Commissioner for Australia and seconded by the Commissioner for the Union of Soviet Socialist Republics, the Commission therefore agreed at this meeting to an appeal being sent to the Antarctic pelagic countries to ask them to withdraw their objection to the change in the Schedule, Paragraph 6(3) brought about by the deletion of the words "except in the waters north of 55° South Latitude from 0° eastwards to 80° East Longitude."

11. *Protection of Humpback Whales* There was unanimous agreement that it should be forbidden to kill or attempt to kill humpback whales in the Pacific Ocean and its dependent waters north of the equator for the 1966 season pending further assessments. The resolution was moved by the Commissioner for Australia and seconded by the Commissioner for the Union of Soviet Socialist Republics.

12. *Protection of Sperm Whales* Great concern was expressed by some of the Commissioners at the increased taxation of the stocks of sperm whales. There had been much larger catches in the last year and it was feared that decreased whaling in the Antarctic might divert more factory ships to pursue this species in the area outside the Antarctic where the female breeding stocks are to be found. Moreover, while the minimum size limit—38 feet—should be enough to save the great majority of females, massive evidence was available to the Commission to show that this regulation was being broken on a large scale. Although much more information is needed on the state of the stocks of this species, it was pointed out that delaying conservation action until better evidence on depletion is obtained has already produced instances of having waited until the sustainable yield is no longer economic.

13. With these arguments before them, the Commission therefore considered an amendment to the Schedule, Paragraph 6 moved by the Commissioner for Australia and seconded by the Commissioner for New Zealand which stated "6(4) it is forbidden to use a whale catcher attached to a factory ship for the purpose of killing or attempting to kill sperm whales in the waters between 40° South Latitude and 40° North Latitude". The amendment was carried by seven votes in favour to two against but there were four abstentions.

14. In accepting the Report of the Scientific Committee the Commission also agreed that there should be a further meeting of the Sperm Whale Sub-Committee. This would be in 1966 either immediately before or immediately after that of the North Pacific Working Group. The meeting would be convened by Mr. R. Gambell (U.K.).

15. *Appeal to Chile and Peru* In relation to the conservation of sperm whale stocks the Commission considered a recommendation of the Scientific Committee that appeals should be made to Chile and Peru to adhere to the 1946 Convention and in any case to observe the Commission's minimum size-limits for sperm whales and to continue to supply complete data to the Bureau of International Whaling Statistics. As a result the Commissioner for Australia, seconded by the Commissioner for the United States of America made a recommendation

that the Commission appeals to Chile and Peru to adhere to the 1946 Convention and that in the meantime they observe the minimum lengths applying to sperm whales and continue to supply complete statistical data to the Bureau of International Whaling Statistics. The recommendation was carried without any objection.

16. *Blue Whale Unit Limit* At the Sixteenth Meeting no quota of blue whale units had been agreed for the 1964/65 season, but at the Special Meeting in May 1965 Commissioners had agreed to recommend to their Governments a quota for the 1965/66 Antarctic season of 4,500 blue whale units and that further reduction should be made in the 1966/67 and 1967/68 seasons so that the quota for the 1967/68 season would be less than the combined sustainable yields of the fin and sei whale stocks as determined on the basis of more scientific evidence. During the Seventeenth Meeting this recommendation of the Special Meeting was implemented by an amendment of the Schedule which was proposed by the Commissioner for the United Kingdom and seconded by the Commissioner for Canada. The amendment was to delete in Paragraph 8(a) of the Schedule the words "10,000 blue whale units in 1963/64" and add "4,500 blue whale units in 1965/66. There shall be reductions for the years 1966/67 and 1967/68 that will assure that the total catch for 1967/68 will be less than the combined sustainable yields of the fin and sei stocks as determined on the basis of more precise scientific evidence". On this amendment being put to the vote all twelve Commissioners present were found to be in favour of it.

17. *Limit for Daily Notification of Catch* At the time this meeting commenced Paragraph 8(c) of the Schedule to the Convention gave the number of blue whale units caught in the Antarctic after which daily records of catches must be sent to the Bureau of International Whaling Statistics at Sandefjord, Norway as 9,000 and referred to the 1963/64 catch. This allowed the Bureau to indicate to the factory ships the day when the total quota for 1963/64 had been reached. For the future, however, it was proposed by the Commissioner for Australia and seconded by the Commissioner for Japan that Paragraph 8(c) of the Schedule should be changed by the deletion of "9,000" in the third from the last line and its replacement by the words "85 per cent of whatever total catch limit was imposed by the Commission". This proposal was carried without dissent.

18. *Sanctuary and Length of Antarctic Season* No action was taken by the Commission in connection with the Sanctuary and the length of the Antarctic baleen whaling season. This means that for the next Antarctic season the Sanctuary will remain open and that the dates for commencing and ending the baleen whale season will remain the same.

19. *Catching of Whales at Land Stations* The catching of Antarctic whales from land stations south of 40° South Latitude as well as in other areas of the Southern Hemisphere received the special attention of the Commission. They considered that these catches had increased in importance in the light of the recent situation of whale stocks in the Antarctic. To deal with this position and after some amendment the Commission accepted a resolution of their Technical Committee set out in the following terms:

> With regard to the catch of Antarctic baleen whales from land stations situated south of 40° South Latitude as well as in other areas of the Southern Hemisphere, it is recommended that:

(a) Taking into consideration the fact that the problem of catching the Antarctic whales at land stations has increased its importance in the light of the recent situation of whale stocks in the Antarctic, it is desirable for the Commission to set up a special group representing member countries concerned with land stations situated south of 40° South Latitude as well as in other areas of the Southern Hemisphere in order to elaborate suggestions to bring into order the catching of whales at such land stations so that this problem may be discussed in detail at the Eighteenth Meeting of the Commission.

(b) The Commission shall determine the total catch limit of Antarctic pelagic whaling for the 1966/67 season and after, taking into consideration the catch of Antarctic whales from land stations situated south of 40° South Latitude as well as in other areas of the Southern Hemisphere.

(c) The Commission invites the Governments concerned with land stations situated south of 40° South Latitude as well as in other areas in the Southern Hemisphere to take domestic measures on a voluntary basis so that the level of catch from such land stations for the forthcoming season does not exceed that in the 1964/65 Antarctic season or the average (calculated in blue whale units) of the catches over the last three seasons 1963, 1964 and 1965, outside the Antarctic as the case may be.

(d) The Commission recommends to the countries at present discussing the problems of national quotas that, for the 1966/67 and 1967/68 seasons, they take into consideration the catches of Antarctic whales from land stations situated south of 40° South Latitude as well as in other areas of the Southern Hemisphere.

The resolution was carried with the assent of all thirteen Commissioners present but with a reservation made by the Commissioner for the Union of Soviet Socialist Republics that the fourth point of the resolution should also apply to the 1965/66 season.

20. *The International Observer Scheme* The International Observer Scheme was the subject of a proposal by the Commmissioner for Norway amended by the Commissioner for Japan. It ran as follows:

The International Whaling Commission, referring to Paragraph 1(a) of the Schedule according to which the Commission can appoint international observers on factory ships operating in Antarctic pelagic whaling; taking note of the expressed desire of the countries parties to the Agreement concerning an International Observer Scheme dated 28th October 1963 to conserve whale stocks and to maintain proper productivity of pelagic whaling by establishing such a scheme; reaffirming their views expressed at every session since the agreement came into force, supported by the F.A.O. that an International Observer Scheme should be implemented as quickly as possible; bearing in mind the fact that the international observers agreement expires after the 1965/66 season and fearing that such a scheme might never come into existence if not implemented in the coming season; strongly request the countries concerned to ensure the implementation of the International Observer Scheme in the 1965/66 season; *invite* each of the active pelagic whaling nations to give a firm assurance at the Seventeenth Session to the effect that they on their part will put the Scheme into operation in the 1965/66 season in accordance with the rules for the implementation of the International Observer Scheme agreed upon among the five countries concerned in Sandefjord on 26th June, 1964.

This resolution received the affirmative votes of all twelve Commissioners present. The Commissioner for the Union of Soviet Socialist Republics, however, explained that his vote in favour was made to give the Union of Soviet Socialist Republics the right to discuss the problem of the allocation of national quotas.

21. With regard to the assurances in the resolution invited from the active pelagic whaling nations, two were able to give these but the delegation of the Union of Soviet Socialist Republics stated that, while they were in favour of implementation of the scheme in the coming season, their assurance must be qualified by the reserve that both the quota of the whole catch and the International Observer Scheme should be extended to both factory ships and to all land stations catching Antarctic whales and that to implement the International Observer Scheme it would be necessary to solve on a just basis the problem of re-allocation of national quotas between the countries concerned. It was agreed that talks on these matters would be continued but no solution had been worked out by the end of the Commission's meeting.

22. Attention was then given to the relevance of an International Observer Scheme to land stations. In this connection the Commissioner for the United Kingdom proposed and the Commissioner for the Union of Soviet Socialist Republics seconded the following resolution:

> The Commission considers that provisions comparable to those of the International Observer Scheme should be made in respect of land stations in the Southern Hemisphere and asks the special group which is to meet to bring into order the catching of whales at such land stations to study the matter and make recommendations to the Eighteenth Meeting of the Commission.

This resolution was carried; there being four in favour and eight abstentions.

23. *National Quotas* The countries party to the Arrangements for the Regulation of Antarctic Whaling of 1962, represented by their Commissioners, met together before and during the Seventeenth Meeting to discuss proposals for the allocation of national quotas but had not been able to conclude these discussions by the end of the meeting. To these countries the Commission recommended that for the 1966/67 and 1967/68 seasons they take into consideration the catches of Antarctic whales from land stations situated south of 40° South Latitude as well as in other areas of the Southern Hemisphere.

24. *North Pacific Whale Stocks* Bearing in mind the Scientific Committee's views on the threat to the whale stocks in the North Pacific area, where, for instance, against a catch of 3,991 fin whales in 1964 there was an estimated sustainable yield of 1,600, the Commission considered that the four North Pacific countries, Canada, Japan, the Union of Soviet Socialist Republics and the United States of America should meet to discuss this matter. At a first discussion under the chairmanship of Dr. McHugh, it was agreed that representatives of the countries concerned should meet sometime in 1966, probably in January or February.

25. With the acceptance of the Scientific Committee's Report the Commission agreed that the North Pacific Working Group should meet as soon as possible after the completion of the 1965 season but not later than early 1966 to complete their scientific analyses which are based so far on incomplete data.

26. The Commission also agreed that an appeal be made to the countries

concerned in taking humpback whales in the Pacific Ocean north of the equator not to exceed in 1965 their catch in 1964.

27. *Infractions* The Infractions Sub-Committee reported to the Technical Committee on their concern that the minimum size-limits fixed by the Commission were not being properly enforced by all member nations. As a result of its deliberations the Sub-Committee urged that international observation should be extended to all pelagic and land whaling stations as soon as possible. The Technical Committee concurred with the views of the Infractions Sub-Committee. On the proposal of the Commissioner for Australia seconded by the Commissioner for the United States of America the Commission accepted the report on this subject by the Technical Committee.

28. *Finance* The Finance Committee's Report was given careful consideration by the Commission. From the Ordinary Budget, the Income and Expenditure for the year ending 31st May, 1965 and the Provisional Balance Sheet at 31st May, 1965 it was noted that expenditure was £6,174 17s. 0d. compared with £5,227 13s. 8d. in 1963/64. The increase was mainly due to additional meetings and printing. It was recommended that an item of £500 paid to the National Institute of Oceanography for many years should be the subject of a letter to the Institute from the Secretary. In his letter he should enquire about the efficiency of the whale marking scheme and whether more or less support might be appropriate. The answer should be conveyed to the Scientific Committee for its next meeting.

29. Income amounted to £5,775 13s. 9d. and was made up of £5,100 from the annual contributions of £300 from 17 Contracting Governments and £675 13s. 9d. contributed from the special funds for scientific investigations in the Extra-Ordinary Budget. The contribution from the latter was agreed to by the Commission at their Special Meeting in May 1965 to cover the costs of that meeting. The deficit—£399 3s. 3d.—between income and expenditure was met from the balance in hand which was thereby reduced at 31st May, 1965 to £1,629.

30. Outside the balance brought forward the Extra-Ordinary Budget had no income. Expenditure including the contribution to the Ordinary Budget just mentioned, the cost of the meeting of the Committee of Four Scientists in June 1964 and some data computing expenses came to £2,320 16s. 1d. This was met from the funds in hand—£3,359 11s. 7d. leaving a balance at 31st May, 1965 of £1,038 15s. 6d.

31. This first part of the Finance Committee's Report was accepted by the Commission on a proposal of the Commissioner for the United Kingdom seconded by the Commissioner for the Union of Soviet Socialist Republics.

32. Estimates for the year ending 31st May, 1966 envisaged a continuance of expenditure in the Ordinary Budget at the 1964/65 level; in addition it was intended to resume the contribution from the Ordinary Budget to the Extra-Ordinary Budget for stock assessment work which was suspended in 1964/65. Expenditure on the stock assessment work in 1965/66 was expected to be met mainly from the available funds possibly leaving a small deficit of around £100 by 31st May, 1966.

33. The Commissioner for the United Kingdom proposed and the Commissioner for Japan seconded the acceptance of the estimates. The proposal was agreed.

34. In view of the Commission's financial position the Finance Committee believed that an increase of £50 was necessary in the annual contribution from each country. The Commission examined this position and the Commissioner for Australia proposed that member countries be recommended to increase their annual contribution by £50. The Commissioner for South Africa seconded this proposal which was carried. There were ten votes in favour, one against and three abstentions.

35. *Election of Vice-Chairman* Having been transferred to work in the United Kingdom Government not connected with whaling, the Vice-Chairman Mr. H. Gardner (United Kingdom) had resigned during the past year. As he would have had one more year of office it became necessary to elect a successor for this period. The Commissioner for Canada therefore moved and the Commissioner for Australia seconded a proposal that Mr. W. C. Tame (United Kingdom) should be appointed to this position. Mr. Tame was elected with general approval.

36. *Representation at Meetings of other Organizations* The International Council for the Exploration of the Sea had invited the Commission to be represented by an observer at the Fifty-third Statutory Meeting of their Council which was to be held in Rome from 4th–13th October, 1965. The Commission considered this and decided to ask Mr. A. J. Aglen (United Kingdom) to represent them as an observer on this occasion.

37. *Constitution of Committees* The membership of the Commission's Committees was as follows. *Technical Committee* Argentina, Australia, Canada, Denmark, France, Japan, the Netherlands, New Zealand, Norway, Republic of South Africa, Union of Soviet Socialist Republics, United States of America and United Kingdom. *Scientific Committee* Australia, Canada, France, Japan, the Netherlands, Norway, Republic of South Africa, Union of Soviet Socialist Republics, United States of America and United Kingdom. Doctor D. G. Chapman (U.S.A.) was elected Chairman. *Finance Committee* The Chairman of the Commission nominated His Excellency Mr. H. Sv. Bjornsson (Iceland), Mr I. Fujita (Japan), Mr. R. B. Atkins (New Zealand), Mr. K. Holler (Norway) and Dr. J. L. McHugh (U.S.A.). Dr. J. L. McHugh was elected Chairman.

38. *Place and Date of Next Meeting* At the meeting of the Finance and Administration Committee it had been recommended that the Eighteenth Meeting of the Commission should begin on Monday 27th June, 1966 in London. The Commission approved this recommendation.

39. *Press Release* The Commission agreed that the Chairman and Secretary should issue the Press Release.

M. N. SUKHORUCHENKO
Chairman

APPENDIX A

REPORT OF SPECIAL GROUP CONCERNED WITH LAND STATIONS IN THE SOUTHERN HEMISPHERE

1. The Commission at its Seventeenth Meeting decided to set up a Special Group representing member countries concerned with land stations in the Southern Hemisphere to elaborate suggestions to bring into order the catching of whales at those land stations; and to study the possible application of provisions comparable to those of the International Observer Scheme to these stations.

2. The Group met at the Ministry of Agriculture, Fisheries and Food, London, on 20th and 21st June, 1966. Representatives of Argentina, Australia, New Zealand, South Africa and the United Kingdom attended.* The Group elected Mr. W. C. Tame (U.K.) as chairman. Observers from Japan, Norway and the U.S.A. were present.

3. The Group considered first the question of bringing into order the catching of whales at land stations. It had before it figures provided by the Bureau of International Whaling Statistics showing the catches of land stations in the Southern Hemisphere during the summer of 1965 and the 1964/65 season (see Annex A.) It noted with concern the increases in catches, particularly of blue and humpback whales, by Peru and Chile, both non-member countries, which were now taking approximately half the total land stations' catch.

4. The Group agreed that the Commission's aim of bringing the catch of Antarctic baleen whales below the sustainable yield could not be achieved without taking into account the catches of land stations.

5. It appeared, however, that Article V 2(c) of the Convention would not permit the Commission to fix a specific quota for a group of land stations such as those in the Southern Hemisphere. Consequently, the alternatives available to the Commission were either:

(a) to fix a combined catch limit for pelagic expeditions and land stations in the Southern Hemisphere, leaving it to the countries concerned to seek agreement on the division of the catch amongst themselves; or

(b) to seek the voluntary agreement of the countries operating from land stations to a restriction on their catch and take this into account when deciding upon the level of the pelagic catch limit.

6. As regards the first alternative, the Group took note of the difficulties that the pelagic countries had had in previous years in the sub-division of the pelagic catch and considered that it would be even more difficult to reach agreement if land stations were included.

7. As regards the second alternative, the Group noted that South Africa and the United Kingdom are the only members of the Commission at present operating from land stations taking baleen whales in the Southern Hemisphere. These two countries have voluntarily complied with the Resolution adopted at

* Representatives of Argentina attended only on 20th June and accordingly were not present when this report was discussed.

the Seventeenth Meeting of the Commission to limit the catch from land stations to the figure for 1964/65 or the average over the seasons 1963, 1964 and 1965. These countries also indicated to the Group that they would be willing to continue appropriate voluntary restrictions on catches from land stations.

8. The Group considered that the best way to meet the situation would be to accept the offer of the Governments concerned to impose voluntary limitations. It might be sufficient to continue the limitations already adopted but this should be reconsidered in the light of the report of the scientists and the Commission's views on the total catch of baleen whales and the pelagic catch limit.

9. In view of the large catch now being taken by Chile and Peru, the Group considered that urgent efforts should be made (if appropriate through the Permanent Commission for the South Pacific) to secure the co-operation of these countries in limiting their catches. Unless this could be secured it would be impossible to protect effectively the baleen whale stocks in the Southern Hemisphere.

10. The representative of South Africa on the Group expressed the willingness of his Government to accept a total protection of blue whales in the whole of the Southern Hemisphere. The Group recommends the Commission to adopt such a regulation and to seek the urgent agreement of countries which are members of the Permanent Commission for the South Pacific to the acceptance of the same restriction on both blue and humpback whales.

11. On the second question remitted to it, the Group noted that the International Observer Scheme for pelagic whaling had not operated and had now expired. The countries operating from land stations expressed their willingness in principle to co-operate in the International Observer Scheme, but the Group feels unable to put forward any specific proposals in the absence of information about the future of the Scheme generally. Members of the Group pointed out, however, that if a Scheme were to be implemented and if the land stations were included, it would be necessary for the cost to be shared equitably amongst countries participating in any new Scheme.

ANNEX A

SUMMARY OF BALEEN WHALING FROM LAND STATIONS IN SOUTHERN HEMISPHERE IN THE 1964/65 ANTARCTIC SEASON AND SUMMER 1965

Country	*Blue*	*Fin*	*Humpback*	*Sei*	†*B.W.U.*
S. Africa ... ... (2 Stations)	9	380	—	1223	403 (316)
Brazil	—	—	—	149	25 (43)
Peru	78	150	137	2	208 (Nil)
Chile* ... ... (2 Stations)	371	265	6	439	578 (188)
Australia	—	—	—	—	Nil (Nil)
S. Georgia	—	503	—	506	336 (344)
			TOTAL (excluding Brazil)		1525 (848)

* A third station may have been used but no catch figures have been received.
† Previous seasons catches shown in brackets.

APPENDIX B

REPORT OF I.W.C./F.A.O. JOINT WORKING PARTY ON WHALE STOCK ASSESSMENT HELD FROM 26TH JANUARY TO 2ND FEBRUARY, 1966 IN SEATTLE

SUMMARY

The joint F.A.O./I.W.C. Working Party on Antarctic Whale Stock Assessment met in Seattle from 26th January until 2nd February 1966, to review the situation as it has developed since the Commission's Special Committee of Four Scientists had submitted its final report, and especially to see whether more detailed analysis of recent data called for revisions of stock and parameter estimates previously made.

The main conclusions of the present report are:

(a) *Land station catches* (section 2 of Report)

The land station catches must be taken into account in determining overall pelagic quotas if these are to arrest the decline in the stocks. The recent catches of blue, fin and sei whales from Southern Hemisphere land stations, the catches of which are believed to include whales from the Antarctic stocks, amount to about 850 B.W.U's. or about 30 per cent of the present sustainable yield in B.W.U's. If this level of 850 B.W.U's. were to be continued in future years, the pelagic catch would have to be brought down to this amount less than the present sustainable yield of 2,500 B.W.U's. i.e. to below 1,650 B.W.U's. If, however, the land station catch were to be reduced in the same proportion as the necessary reduction in the pelagic catch as compared with that in 1964/65, the quota would need to become less than 2,000 B.W.U's. for pelagic catches and less than 300 B.W.U's. for land station catches.

(b) *The numbers of sei whales* (section 3 of Report)

New estimates of the average number in the sei whale population during the 1964/65 season gave a figure of 47,400. This figure is based on the assumption that in this season sei whales were equally catchable as fin whales. If the catchability in reality would be higher or lower than that of fin whales, the population size accordingly would be smaller or greater respectively than the stated figure.

(c) *Fin whales* (section 4 of Report)

(1) A new analysis of mark recapture data give an estimate for the total mortality rate of fin whales in the period 1954/61 of 0·27 as compared with the estimate in the Committee of Four's report, based on age analysis, of 0·282 (Fourteenth Report of the Commission, p. 46).

The same analysis for the period 1934/38 gave an estimate of 0·04 as compared with the estimate in the Committee's report of 0·084, and an analysis comparing pre and postwar recoveries yielded an estimate of 0·102 corresponding to the estimate based on age analysis for the same period of 0·094.

Thus, the analysis of mark recapture data confirmed the estimates of total mortality rate used in the assessments of the fin whale stocks.

(2) The data given in the previous section are not invalidated by two somewhat surprising features of the marking data, i.e. the low overall

rate of return of marks, and the comparatively high numbers of prewar marks returned in some recent seasons. An analysis showed that these features could be satisfactorily explained by assuming an initially low, but increasing, efficiency in the return of tags, for which assumption evidence is brought forward.

(d) *Blue whales* (section 5 of Report)

New analysis based on data on mortality rates led to an estimate of blue whale stock size in 1953/54 of about 12,000 whales and in 1962/63 of below 1,000 whales (about 600 according to the best estimate).

(e) *Variation in catch rates between expeditions of different nationalities*

Substantial differences exist in the catches per unit of effort between expeditions, which differences had some consistency in terms of nationality and showed different trends over a period of years. Changes in the relative whaling effort by different nations, and selective withdrawal of expeditions or catchers could lead to a bias in the estimates of changes in stock abundance which would not be eliminated merely by correcting for the tonnage of catchers or other common index of efficiency.

Although some biases were shown, the Working Party did not consider it essential at this time to revise the indices of abundance on the basis of expedition efficiency. Nevertheless, in future years it will be necessary to keep a watch for, and where necessary take account of, bias arising from changes in fleet composition if the fleets are further reduced.

(f) *Statistical tables*

Difficulties experienced in the use of the International Whaling Statistics for the assessment work carried out by the Committee of Four has led to the formulation of a number of suggestions for changes in the arrangements of these statistics. These suggestions are formulated in section 7 of the Report, and provisional tables of the 1965/66 pelagic season's data will be made along these lines for review by the Working Group on statistics and the Scientific Committee.

Attention is drawn also to the need for annual submission of age-length data by the national laboratories, in order not to seriously impede further assessments of the whale stocks on an international basis. It is suggested that the Commission should decide on the future location of the basic data and the route of its submission, taking into consideration the desirability of storing the data at a permanent centre where staff and facilities for storage are available and where, if possible, facilities for carrying out computations are accessible.

1. *Introduction*

Under the terms of the exchange of letters between F.A.O. and the International Whaling Commission it was agreed that continued studies of the condition of stocks of Antarctic baleen whales should be undertaken by F.A.O. in cooperation with the Commission and with the Bureau of International Whaling Statistics. During discussions among scientists participating in the 17th meeting of the I.W.C. it was agreed that it would be timely for a group to meet early in 1966 to review the situation as it had developed since the Commission's Special Committee of Four Scientists had submitted its final report, and especially to see whether more detailed analysis of recent data called for revisions of stock and parameter estimates previously made. The Working Party established included all members of the original Committee of Four, and the authors of the report prepared by F.A.O., *F.A.O. Fish. Tech. Pap.* (59–Fib/T59) and considered by the Special Meeting of the Commission in May, 1965, as follows:

—K. R. Allen
—L. K. Boerema
—D. G. Chapman (Chairman of Scientific Committee of I.W.C.)
—J. A. Gulland
—S. J. Holt

The Working Party met on the campus of the University of Washington, Seattle, from 26th January to 2nd February, 1966. In addition to the previous reports and statistical tables etc., the members had available tables kindly prepared by B.I.W.S. in which were summarized the catches of each species by months and area divisions, for the whole post-war period 1945/46 to 1964/65. The present report summarizes the studies made by the Working Party members before and during their meeting and offers further comments on certain other matters, notable the future routine presentation of statistics and biological data as a basis for continuing stock assessments.

The Working Party gave particular attention to the following matters:

The interpretation of marking data, especially long-term returns; recalculation of fin-whale mortality rates; the problem of estimating stocks, especially of sei-whales from catch per unit effort data when there is strong species selection and its degree is changing from year to year; the consequences of national differences in catcher efficiency in bias of overall catches per catcher's days work; the effect on population estimates of different methods of conversion of lamination counts to age in years; the effect of different assumptions regarding the instantaneous natural mortality rate.

Arrangements have been made for two members of the Working Party (Boerema and Gulland) to come together as soon as the statistical data are available for the 1965/66 pelagic whaling season so that a status report can be prepared for consideration at the 18th meeting of the Commission.

2. *Land station catches*

As a basis for further examination of this problem, the Working Party compiled the attached statistical tables (Annex I), showing annual catches and catches per catcher per year from Southern Hemisphere land stations the catches of which are believed to include whales from the Antarctic stocks. For comparison, data on the pelagic catches are also included.

The Working Party reaffirms that the sustainable yields calculated by the Committee of Three and Four and the F.A.O. Group refer to the *total* sustainable yields from the whole Antarctic stocks. From this point of view an expected or permitted land station catch must be taken into account in determining overall pelagic quotas if these are to arrest the decline in stocks.

The land station catches other than from South Georgia were not taken into account in the calculation by the Committee of Three of stock sizes during the 1950's but at this period these land station catches were a small proportion of the total, even counting the whole of them as comprising Antarctic whales, and the underestimates of stock sizes and of the sustainable yields which this produced was not more than about 4 per cent.

However, in recent years the land station catches (both including and excluding South Georgia) have been increasing relative to the pelagic catches, and increasing account needs to be taken of them in calculations. The important fact is however that the recent land station catches are a rather high proportion (about 30 per cent in B.W.U's.) of the present sustainable yields. It is therefore essential that they be subtracted from the estimated sustainable yield in each year to arrive at the total quota which the pelagic catch must not exceed if the stocks and yields are to be permitted to begin to recover.

The Working Party had hoped to study the rates of change of catch per unit effort by land stations over the years, to give a pointer as to whether the parts of the whale stocks accessible to them had been declining in the same way as those accessible to the pelagic expeditions. Unfortunately, the only "effort" data available were the numbers of catchers operating at each station in each year.

The average catch in B.W.U. per catcher per year for all land stations of the Southern Hemisphere (excluding South Georgia) hardly shows a tendency to decline. However, the fin whale catches decreased considerably both in South Africa and Chile over the last 6–10 years, whereas the catch per catcher of sei whales increased in South Africa (and Brazil) and decreased in Chile. These data confirm information from other sources that at least the fin whales caught by these stations belong to the Antarctic stocks.

Trends in the stock abundance of the whale species are obscured in the data on catch per catcher per year by changes in the length of season, the sizes and ranges of catchers, use of aircraft for spotting, season-to-season variation in the behaviour of the whales, and so on. It is essential, therefore, that effort data be provided in future, for land stations as well as for pelagic expeditions and that the data supplied for land stations should include relevant information necessary to reduce the above sources of error as much as possible. These, and the corresponding catch data, should be made available promptly, so that the assessments made each year prior to each meeting of the Commission can take full account of the land station catches in the previous year as well as of the pelagic catches in the Antarctic season just ended.

The most recent land station (other than South Georgia) data available to the Working Party were for 1964. These were added to the 1964/65 Antarctic catches to give the most recent annual total.

If the recent level of land station catch (about 850 B.W.U's.) were to be continued in future years, the pelagic catch would have to be brought down to this amount less than the present (November 1965) sustainable yield of 2,500 B.W.U's., i.e. to below 1,650 B.W.U's. If however, the land station catch were to be reduced in the same proportion as the necessary reduction in the pelagic catch from the 1964/65 level the quota would need to become less than 2,200 B.W.U's. for pelagic catches (land station catch less than 300 B.W.U's.).

3. *The numbers of sei whales*

In the 1965 F.A.O. report (FIb/T59) an estimate was made of the sei whale stock. This estimate depended on the assumption that during the 1964/65 season the relation of catch per unit effort to abundance was the same for fin and sei whales. Prior to this season it is clear that the catches per unit effort of sei whales were determined less by the abundance of sei whales than by the degree to which the whalers were actively searching for sei whales. This searching or preference for one or other species, can be considered as occurring on various scales—which of two whales in sight a catcher will pursue, which way a catcher or expedition will move from day to day, and which major area the expedition will work in. The last of these may be detected and corrected if sufficiently detailed statistics are available, but there is a limit (around the size of the present 10° squares) beyond which more detailed sub-division of the Antarctic whaling grounds would result in there being a large proportion of sub-divisions for which no catch data would be available. However, with the areas used in the F.A.O. report estimates of catch per unit effort can be obtained which give much better indices of the abundance of the stocks than the simple rates of total catch to total effort (see Table 1). Such estimates can be obtained either

from the total season's catch in each area, (centre columns, as in the F.A.O. report), or from the mean monthly values in each area (right hand columns).

TABLE 1

Indices of stock abundance of fin and sei whales

(Cf. Table 6 of Fb/T59)

	Total catch / Total effort		Average catch per unit effort. (season totals)		Average of monthly catches per unit effort (December-March)	
	Fin	*Sei*	*Fin*	*Sei*	*Fin*	*Sci*
1963/64	0·68	0·40	0·62	0·36	0·61	0·37
1964/65	0·42	1·13	0·43	0·72	0·46	0·73
Ratio 1964/65: 1963/64	0·62	2·8	0·69	2·0	0·75	2·0

The estimates of the change in abundance of fin and sei whale stock from 1963/64 to 1964/65 (bottom row) based on area data are considerably closer to the expected changes—some decrease in seis and the 1964/65 fin whale stock about 0·86 of the 1963/64 stock—than those based on the rates of total catch to total effort. Even better agreement is likely if complete data were available on the density of each species within smaller areas.

The Working Party examined briefly the data for the ratio of fin-sei catches at South Georgia, where there is obviously little flexibility in choice of whaling area. There, the overall ratio does not change much from year-to-year; the sei catches remain at about the same level, but the fin catches in the latter part of the season are rather lower in recent years.

Within some areas (e.g. Area II West), sei whales now make up the great majority of the catch, so that the distribution of the expeditions in these areas is governed mainly by the distribution of seis, and probably little further concentration on seis is possible. Therefore, apart from further concentration on to seis in other areas or some change in preference back from seis to fins, the estimates of catch per unit effort, taking into account the distribution of the expeditions between major areas, is likely to provide a satisfactory index of abundance of seis: that is any change in stock abundance will be reasonably accurately reflecte d in a proportional change in catch per unit effort.* However, it is not necessarily true that the ratio of the catch per unit effort to actual abundance is the same for all species of whales. Within the large areas used different species of whales may be more or less patchily distributed, so that there are differences in the ease with which the expeditions can concentrate on the small areas of peak abundance. For the individual catcher different species of whales may be detectable at different ranges, and once detected, the probability of capture may be different.

Also there may be different proportions of the total stocks of different species outside the regions to which the catch per unit effort data applies.

From the results given in this and earlier reports the following table (Table 2) can be drawn up relating actual number in the stock of whales to various indices of catch per unit effort.

* Since the meeting and the preparation of the report, the results of the 1965/66 season have become available; there has in fact been a further increase in the overall catch per unit effort of seis, due to greater concentration (and hence higher catches per unit effort) on seis in areas where sei whales did not predominate in the catches in 1964/65.

TABLE 2

Relation of indices of catch per unit effort to absolute abundance

Species	Index	Season	Average Tonnage of catchers	Index			No. of Whales at unit cpe
				No correction for tonnage	Corrected for tonnage	Stock	
Blue	Total catch/total effort	1953/54	498	0·209	0·420	11,000	26,200
Fin	,,	1963/64	709	0·68	0·96	32,400	33,750
Blue	Mean of cpe. in division	1953/54	498	0·185	0·372	11,000	28,500
Fin	,, in division and months	1964/65	715	0·46	0·643	30,100	46,450

The areas fished in 1953/54 were substantially different from those fished in 1964/65 but there is some overlap; the index chosen was the average of the catches per unit effort in the six divisions (Series A, Area II E, III and IV and series B, areas III, IV and V) which were fished in both seasons. The average catches per unit effort of fin whales in these divisions in 1964/65, 0·456, is almost exactly the same as the index used in the comparison fin/sei given in Table 1 using monthly data in the divisions fished in both the 1963/64 and 1964/65 seasons.

Table 2 shows that there are differences in the relation of index of catch per unit effort to absolute abundance, depending both on the species concerned, and the methods of computing the index. These differences do not invalidate the use of any index as a measure of the changes in the stock, but make it more difficult to estimate the absolute abundance of the sei whale stock directly from any index of catch per unit effort. As suggested in Table 1, the best available index for sei whales is that based on divisions and months—i.e. 0·73, or correcting for tonnage, 1·02–. This is likely to be most comparable, among the values in Table 2, with the similar index for fin whales, for which unit catch per unit effort corresponds to 46,450 whales, i.e. the estimate of the average sei whale population during the 1964/65 season is $1{\cdot}02 \times 46{,}450 = 47{,}400$ whales. However there is yet no statistical evidence as to whether sei whales are more or less catchable than fin whales; Table 2 suggests that if the catchability (rate of cpe to abundance) of sei whales is more like that of blue whales than fin whales, this figure may well be an over-estimate.

4. *Fin Whales*

(a) *Further analysis of mark recapture data*

In the original report of the Committee of Three the mark-recapture data were analyzed (Fourteenth Report of the Commission Appendix V Section C pp. 43–45). Despite the problem inherent in whale mark recapture data it was shown there that quantitative results could be obtained. The methods developed there are here extended using a procedure due to Seber (Biometrika 49, (1962) pp. 339–349). Seber's method like the Committee's original analysis is based upon a comparison of marks recaptured in the same season from different marking experiments. This comparison thus eliminates the problems that have been much emphasized, viz., that the efficiency of recovery of marks varies between expeditions and between years. The present analysis also has utilized the several additional years of mark-recapture data that have become available since the 1962 meeting of the Committee of Three.

Table 3 shows the results of postwar marking experiments beginning in 1953/54. Zero year recoveries have been disregarded since these may be unrepresentative due to incomplete mixing.

TABLE 3
Postwar marking and recoveries

Season	No. marked	No. marked less zero year recoveries = t_0	No. marked in following season, less zero year recoveries = t_1	No. of marks recovered in second season and later = S_{02}	No. of marks recovered from following season's marking in first or later seasons = S_{12}	Estimated Annual Mortality Rate
1953/54	122	118	231	14	42	0·36
1954/55	236	231	217	40	48	0·23
1955/56	227	217	129	35	12	—0·60
1956/57	145	129	151	9	36	0·72
1957/58	169	151	105	16	14	0·26
1958/59	121	105	56	7	4	0·25
1959/60	68	56	154	3	14	0·45
					Average	0·24

The mortality rate is calculated from the formula $1 - \frac{t_1 S_{02}}{t_0 (S_{12} + 1)}$ where the symbols are defined in the column headings. The expression $S_{12} + 1$ in the numerator removes a slight bias that arises in using the simple formation for the survival of marked whales during the first year after marking—ratio of proportion returned $= \frac{S_{02}/t_0}{S_{12}/t_1}$. It is seen that the estimates are very variable as is to be expected when they are based on rather small numbers of marks over a very extensive area. Yet the average is in excellent agreement with the results obtained from the age analysis. The mortality rates calculated above apply to the seasons 1954/55 through 1960/61 and are annual rates. The instantaneous rate corresponding to an annual rate of 0·24 is 0·27. If from this is subtracted 0·05, the natural mortality coefficient, the resultant estimate of F is 0·22. The estimate of F for approximately the same period from age analysis is 0·232. (Fourteenth Report of the Commission p. 46).

It may be asserted that the marking has not been fully representative of all stocks in the Antarctic. However the same analysis can be applied to Areas II and III only, where the largest part of the marking was carried out. The data for these areas also are shown in Table 4.

TABLE 4
Postwar marking and recoveries, Areas II and III

Season	No. marked less zero year recoveries = t_0	No. marked less zero year following season = t_1	No. of marks recovered in second and later seasons = S_{02}	No. of marks of following season recovered in first or later seasons = S_{12}	Estimated Annual mortality rate
1953/54	113	231	9	25	0·29
1954/55	231	185	23	30	0·41
1955/56	185	23	19	0	—1·36
1956/57	23	53	0	7	1·00
1957/58	53	30	2	5	0·79
				Average	0·23

This average annual rate corresponds to an instantaneous *total* mortality coefficient of 0·26 which is compared with the estimate given in the Committee's Report (Fourteenth Report of the Commission p. 46) of 0·282 (0·263 for this period for Area II, 0·201 for Area III). Taking into account that the marking rate includes a small amount of emigration the agreement is again excellent.

The same analysis can be applied to the pre-war mark data. The results are shown in Table 5.

TABLE 5

Pre-war marking and recoveries

	t_0	t_1	S_{01}	S_{11}	Estimated Annual Mortality
1934/35	761	903	70	55	—0·48
1935/36	903	1,100	53	62	—0·02
1936/37	1,100	609	44	64	0·62
1937/38	609			Average	0·04

This rate which applies to the period 1934–38 corresponds to the rate given in the Committee's Report of 0·084. The differences between these two estimates is well within the range of probability of the marking data, although it could have been contributed to by any differences in the portions of the stock marked by the research vessel doing the marking and by the industry.

A further analysis can be made comparing pre-war and post-war recoveries—this is a continuation and slight refinement of the Committee's analysis (p. 43 Table I of the Fourteenth Report of the Commission). The data are shown in Table 6.

TABLE 6

Comparison of recoveries of pre-war and post-war marks in 1953/4 and subsequent years

Season	No. marked excluding zero year recoveries	No. recovered	Recoveries from 3,413 pre-war tags	Estimated number of pre-war marked whales still alive
1953/54	118	16	77	534
1954/55	231	42	71	381
1955/56	217	48	65	288
1956/57	129	12	60	595
1957/58	151	36	50	204
1958/59	105	14	39	273
1959/60	56	4	27	302

The data of Table 4 yield an estimate of total mortality for the period 1934–38 to 1953–60 = 0·898. This implies an annual rate for this period of 0·102 which corresponds to the estimate based on age analysis for the same period of 0·094. Again the agreement is excellent.

It should be noted that although the agreement of the average mortality estimates obtained from the marking experiments with those obtained by other methods is very good, the year to year estimates show a wide diversity. The sampling errors in the estimates by this method seem to be very high.

This analysis can be taken one step further: the decline in the estimated number of living pre-war marked whales yields an estimate of the mortality rate

of these older animals in the period 1953–1960. A regression of the natural logarithm of the estimate against time yields an estimate of 0·10. This lower mortality rate applies to these very old animals—approximately 25 years old.

(b) *Efficiency of detection and return*

It has long been recognized that not all the marks on whales caught are detected and returned. This inefficiency, and changes in the proportion returned, can explain in general terms two somewhat surprising features of the marking data—the low over-all rate of return (about 10 per cent for the pre-war marking and 15–30 per cent for the post-war marking) and the comparatively high numbers of pre-war marks returned in some recent seasons (as many were returned in the 1963/64 season as in the 1946/47 season) although the increase in catching effort over this period also contributes to the latter effect. To test whether this qualitative explanation can be put in quantitative terms estimates were made of the number of whales with pre-war marks alive at the beginning of each season, using estimates of total mortality each season. These estimates, and the observed and expected numbers of marks returned are set out in the table below.

TABLE 7

Returns of Pre-war marked whales

Season	Effort	Mortality Z	Marked animals alive N	Marks returned Observed (n)	Expected (n')	Efficiency of Return (n/n')%
1945/46	8·3	0·09	1,538	10	62	16
1946/47	13·0	·11	1,406	7	84	8
1947/48	21·0	·15	1,257	10	112	9
1948/49	24·5	·17	1,081	9	119	8
1949/50	26·6	·18	917	9	109	8
1950/51	28·6	·19	767	6	97	6
1951/52	29·7	·19	637	7	84	9
1952/53	33·2	·21	527	10	77	13
1953/54	32·9	·22	428	12	62	19
1954/55	36·4	·22	349	6	55	11
1955/56	33·4	·21	278	6	41	15
1956/57	36·9	·22	226	5	36	14
1957/58	40·6	·24	180	10	32	31
1958/59	43·4	·26	145	11	27	41
1959/60	59·8	·33	109	12	27	44
1960/61	67·0	·37	82	4	22	18
1961/62	87·8	·47	54	9	19	47
1962/63	70·1	·38	34	7	10	70
1963/64	65·2	·36	23	7	6	(117)

In this table the effort has been calculated from the catcher days work corrected for tonnage, and adjusting for the ratio of fin to blue whales in the catches. The mortality has been estimated from the effort data, taking M = 0·05 and the fact that the average total mortality for males and females calculated from the ratio of 5+ to 4+ in the previous season over the period 1945/46 to 1960/61 is 0·209: 3,663 fin whales were estimated as having been effectively marked before the war; of these 1,538 were estimated as surviving to the beginning of the 1945/46 season. These decline during the post-war period to an estimated 23 at the beginning of the 1963/64 season. The expected number of marks returned does not decline so fast, due to the increases in effort; the table shows that, with the estimates of mortality used the increased number of marks actually returned must be accounted for by an increasing efficiency in the return of tags. Up to the 1963/64 season the estimates of efficiency of

detection and return are quite reasonable, but the 1963/64 estimate is an expected six returns with full efficiency, compared with an observed seven returns. This difference may merely be due to the small numbers.

TABLE 8

Returns of marks by different countries

Country	Number of marks returned	Number of whales caught	Marks per 1,000 whales	Efficiency relative to Japan
Netherlands	9	10,626	0·847	29
Norway	68	57,402	1·185	48
Japan	234	79,992	2·925	100
U.K.	29	22,099	1·312	45

If all countries were equally efficient in detecting and returning marks, the marks returned per 1,000 whales caught should be the same for all countries except for any differences in area or season fished. Clearly this is not so; Japan returns far more marks per whale than any other country, and this difference is reasonably consistent from year to year. Data were not available on the detailed returns of marks by countries and areas to test to what extent the difference could be due to differences in the areas fished, but it is unlikely that this is very important, and it is most probable that the difference represents a real difference in efficiency of return. Assuming, as an upper limit, that the Japanese are fully efficient, then the estimated efficiencies of other countries are shown in the last column of Table 8. From these national differences alone it is clear that the increasing proportion of the total catch taken by Japanese expeditions must result in an increase in the overall efficiency of return of tags, though not as great as is suggested in Table 7. However, if the greater efficiency of the Japanese expeditions is due to their greater interest in meat and other by-products, then it is likely that the general increase in various by-products will have resulted in improved returns of marks by all countries. Lacking further data, it is at least reasonable to say that the figures in Table 7 of estimated efficiency of return are not improbable, and that the pattern of long term returns from the pre-war experiments is not inconsistent with the mortality rates estimates from other material.

Within any season the efficiency of return is presumably the same for pre and post-war marks, so that the efficiencies in Table 7 can be used to estimate, from the returns, the actual number of marked whales recaptured each season. These are given in Table 9. This table gives, for each season of marking and recapture, the numbers returned with the estimated number recaptured in brackets.

Clearly there has been, at least in some seasons, too big a correction, since it is estimated that more marks were recaptured from the 1955/56 and 1956/57 seasons than were originally effectively marked. The difference is not very great, and the overall figure of 1,141 marks recaptured out of 1,456 marked or (78 per cent) is not excessive for a heavily exploited stock. In particular the figures suggest that the low returns after the first season of marks from the 1956/57 experiment were due to the high proportion caught during the first season. Using these figures of the actual recaptures in the season of marking enables revised estimates to be made of the annual mortality by Seber's method (see Table 1). (The method does not depend on knowing the efficiency of return during the recovery period, but some allowance has to be made of the loss of marked whales from the stock during the season of marking, while they are not completely mixed with the stock). The revised version of Table 3 is given on p. 38.

TABLE 9

Returns and estimated recaptures of whales marked since the war

Season Recaptured	Marked / Efficiency	1953/54	1954/55	1955/56	1956/57	1957/58	1958/59	1959/60	1960/61	1961/62	1962/63
1953/54 ...	19	4 (21)									
1954/55 ...	11	2 (18)	5 (46)								
1955/56 ...	15	5 (34)	2 (13)	10 (68)							
1956/57 ...	14	— (—)	6 (43)	13 (94)	16 (15)						
1957/58 ...	31	— (—)	5 (16)	6 (19)	3 (10)	18 (58)					
1958/59 ...	41	— (—)	1 (2)	3 (7)	5 (12)	20 (50)	16 (40)				
1959/60 ...	44	2 (4)	4 (9)	7 (15)	2 (4)	3 (7)	7 (15)	12 (26)			
1960/61 ...	18	2 (11)	7 (38)	6 (33)	1 (6)	7 (38)	5 (27)	1 (6)	13 (72)		
1961/62 ...	47	4 (8)	8 (17)	2 (4)	1 (2)	2 (4)	2 (4)	2 (4)	12 (25)	13 (27)	
1962/63 ...	70	— (—)	8 (11)	4 (6)	— (—)	2 (3)	— (—)	— (—)	2 (3)	6 (8)	9 (13)
1963/64 ...	(50)	1 (2)	1 (2)	7 (14)	— (—)	2 (4)	— (—)	— (—)	— (—)	— (—)	1 (2)
TOTAL RECAPTURED		(98)	(197)	(260)	(149)	(165)	(86)	(37)	(100)	(35)	(15)
TOTAL RETURNED		20	47	58	28	54	30	16	27	19	10
TOTAL MARKED		122	236	227	145	169	121	68	167	113	88
Per cent recaptured in Season 0		77	19	30	71	34	33	38	43	24	(mean 32·4) 15

TABLE 10

Revised estimates of mortality from post-war marked

Season	No. marked	No. marked less zero year recaptures		Number returned in		Annual Mortality
		Same Season	Following Season	S_{ss}	S_{1s}	
1953/54	122	101	190	14	42	0·31
1954/55	236	190	159	40	48	0·32
1955/56	227	159	30	35	12	0·49
1956/57	145	30	111	9	36	0·10
1957/58	169	111	81	16	14	0·22
1958/59	121	81	42	7	4	0·27
1959/60	68	42	95	3	14	0·55

The average mortality is 0·33, corresponding to an instantaneous rate of 0·40. This version has eliminated the two particularly anomalous values for the 1955/56 and 1956/57 seasons of marking. The average mortality is rather higher than other estimates (cf. the mean mortality given for the corresponding period (1954/55 to 1960/61) in Table 5 is 0·26). Table 9 shows that the returns in the season of marking are particularly high, and this high rate continues to some extent in the following seasons, (Table 11).

TABLE 11

Estimated recaptures of post-war marked whales in successive seasons after marking

Season since marking	0	1	2	3	4	5	6	7	8	9	10
Number marked	1,456	1,456	1,368	1,255	1,088	1,020	899	730	585	358	122
Number returned	116	67	34	20	11	13	13	1	19	1	1
Estimated number recaptured	486	241	149	70	27	47	50	34	33	2	2
% recaptured	33·3	16·5	10·8	5·5	2·5	4·6	5·6	4·7	5·6	0·6	1·7
Average effort	51	54	56	59	62	66	70	72	74	67	65
% recaptured per unit effort	0·650	0·303	0·191	0·092	0·040	0·070	0·086	0·065	0·075	0·009	0·026

The decline in the percentage recaptured per unit effort should give a measure of the total mortality. Plotted on a logarithmic scale the points are rather scattered, but from season 1 onwards can be fitted by a line decreasing by about 25–30 per cent per year. Recaptures in season 0 certainly, and possibly also in season 1, are significantly above this line; such extra high returns in season 1 would account for the high value (33 per cent) for the mortality obtained by Seber's method above. (In fact the corresponding estimate, using the same method, but comparing returns in seasons 3 onwards with returns in season 2 onwards from the following season marking, give a mean mortality of 22 per cent).

The high returns in season 0 (and possibly also season 1) may be due to:

(1) incomplete mixing of the marked animals with the stock in the Antarctic;

(2) the fact that, at least in season 0, all the marked animals are in the Antarctic but only part of the whole stock is there.

(3) the marked animals are less experienced and more vulnerable than the stock as a whole.

(3) is reasonable, but it is likely that the estimate of mean mortality used, which is weighted towards the mortality among the younger whales, would be biased upwards for the same reason.

(2) is a possibility often put forward. The present data do not support it, at least in the simple form of visits to the Antarctic every other year, otherwise one would expect high returns again in season 2, after low returns in season 1. It may be worth emphasizing here that for most analyses (except for sighting data and the marking returns in the early seasons) it is irrelevant whether or not part of the stock is absent from the Antarctic in a particular year, just as it is irrelevant that most, if not all, of the stock is absent from the Antarctic for part of the year. If there are animals that never go to the Antarctic, these would be excluded from the Antarctic stock, and from our estimates. The most likely explanation of the high returns in the first season is that the marks are initially concentrated in the areas where the expeditions are operating, and therefore suffer a greater fishing mortality than the stock as a whole.

5. Some additional Analysis of Blue Whales data

In addition to the methods contained in the report of the Committee of Three Scientists (Fourteenth Report of the Commission), the stock of blue whales has been estimated from data on mortality rates. Table 12 below shows mortality rates of blue whales calculated from the decline in catch per unit of effort by age. These are for 4 areas and for zones B and C since the blue whale catches in zones A and D have generally been too small and irregular for analysis in this manner. The mortality rates shown are averages over January, February and March.

TABLE 12

Mortality of Blue whales from decline in catch per unit of effort in areas II to V for* 1947–1951

Area	II	III	IV	V	Total
Season					
1946/47	·833	1·131	·742	·123	
1947/48	·149	·144	·086	·519	
1948/49	·939	·404	·907	·159	
1949/50	·232	·252	·380	·488	
1950/51	·832	·394	·006	·376	
Average total mortality coefficient	·504	·407	·424	·269	
F	·454	·357	·374	·219	
Average catch 1947–51	1737·6	2155·6	1724·8	1375·6	
Average stock size 1947–51 ...	3,827	6,124	4,612	6,281	20,844

The third last line in Table 12 is calculated by assuming that M = 0·05 as for fin whales and hence F is the total mortality rate less 0·05. The average stock size is as usual average catch divided by average F. The age estimates used for this table are based on age-length keys derived from ovary age reading. Only scattered values are available for other seasons since it is necessary that there be reasonable catches in the same month and area in successive years to apply this method.

* Effort = CDW uncorrected for tonnage.

To check on the validity of this method a De Lury has been calculated of the blue whale population in Areas II to V. The data for this are shown in Table 13. A De Lury estimate was calculated in the Committee's original analysis—this was based on all series B and C data. (Fourteenth Report of the Commission, pp. 63–65).

TABLE 13

Data for De Lury Analysis of Blue Whale Stocks in Areas II–V, 1953/54—1962/63

	Catches of Blue Whales/CDW corrected for tonnage	Cumulative catch* beginning in 1953/54 season (areas II–V)
1953/54	·209	0
1954/55	·164	2,550
1955/56	·147	4,576
1956/57	·075	5,652
1957/58	·120	6,337
1958/59	·091	7,455
1959/60	·060	8,396
1960/61	·028	9,168
1961/62	·025	9,562
1962/63	·014	10,011

From Table 13 it is estimated that the blue whale stock in these areas at the beginning of the 1953/54 season numbered 10,300. A correction should be made for the net recruitment that still existed during this period: because this is not done the estimate may be expected to be too high.

A comparison of these estimates is of interest. The average catch/CDW for 1946/47—1951/52 for these four areas is 0·42 while for 1953/54 it is 0·18. On this basis the 1953/54 average population should have been $\frac{1}{4}\frac{8}{2} \times 20{,}844$ or approximately 8,960. Adding on half the seasons catch (1,275) yields an estimate of about 10,000. The agreement between the two estimates is excellent.

This estimate ignores the Area I and VI blue whale stocks but these are undoubtedly small. For the period 1953/54—1962/63 the average catch of Area I and VI combined was 20 per cent of the total pelagic catch in all areas. Thus the stock in these areas in 1953/54 numbered around 2,000. Then the 1953/54 total was about 12,000 and the 1962/63 stock size was below 1,000 (about 600 according to the best estimate).

6. *Variations in catch rates as between expeditions of different nationalities*

In the report of the Committee of Four Scientists (I.W.C., 15th Report, 1965, Appendix V, p. 52) it was pointed out that there are substantial differences in the catches per unit effort of fin whales, and in B.W.U's. per catcher day, between expeditions, that these differences had some consistency in terms of nationality, and that they showed different trends over a period of years. With changes in the relative whaling effort by the different nations, this could lead to a bias in the estimates of changes in stock abundance which would not be eliminated merely by correcting for the tonnage of catchers or other common index of efficiency. An additional bias might arise if there were, as a consequence of the stock decline and of the reduction in number of expeditions, a change in the number of catchers per expedition. The Working Party, therefore, re-examined the data shown graphically in Fig. 1 of the above report, with the corresponding data for the 1964/65 season. The results are summarized in Table 14.

* Pigmy whales caught by Japan removed from these totals.

Differences between countries observed in previous years were maintained in 1964/65 but the change in the catch per unit effort of fin whales now appeared to be rather different from that of the total catch in B.W.U per unit effort. This is because of the general change in preference towards sei whales and the fact that this change was more pronounced for some countries than others. A better indication is therefore given by catch of fin plus sei, or of B.W.U. per unit effort (see right hand column of Table 14) and here the order of the various countries remains constant from year to year.

TABLE 14

Trends in catches per catcher day by expeditions of different nationalities

Country	Catch per catcher day Fin Whales			B.W.U.		
	1962/63	1963/64	1964/65	1962/63	1963/64	1964/65
A	1·38	1·30	·64	·81	·70	·56
B	·91	·55	·17	·55	·39	·31
C	·53	·36	·31	·34	·27	·27

Changes in average "efficiency" that might accompany the slight changes in the proportion of total effort executed by each country following the reduction in total number of expeditions in 1965/66 were examined. It does not seem likely that the overall effect of this can be to alter the average efficiency by more than 5 per cent.

A greater bias might be introduced by a change in the average efficiency of expeditions as a result of selective withdrawal of expeditions from whaling operations. It seemed likely that such a change may be greater between the 1964/65 and 1965/66 seasons than in previous pairs of years because of the considerable reduction in the number of expeditions operating: from 15 to 10, or about 33 per cent of the potential pelagic whaling effort. The Working Party therefore examined the likely magnitude of such a bias, by an analysis of the catch per day in each year by each expedition.

First it was found that there is some consistency in the differences in annual fin whale catch per catcher day as between the various expeditions of each nationality, as well as between nationalities. That is to say the more successful expeditions (in terms of catch per catcher day) within a national fleet in one year tended to be the more successful ones in other years, but of course there were many individual exceptions to this general rule. This indicated that it would be worthwhile to calculate the year to year change in abundance of whales from the catches and efforts only of those expeditions which operated in both of each successive pair of seasons. A preliminary examination of the consequences of doing this over the period 1953/54 to 1964/65 showed that in certain pairs of years the change in composition of the total fleet from one year to the next may have caused a bias in the estimates of the change in whale abundance of up to about 5 per cent, but in most pairs much less than this. Therefore, although these estimates would undoubtedly be improved by taking account of data from expeditions operating in successive pairs of years, the Working Party did not consider it essential at this time to revise the indices of abundance previously obtained.

However, it did seem possible that a greater bias might occur from 1964/65 to 1965/66, if, for example, within the fleet of each country, the expeditions with the lower catches per unit effort in past years were the ones now withdrawn from operation.

Because of the differential preferences for sei and fin whales in recent years

the catches of fin plus sei, and of B.W.U's. per catcher day were analysed. First the Working Party calculated the consequences of including only the expeditions with highest performance from each national fleet (2 from Norway, 3 from U.S.S.R., 5 from Japan) on basis of the 1964/65 and earlier catches per unit effort. It was found that, on this hypothesis, the estimate of the 1965/66 stock could have an upward bias of 6–7 per cent compared to that of 1964/65. However the elimination of expeditions is not in fact following this simple rule. The mean of the catches per unit effort in 1964/65 by the five expeditions which are not operating in 1965/66 was the same as that of the ten which are actually operating. This is because the expeditions eliminated from one national fleet are those which tended to have lower catches per unit effort, but from another fleet they are the ones with rather higher than average catches per unit effort. Therefore, there is nothing to be gained by comparing the 1965/66 results, when the data become available, with the 1964/65 data for the same ten expeditions. Nevertheless, in future years it will be necessary to keep a watch for, and when necessary take account, of bias arising from changes in fleet composition if the fleets are further reduced. In doing this not only should change in average tonnage of catchers (or index of their individual efficiency) be taken into account, but also changes in the number of catchers with each particular expedition. It may also be expected that the more efficient catchers and gunners will "survive" and this will of course lead to some bias in the estimates which would not be detected by this method of analysis.

7. *Statistical tables*

The Working Party examined the proposals put forward by Mr. Vangstein (Bureau of International Whaling Statistics) on the basis of the suggestions made by members of the Scientific Committee's group who had studied the arrangement of the published statistical tables. The following suggestions are made for the presentation of the 1965 and 1965/66 statistics, which might be further considered by the Scientific Committee:

(1) In order to avoid the very wide range of starting dates of different historical tables as published at present, the form of such tables should be standardized. This should be done as follows: Historical tables could be given once every ten years, and cover the whole period, starting about 1920, or give average values for previous and annual values for last decade. In the intermediate periods these tables could be cumulative starting from the year following the last year covered in the last ten-years tables.

(2) The tables should be rearranged to bring as much as possible all relevant data on each particular aspect together in one table. This should at the same time bring economics in the space needed and prevent duplication of data and doubts about the correct understanding of the contents of some tables. Lay-outs of the suggested revised tables have been sent to Mr. Vangstein, who will prepare the tables for consideration by the Scientific Committee.

As an example, pelagic catch by species, catching days and size of catchers (in tonnage) were previously in three different tables, and are here brought into one table together with the catch per catcher day by species. Tables with data on length distribution, average size and pregnancy distribution could be very much reduced in size by combination and rearrangement without change in content.

This rationalization has been achieved by omitting some fringe data.

(3) An increase in the detailed information on pelagic whaling in the Antarctic. This information, not available in the printed statistics, is required for assessment study; it includes a further area breakdown of the

length-distributions in the Antarctic catches, and additional tables containing a more detailed breakdown of catch and effort data by area and month and a table of catches per country and expedition.

(4) Some minor data contained in the previous printed statistics should be omitted. These concern days worked per catcher, barrels produced per floating factory, mean lengths of whales captured by individual companies, oil production by company, and data on whale foetuses. Part of these data can, if desired, still be calculated from the data in the proposed tables.

(5) The main attention has been given to the Antarctic tables, but revision is also needed in the other tables. The Antarctic length distribution tables give the basic form suggested for all length and maturity-data and have been extended to contain data from all whaling grounds outside the Antarctic. These tables together with tables giving the monthly and annual figures of effort and landings by whale species for all whaling grounds outside the Antarctic provide in a condensed and easily accessible form nearly all the essential information at present contained in the odd-numbered volumes of the International Whaling Statistics except the data by whaling country, and data on oil production. Data by whaling country could be given in an annual table as for the Antartic whaling, whereas oil production by country could be given in a historical table.

(6) It seems that in this way all important data for both the Antarctic and the other whaling grounds can be given in one volume of the International Whaling Statistics, of a size which is probably not much bigger than one of the present volumes and certainly less than the two volumes published annually up till now. If this were decided, it is most convenient if the data on whaling outside the Antarctic for a certain calendar year are combined with the Antarctic data of the season starting at the end of that year. The volume would then contain tables grouped in the following way:

(a) Antarctic: Overall production and catch/effort statistics

(b) Antarctic: Detailed catch/effort statistics

(c) Outside Antarctic: Overall production, catch and effort statistics

(d) Outside Antarctic: Detailed catch and effort statistics

(e) All grounds: Length and maturity statistics.

The Working Party noted that age-length data had not been made available to the Commission since the initial compilation for the Committee of Three. Much further data exists in national laboratories, especially for sei whales and the unavailability of these data is seriously impeding further assessments of the whale stocks on an international basis. It is therefore, strongly recommended that data for the recent years (from 1961/62) should as soon as possible be submitted on forms A, C, D and G and that in future such data should be submitted annually. The earlier data, on cards, are at present in the care of the Chairman of the Committee of Three (now Chairman of the Scientific Committee) and it is suggested that the Commission should decide on the future location of the basic data and the route of its submission. The various possibilities seem to be:

(1) Chairman of the Scientific Committee

(2) I.W.C. Secretariat

(3) B.I.W.S.

(4) F.A.O. Fisheries Data Centre.

In deciding on the location, the Committee feels that consideration should be given to the desirability of storing the data at a permanent centre where staff and facilities for storage are available, and where, if possible, facilities for carrying out computations are accessible.

ANNEX I

TABLE I

Southern Hemisphere land stations

Numbers of whales caught (humpback not included)

Blue Whales	Austr.	Brazil	Chile	New Zealand	Peru	S. Africa	Total	S. Georg.	Grand Total
1950	—	—						82	
1951	—	—	77	—	4	24	105	6	111
1952	—	—	143	—	7	19	169	4	173
1953	—	—	172	—	10	9	191	13	204
1954	1	—	70	—	8	10	89	13	102
1955	—	—	150	—	8	6	164	3	167
1956	—	—	209	—	—	5	214	7	221
1957	—	—	100	—	—	9	109	6	115
1958	2	—	166	—	—	7	175	1	176
1959	12	—	80	—	—	3	95	9	104
1960	2	—	131	—	—	7	140	4	144
1961	—	—	142	—	—	9	149	—	149
1962	4	1	11	—	—	8	24	—	24
1963	1	—	31	—	—	7	39	—	39
1964	—	—	112	—	—	6	118	—	118
Fin Whales									
1950	—	—		—				1,982	
1951	—	—	279	—	21	1,007	1,307	2,007	3,314
1952	—	—	424	—	14	754	1,192	1,670	2,862
1953	1	—	283	—	28	569	881	2,673	3,554
1954	—	—	434	—	30	515	979	2,746	3,725
1955	—	—	359	—	7	477	843	2,669	3,512
1956	1	1	202	—	1	613	818	2,057	2,875
1957	—	—	69	—	—	901	970	2,251	3,221
1958	—	1	73	—	—	943	1,017	1,291	2,308
1959	1	—	70	—	—	964	1,035	1,160	2,195
1960	—	21	52	—	—	993	1,066	1,387	2,453
1961	—	10	16	—	—	823	849	661	1,510
1962	—	49	34	—	—	541	624	—	624
1963	—	4	11	—	—	402	415	552	969
1964	—	—	136	1	—	300	437	503	940
Sei Whales									
1950	—	98	—	—		428		519	
1951	—	151	2	—		484	637	498	1,135
1952	—	157	10	—	17	866	1,051	498	1,549
1953	—	161	24	—	36	391	612	778	1,390
1954	—	183	26	—	2	71	282	423	705
1955	—	200	32	—	1	176	409	284	693
1956	—	196	48	14	—	101	359	980	1,339
1957	—	115	39	2	—	323	479	924	1,403
1958	—	118	16	—	—	577	711	1,019	1,730
1959	—	294	17	2	1	904	1,218	1,075	2,293
1960	—	750	13	—	—	681	1,444	792	2,236
1961	—	958	13	1	—	703	1,675	447	2,122
1962	2	610	9	—	—	707	1,328	—	1,328
1963	3	346	6	—	—	1,090	1,445	409	1,854
1964	—	256	47	4	—	955	1,262	506	1,768

ANNEX I

TABLE 11

Southern Hemisphere land stations
No. of catchers

.	Austr.	Brazil	Chile	New Zealand	Peru	S. Africa	Total	S. Georg.	Grand Total
1950	4	2		3		25		21	
1951	6	2	10	3	51	27	99	21	120
1952	10	2	10	3	1	26	52	21	73
1953	9	2	8	3	6	20	48	21	69
1954	9	2	12	3	19	12	57	21	78
1955	9	2	13	3	6	13	46	21	67
1956	11	3	12	4	6	13	49	21	70
1957	12	3	13	4	8	15	55	20	75
1958	13	2	13	3	8	16	55	21	76
1959	13	3	14	6	8	16	60	21	81
1960	14	5	16	6	8	17	66	16	82
1961	12	4	10	8	8	17	59	8	67
1962	13	3	10	6	9	16	57	—	57
1963	8	3	10	1	9	18	49	16	65
1964	3	1	13	1	10	15	43	21	64

ANNEX I

TABLE III

Southern Hemisphere land stations

Catch per catcher, (Humpbacks not included)

	Australia				Brazil				Chile			
	Blue	Fin	Sei	B.W.U.	Blue	Fin	Sei	B.W.U.	Blue	Fin	Sei	B.W.U.
1950	—	—	—	—	—	—	49·0	8·2				
1951	—	—	—	—	—	—	75·5	12·6	7·7	27·9	0·2	21·7
1952	—	—	—	—	—	—	78·5	13·1	14·3	42·4	1·0	35·7
1953	—	0·3		0·1	—	—	80·5	13·4	21·5	35·4	3·0	39·7
1954	0·3	—	—	0·3	—	—	91·5	15·3	5·8	36·2	2·2	24·3
1955	—	—	—	—	—	—	100·0	16·7	11·5	27·6	2·5	25·8
1956	—	0·3	—	0·1	—	0·3	65·3	11·1	17·4	16·8	4·0	26·5
1957	—	—	—	—	—	—	38·3	6·3	7·7	5·3	3·0	10·9
1958	0·5	—	—	0·5	—	0·5	59·0	10·1	12·8	5·6	1·2	15·8
1959	3·0	0·3	—	3·1	—	—	98·0	16·3	5·7	5·0	1·2	8·4
1960	0·5	—	—	0·5	—	4·2	150·0	27·1	8·2	3·3	0·8	10·0
1961	—	—	—	—	—	2·5	239·5	41·2	14·2	1·6	1·3	15·2
1962	1·0	—	0·5	1·3	0·3	16·3	203·3	42·4	1·1	3·4	0·9	3·0
1963	0·3	—	0·8	0·6	—	1·3	115·3	19·9	3·1	1·1	0·6	3·8
1964	—	—	—	—	—	—	256·0	42·7	8·6	10·5	3·6	14·5

	New Zealand				Peru				S. Africa			
	Blue	Fin	Sei	B.W.U.	Blue	Fin	Sei	B.W.U.	Blue	Fin	Sei	B.W.U.
1950									0·5	22·6	17·0	15·0
1951	—	—	—	—	0·1	0·4	0·02	0·3	0·9	37·3	17·9	22·5
1952	—	—	0·3	0·1	7·0	14·0	17·0	17·2	0·7	29·0	33·3	20·8
1953	—	—	—	—	1·7	4·7	6·0	4·6	0·5	28·5	19·6	18·0
1954	—	—	—	—	0·4	1·6	0·1	1·2	0·8	42·9	5·9	23·2
1955	—	—	—	—	1·3	1·2	0·2	1·9	0·5	36·7	13·5	21·1
1956	—	—	3·5	0·6	—	0·2	—	0·1	0·4	47·2	7·8	25·3
1957	—	—	0·5	0·1	—	—	—	—	0·6	60·1	21·5	34·2
1958	—	—	—	—	—	—	—	—	0·4	58·9	36·1	35·7
1959	—	—	0·3	0·1	—	—	0·1	0·02	0·2	60·3	56·5	39·8
1960	—	—	—	—	—	—	—	—	0·4	58·4	40·1	36·3
1961	—	—	0·1	0·02	—	—	—	—	0·5	48·4	41·4	31·6
1962	—	—	—	—	—	—	—	—	0·5	33·8	44·2	39·5
1963	—	—	—	—	—	—	—	—	0·4	22·3	60·6	21·5
1964	—	1	4·0	1·2	—	—	—	—	0·4	20·0	63·7	21·0

ANNEX I

TABLE IV

Total B.W.U. Southern Hemisphere
Land Stations (humpback not included)

	Except S. Georgia		Including S. Georgia	
	B.W.U.	B.W.U. per catcher	B.W.U.	B.W.U. per catcher
1951	865	8·7	1,957	16·3
1952	940	18·1	1,862	25·5
1953	734	15·3	2,213	32·1
1954	626	11·0	2,083	26·7
1955	654	14·2	2,039	30·4
1956	683	13·9	1,882	27·0
1957	674	12·3	1,960	26·1
1958	802	14·6	1,618	21·3
1959	816	13·6	1,584	19·6
1960	914	13·9	1,744	21·3
1961	853	14·5	1,258	18·8
1962	557	9·8	557	9·8
1963	489	10·0	833	12·8
1964	547	12·7	833	13·8

CHAIRMAN'S REPORT OF THE SEVENTEENTH MEETING

APPENDIX C

REPORT ON THE EFFECTS ON WHALE STOCKS OF PELAGIC OPERATIONS IN THE ANTARCTIC DURING THE 1965/66 SEASON AND ON THE PRESENT STATUS OF THOSE STOCKS

by

Stock Assessment Section, Fishery Resources and Exploitation Division,
Food and Agriculture Organization (F.A.O.)

SUMMARY

Catching effort was sharply reduced in 1965/66, only ten expeditions operating for a total of 13,146 catcher days.

The catch of fin whales was also greatly reduced to 2,312 from 7,303 in 1964/65 sei whale catches were more nearly maintained at 17,558 as against 19,845. In B.W.U. the catch was 4,083.

In catch/catcher day the rate of catch of fin whales fell from 0·42 to 0·18 but that for sei whales rose from 1·13 to 1·34. These changes can be correlated with a continuation of the 1964/65 trend towards giving preference to sei whales. This was manifested in a further increase in the proportion of total effort exerted in the Northern series D (40°–50°S, 55 per cent of effort and 75 per cent of sei whale catch); although there was also some concentration in series B (60°–70°S, 25 per cent of effort). The extreme concentration on Division II W which was noted in 1964/65 (42 per cent of effort) was not maintained although it was still the most heavily worked division (25 per cent).

The difference in catching rate by catchers of different nationalities has also continued although the figures are complicated by obvious differences in national policies as to selection between fin and sei whales.

Due to the great difference in the local distribution of sei and fin whales, and the concentration of the catchers in the areas of sei whale abundance, it is not now possible to use the relative rates of catch as an index of the relative abundance of the two species.

After examining the distribution by divisions and months of effort and sei whale catches it is concluded that the catch/day by months gave an acceptable index of abundance of the stock in Division II W in 1964/65 and 1965/66; in this division the catch/day was in 1964/65 1·90, and in 1965/66 1·46; if, as may be desirable, the figures for December are excluded the figures are for 1964/65 2·12 and for 1965/66 1·24. The 1965/66 catch rate as a proportion of the 1964/65 rate is 0·76 (0·58).

Using the proportional decline in catch rate in Division II W and the known catch, an estimate of the sei whale population of Division II W is obtained and is extended to give an estimate of the total Antarctic sei whale population in May 1966 of 61,000 to 131,000, the lower figure being the more probable.

If the lower figure is correct the present sustainable yield is about 4,500 sei whales and it would be important not to exceed this figure if the maximum yield is to be maintained. If the upper figure is correct the maximum sustainable yield is about 7,500 and the stock may be still above the optimum level so that catches above this level would, for a time, be beneficial.

No revision of the fin whale population estimates can be made on account of the swing to sei whales, but extension from the previous estimates gives an estimate of the present stock of 37,700 with a sustainable yield of 4,500.

The effect of any particular quota based on B.W.U. will depend on the proportions of fin and sei whales in the catches. For example if the present sei whale stock is at the high figure of 150,000 a quota of 3,000 B.W.U. would in three years further reduce the combined sustainable yields by 3 per cent if the species were taken in equal numbers, but would increase it by 30 per cent if only sei whales were taken. At lower stock levels different effects would occur. In this situation the previous recommendations for separate species quotas have additional force since without them uncontrolled variations in the species caught may occur from year to year.

For fin whales recovery to a sustainable yield of 15,000 would be quickest with a complete closure and would now take about 15 years.

There would be great advantages in having a complete closure on fin whales and using the sei whales to "buy time" while the fin whales recover. If such a policy is desirable it would be possible to examine whether a given quota could be maintained on sei whales until the fin whales had multiplied sufficiently to support it with a margin for further increase. Quotas up to about 2,500 B.W.U. could probably be sustained in this way and would allow a return to fin whaling in about 10 years; larger quotas would only be possible if the present sei whale population is in the upper part of the range of estimates.

1. *Introduction*

Following the agreement between the International Whaling Commission and F.A.O., that F.A.O. would undertake, in cooperation with the Commissions' Scientific Committee, the continuing assessment of the Antarctic whale stocks, a joint F.A.O./I.W.C. Working Party met in Seattle in January 1966 to review the analyses previously made by the Commission's Special Committee of Four Scientists, and in particular to see whether a more detailed analysis including

recent data would lead to revisions of the estimates. The report of the Working Party is presented to the 18th Meeting of the Commission. During the meeting of the Joint Working Party it was agreed that, Mr. J. A. Gulland and Mr. L. K. Boerema, would work at F.A.O. as soon as the statistical data for the 1965/66 pelagic whaling season were available, to prepare a report on the status of the stocks at the termination of this season, in time for the report to be considered at the 18th Meeting of the Commission. Their meeting took place in Rome from 2–5th May 1966. The present report does not contain any re-appraisal of data for the previous seasons but brings up to date the analyses and conclusions mentioned above and those contained in the F.A.O. report presented to the Commission's Special Meeting in May 1965 (published as F.A.O. Fisheries Technical Paper No. 59, 1965). The data for this report were kindly provided by the Bureau of International Whaling Statistics.

2. *The* 1965/66 *Season*

During the 1965/66 Antarctic pelagic season 10 expeditions (five Japanese, three Russian and two Norwegian) operated. This is five less than in the 1964/65 season. The basic statistics of their operations, and the comparable figures for the previous four seasons, are given in Table 1.

TABLE 1

Catches and effort by Antarctic expeditions

Season	Catcher days	Average catcher tonnage	Catches			Catch/uncorrected catcher-day		
			Fin	Sei	B.W.U.*	Fin	Sei	B.W.U.*
1961/62 ...	29,952	657	26,364	4,716	13,968	0·88	0·16	0·47
1962/63 ...	22,504	703	18,636	5,482	10,232	0·83	0·24	0·45
1963/64 ...	20,407	709	13,853	8,256	8,448	0·68	0·40	0·41
1964/65 ...	17,521	715	7,303	19,845	6,980	0·42	1·13	0·40
1965/66 ...	13,146	743	2,312	17,558	4,083	0·18	1·34	0·31

* Including Blue Whales

The most striking feature of the 1965/66 catches is the drastic reduction in the fin whale catches, to less than a third of the previous season, and less than a tenth of the average annual catches in the nineteen fifties. The sei whale catch also fell slightly, but less than the total effort (which in terms of catcher-days fell proportionally less than the 33 per cent reduction in number of expeditions) and the catch per catcher day of sei rose. This increase was not enough to counteract the fall in fin whale catch per catcher day, so that the catch per day in B.W.U. fell (from 0·40 to 0·31), as did the number of whales per day (from 1·55 to 1·52) and the probably most realistic index of the economic return the fin whale equivalent counting two (rather than three) sei whales as being worth as much as one fin whale (from 0·98 fin whale equivalents to 0·85).

The sharply increasing proportion of sei whales in the catches is also shown clearly in the monthly catches given in Table 2.

In the report on the 1964/65 seasons catches (Fib/T59 and I.W.C./S.M./3) the increased attention paid to sei whales was apparent in the changing distribution of the fleet, and could to some extent be corrected to give better indices of abundance of both fin and sei whale stocks by using detailed statistics concerning the position of the expeditions. In that report the total catch in each

statistical division was used, generally without taking into account the month of operation; as Table 2 shows the relative attention paid to sei whales, as measured by the sei/fin ratio increased in all months of the 1964/65 season, as compared with the 1963/64 season. In the 1965/66 season, however, the increase in the proportion of sei whales relative to the 1964/65 season, was extremely great in December, moderately so in January and February, but in March and April, the proportion of sei whales was no higher than in 1964/65. In the following analysis therefore the data have where possible been considered in terms of month as well as division. The detailed statistics for the last two seasons are given in the Annex.

TABLE 2

Monthly catches of sei and fin whales

	Fin Whales			Sei Whales			Ratio Sei/Fin		
Month/Season	63/64	64/65	65/66	63/64	64/65	65/66	63/64	64/65	65/66
December	2732	2452	326	552	1001	3202	0·20	0·41	9·82
January	4338	2351	624	3204	7214	5692	0·74	3·07	9·12
February	4164	1328	403	2451	7690	5588	0·59	5·79	13·87
March	2482	1086	878	1867	3869	2894	0·75	3·56	3·30
April	137	88	81	182	161	182	1·33	1·83	2·25
TOTAL	13,853	7305	2312	8256	19,845	17,558	0·60	2·72	7·59

The summaries by series and areas, given in Tables 3 and 4, show that the shift towards the northern series (D. 40°–50°S) was continued, some 55 per cent of the total effort being exerted in this series and from it some 75 per cent of the total sei whale catch was taken. There was however also an increase in the proportion of the effort in series B (60–70°S), from less than 10 per cent to about 25 per cent. As between areas the emphasis on area II W(30°–60°W) decreased, and over the season as a whole the effort was spread over all the areas except Area I; in individual months there were concentrations of effort, and more especially catches of sei whales, in particular areas (II West in December and January, II East in February and III in March).

Because the interest of the expeditions is now primarily concentrated on sei whales, the catch per unit effort of fin whales is not a reliable index of their abundance, even when allowance is made for the geographical distribution of fishery (though such area analysis does show that the fin whale stock has not declined to the extent suggested by the drastic fall in total fin whale catch). Conversely, since 1965/66 is the second season in which sei whales make up the major part of the catch, it is beginning to be possible to make independent estimates of the abundance of sei whales from their catches per unit effort.

Table 1 shows that the average catcher tonnage has risen by about four per cent from season 1964/65 to season 1965/66, which indicates that on the average smaller, and thus less effective, catchers have been eliminated. This rise in average catching efficiency should be taken into account in the evaluation of the catch figures.

Another factor affecting the catch figures concerns the differences in the catches per unit of effort between expeditions of different nationality, described in the report of the Committee of Four Scientists (I.W.C. 15th Report, 1965, Appendix V, p. 52), and also discussed in the report of the Joint F.A.O./I.W.C. Working Party (Appendix B). The differences were also apparent in the 1965/66 season, as shown in Table 5.

TABLE 3

Percentage distribution of catcher days in each season by area

Season	Sub-Area II W 30–60° W	Sub-Area II E 0–30° W	Area III 0–70° E	Area IV 70–130° E	Area V 130° E—170° W	Area VI 170°—120° W	Area I 120°—60° W	All Areas
1962/63	13·1	14·0	41·7	12·4	5·6	2·7	10·5	100
1963/64	12·4	28·8	32·5	9·6	16·2	—	0·5	100
1964/65	41·7	18·0	9·8	13·0	17·0	—	0·5	100
1965/66	28·2	21·2	19·0	4·7	19·2	7·4	0·2	100

TABLE 4

Percentage distribution of catcher days by series

Series / Season	D 40–50° S	A 50–60° S	B 60–70° S	C 70–80° S	All Series
1962/63 ...	22·3	45·3	32·3	0·1	100
1963/64	22·7	62·4	14·9	—	100
1964/65 ...	38·3	52·2	9·5	—	100
1965/66 ...	54·7	19·9	25·4	—	100

TABLE 5

Trends in catches per catcher day by expeditions of different nationalities

Country	Catch per catcher day											
	Fin Whales				Sei Whales				B.W.U.			
	1962/63	1963/64	1964/65	1965/66	1962/63	1963/64	1964/65	1965/66	1962/63	1963/64	1964/65	1965/66
A	1·38	1·30	·64	·19	·14	·31	1·40	2·32	·81	·70	·56	·48
B	·87	·66	·17	·18	·53	·83	1·33	1·51	·52	·47	·31	·34
C	·53	·36	·31	·17	·32	·46	·66	·44	·34	·27	·27	·16

The table demonstrates that the catch per day in all countries showed a similar downward trend, with the exception of country B where a relatively large decrease in the 1964/65 season was followed by a slight increase in 1965/66, with the result that the catch per day in 1965/66 showed a decline relative to the 1963/64 season of about the same order as that of the other countries. Greater differences exist between the catches per day of the individual species by the three countries. Whereas the sei whale catch rates of countries A and B continued to increase until the 1965/66 season, the catch rate of sei whales in country C fell off after 1964/65. This shows the differences in species preference and thus in catching efficiency by species of the catchers belonging to expeditions of different nationality.

Most of the analyses in this report have been based on data by statistical division. Although the average catching efficiency of the catchers has increased, the efficiency of the catchers in each statistical division depends on the actual size and nationality of the catchers operating in that division. It has not been possible to include these factors in the analyses carried out in this report and therefore all data given refer to actual uncorrected catches days. It is believed, however, that the inaccuracies resulting from this approach do not materially alter the conclusions reached in this report except for a general over-estimation of the catch per effort in the 1965/66 season proportional to the average increase in catcher efficiency (4 per cent increase in tonnage).

3. *Sei Whales*

(3.1) Catch, and catch per day*

In the previous report a first estimate of the abundance of sei whales was made, based on the ratio of catches per unit effort of fin and sei whales, and the abundance of fin whales. From this the stock in November 1964 was estimated as some 60,000 sei whales. Even allowing for net recruitment (probably of the order of 3,000 whales per year) it is clear that the large catches since then of altogether 37,000 whales would be expected to have reduced very substantially the stock and hence the catch per unit effort. In fact the ratio of the catch to total effort in 1965/66 was about 20 per cent higher than in 1964/65 (1·34 compared with 1·19 whales/day), and approximately the same increase occurred in the average of the catch/day in the 13 divisions which were fished in both seasons (0·89 : 0·74). However, these figures do not take into account either the changes in the pattern of fishing in different months, or possible differences in the changes in stock in different areas.

Little definite information is available on the possible separation of different stocks of sei whales; lacking such information it is reasonable to assume that like the other baleen whales, sei whales make predominantly north-south migrations, and form more or less discrete stocks, which may correspond to the statistical areas. The big catches of sei whales, particularly in the 1964/65 season, were concentrated in one area, II West (see Table 6) so that the stock in that area would be expected to decrease, while in the other areas the stocks may not have changed much.

This is confirmed by a comparison of the detailed monthly figures in the Annexe tables. This shows that in Area II West in those months and series in which there was catching in both the 1964/65 and 1965/66 seasons the catch/day in 1965/66 was lower in five cases, and higher only in December for series D. In December 1964 substantial catches of fin whales were taken in that division (554, compared with 368 sei whales),

* The catch per catcher day will hereafter for brevity, be referred to as "catch/day".

suggesting that the expeditions had not yet started to concentrate on sei whales. In December 1965 in the same division, only nine fin whales were caught, compared with 2,927 sei whales, suggesting a concentration on sei whales from the beginning of the 1965/66 season. Even accepting the December series D figures without adjustment, the average of the catch/day by division and months in Area II W is considerably less in 1965/66 than in 1964/65, as is shown in Table 7.

TABLE 6

Catches of sei whales by Area

Season	Area						
	II W	II E	III	IV	V	VI	I
1959/60	395	28	230	526	1649	232	159
1960/61	979	167	336	103	563	2030	102
1961/62	1008	241	427	633	409	369	1629
1962/63	1583	229	1457	631	430	345	807
1963/64	1623	2527	1984	274	1820	—	28
1964/65	13690	1891	453	1564	2207	—	40
1965/66	8321	4432	2724	436	1014	599	32
TOTAL	27599	9515	7611	4167	8092	3575	2797

TABLE 7

Average of monthly catches/day in those divisions for which data are available for both 1964/65 *and* 1965/66 *seasons.*

Area	II W	II E	III	IV	V	VI	I
No. of division/months ...	6 (5)	9 (8)	9	2	7	—	1
1964/65	1·90 (2·12)	0·67 (0·62)	0·46	0·86	0·55	—	0·62
1965/66	1·46 (1·24)	1·06 (0·57)	0·78	0·63	0·47	—	1·07
Ratio 1966: 1965	0·76 (0·58)	1·58 (0·92)	1·70	0·73	0·85		1·73

For Area II W the values obtained if the catches/day December series D are omitted, are shown in parentheses. In Area II E there is also one division month for which the catch/day might be considered unreliable—January series D, in which in 1966 were 12 catcher-days (one expedition operating for one day), giving the exceptionally high figure of 4·42 sei whales/day, compared with 0·49 in January 1965. Again the values obtained omitting this division/month are shown in parentheses.

In Area II W the catch/day decreases, but in some of the other areas (possibly including II E) the apparent catch/day still increases. This is probably because in at least some of these areas in the 1964/65 season the main attention of the expeditions was still directed to fin whales (in Areas III nd I more fin whales than sei whales were caught and in Area II E only 10 per cent more sei whales than fin whales), see Table 8, so that in these areas there was still a possibility for paying more attention to sei whales. In the 1965/66 season, sei whales predominated in all areas, so that it is unlikely that the overall catch/effort of sei whales can be appreciably increased by further concentration on sei whales.

TABLE 8

Ratio of catches of sei whales to fin whales in different areas in the 1964/65 and 1965/66 seasons

Season/Area	II W	II E	III	IV	V	VI	I
1964/65	4·97	1·10	0·38	2·04	2·95	—	0·61
1965/66	45·20	9·63	2·70	6·92	2·63	2·94	6·40

(3.2) Ratio of sei to fin whales

In last year's report, when discussing the effect of different quotas, it was expected that the sei : fin ratio in 1965/66 would be in the range 1 : 1 to 2 : 1—very different from the observed ratio of 7·6 : 1. Implicit in the argument on which the prediction of the radio was based was the assumption that the catch/effort of fin whales would remain a reasonable index of the abundance of fin whales, or, in other words, that the fleet would continue to operate roughly the same hunting grounds as before, and that the increase in the sei : fin ratio was due in part to a real increase in the ratio of sei whale to fin whale abundance as the fin whale stock declined, and particularly to increased concentration on sei whales, giving greater catches of that species. Table 8 and in more detail Annex Table IV, show that there are areas e.g. in the northern part of Area II W where the fin whale catches in the 1965/66 season were extremely small. If we may assume that, even if the fleets are concentrating on sei whales, they will not hesitate to hunt any fin whale which is encountered, it follows that very few fin whales were present in these areas. In 1965/66 much effort was concentrated in those areas where fin whales were very scarce, and where, presumably, the sei whale concentrations were greater than on the grounds where the effort was concentrated in previous years, making the catch/effort of fin whales an under-estimate of the fin whale stock, and giving a large value for the sei : fin ratio. Since there are areas in which useful catches can be taken (i.e. more than 100 whales in 1965/66) in which the sei : fin ratios in 1965/66 range from 300 : 1 to 1·2 : 1 it is likely that quite small changes in either the abundance of, or the commercial preference for, one or the other of the two species would cause the ships to move to other grounds and so make a very big difference in the ratio of sei : fin in the catches. So far as the southern areas (series A and B, and probably parts of D) are concerned the two species seem to be reasonably well mixed (see Annex tables so that the previous conclusion holds good that the ratio in the catches would, now that both species are sought after, settle down roughly in the ratio of the abundance in those areas (i.e. probably between 1 : 1 and 2 : 1). However, the 1965/66 results show that at least in Areas II W and II E there are parts of series D in which fin whales are virtually absent and seis are fairly abundant, and the sei : fin ratio in the whole seasons catches will depend on how much effort is exerted in the purely sei areas. The group therefore could not make any precise forecast of the sei : fin ratio in the future and this doubt causes corresponding doubt in the relative effects on the different stocks of future quota schemes based on B.W.U's.

(3.3) The size of the sei whale stock

As mentioned above, the previous report estimated the stock of sei whales as 60,000 animals in November 1964, and this is clearly an under-estimate. Like the forecast of the sei : fin ratio, the method of estimation depended on the two species being mixed on the whaling grounds, and

also on the assumption that in the 1964/65 season the catcher/day of the two species were comparable indices of abundance i.e. that the fact that the 1964/65 average catch/day of sei whales was 1·67 times (0·72/0·43) that of fin whales meant that the stock of sei whales was 1·67 times as great (i.e. 1·67 × 30,000 = 50,000 whales) at the middle of the season (plus half the catch or in total 60,000, at the beginning of the season). However, such an assumption is only valid for the areas in which fin whales occur and are caught. Therefore the estimate excludes the sei whales in those northern areas from which fin whales are virtually absent. No direct estimate of the sei population in these areas can be made, but it may be noted that the northern series (D) of Areas II W and II E which are apparently pure sei areas (sei : fin ratio of over 50 : 1) produced 11,857 sei whales in 1965/66 (approximately two-thirds of the total). Because whaling was concentrated in these areas this proportion probably exaggerates the proportion of the total sei whale stock present in those areas. However, there may also be quantities of sei whales in the northern parts of the other areas in the southern Indian and Pacific oceans, which have not yet been substantially exploited; if so an estimated population of two-thirds of the total sei stocks outside the normal fin whale range may not be unreal—this would give an estimate of the November 1964 population of 3 × 60,000 = 180,000 whales. It should be emphasized that this is an extremely rough figure, and could be as much an over-estimate as the previous estimate of 60,000 appears to have been an under-estimate.

The abundance of sei whales, at least in Area II W, may also be estimated directly, without comparison with fin whales. This is the area in which the bulk of the catches were taken in 1964/65 and an area which showed a clear decrease in catch per unit effort in most months of 1965/66. This decrease has been variously estimated as 24 per cent or 42 per cent (see Table 7) depending on the attention paid to the December catch/day in series D. Equating this decrease to the average catch in Area II W during the past two seasons (11,000 whales), gives the estimates of the population in the middle of the 1964/65 season:

as: $11{,}000/0{\cdot}42 = 26{,}000$

or: $11{,}000/0{\cdot}24 = 46{,}000$

These estimates make no allowance for net recruitment, so that they are over-estimates; taking net recruitment as 10 per cent of the population gives revised estimates, after some iteration, of

$$(11{,}000 - 2{,}100)/0{\cdot}42 = 21{,}000$$

and $$(11{,}000 - 3{,}200)/0{\cdot}24 = 32{,}000$$

These estimates refer to the average stock during the 1964/65 season; adding half the 1964/65 catch (6,800 whales) gives an estimate of the stock in December 1964 of about 28,000—39,000 whales.

This estimate of the stock in Area II W may be extrapolated to give the estimate of the whole stock south of 40°S in several ways. Firstly Area II W consists of 30 degrees of longitude out of 360; in proportion therefore it should contain 1/12th of the entire stock, which may be estimated to have been (28,000 to 39,000) × 12 = 336,000 to 468,000 whales at the beginning of intensive catching of sei whales. This is certainly an over-estimate; consideration of the recent catch per effort of sei whales, the past catches of blue and fin whales and the distribution of krill, the basic food of the whales suggest that the South Atlantic (Area II) is more productive than some of the other areas. Past data of fin and blue whale

catches were not separated into Areas II West and East, but over the seasons 1932/33 to 1962/63 20 per cent of all the blue whales and 30 per cent of fin whales were caught in Area II. Assuming that at the start of intensive sei whaling the same number were present in Area II E as in Area II W (almost certainly an overestimate, judging by the relative catch/effort in the two areas), then if throughout the Antarctic the distribution of sei whales was initially similar to blue or fin whales, the estimates of the total sei whale stock in December 1964 are 2 × (28,000 to 39,000)/0·2 or 2 × (28,000 to 39,000)/0·3 i.e. 190,000 – 390,000.

Alternatively and better, an estimate can be made from the relative catch/effort in the different areas in the 1965/66 season, when it is believed that catching was concentrated on sei whales in all areas. The estimated population in Area II W in the middle of the season is 28,000 to 39,000 minus all the 1964/65 catches, plus the net recruitment in the winter 1965, minus half the 1965/66 catches = 12,000 to 24,000 whales. The relative catches/effort in the different areas may be estimated in different ways—total catch/total effort, mean of catches/effort by series, and mean of catches/effort by series and months. The latter though theoretically better may not give much improvement because there will be several series-months for which no data are available. The relevant data are given in Table 9. The catch/day, or other measure of catch/effort provides an index of density (whales per unit effort), and estimates are required of total abundance. Because Area II W and Area II E are only half the size of the other areas (30° of longitude, compared with 60°), the better index of the relative abundance in different areas is obtained by dividing the catch/effort in Areas II W and II E by two; these are shown in brackets in Table 9. (Strictly corrections should be made for the fact that Area III is 70° and Area VI 50°, but such corrections would make very little difference to the estimates, especially as the densities in the two areas differ very little). Table 9 also shows the estimated index of total abundance, and the percentage in II W. The three percentages are reasonably consistent, with a mean of 17·0 per cent. The total abundance in the middle of the 1965/66 season in absolute numbers is therefore 12,000 to 24,000/0·170 = 70,000 to 140,000. Subtracting half the 1965/66 catch (8,800 whales) gives an estimated stock in May 1966 of 61,000 to 131,000 whales. This is probably a much more realistic estimate than the others, being based purely on observations of sei whale catches, without extrapolation from fin or blue whale data. However it might be argued that in Areas IV to I no fishery has developed in the northern series directed more or less exclusively to sei whales, but that such a fishery could develop; hence the present catch/effort is an under-estimate of the potential catch/effort and the stock is also under-estimated. Taking account of such consideration would bring this kind of estimate more nearly into line with the other estimates which are also based on the assumption, implicit or explicit, that there are stocks of sei whales in all areas north of the regions in which fin whales are normally caught. It must be emphasized that while it may not be unreasonable to assume that such groups of sei whales exist, there is only direct evidence from catches in Areas II and III.

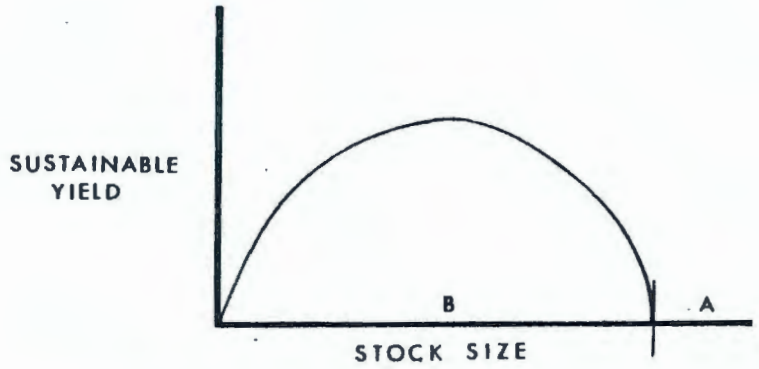
(3.4) Sustainable yield of sei whales

The sustainable yield of sei whales is known even less precisely than the size of the stock, since the sustainable yield as a proportion of the stock depends on the degree to which the stock has been depleted below the unfished state (at which the sustainable yield is zero): see Figure 1.

TABLE 9

Indices of catch/effort of sei whales by areas in 1965/66 *and estimated indices of total abundance*

Index	Area								
	II W	II E	III	IV	V	VI	II	Total	%II W
Total catch/Total effort	2·24 (1·12)	1·59 (0·80)	1·09	0·71	0·40	0·62	1·07	5·81	19·3
Mean c/e by series	1·53 (0·76)	1·05 (0·53)	0·67	0·71	0·37	0·67	1·07	4·78	15·9
Mean c/e by series/month ...	1·46 (0·73)	0·85 (0·42)	0·68	0·72	0·38	0·59	1·07	4·59	15·9



This diagram, showing the relation between sustainable yield and stock abundance is essentially the same as Figure 1 of last year's report, except that no attempt has been made to indicate absolute values of stock or sutainable yield. Two points are important, A) the maximum (unfished) level of the stock and B), the stock giving the maximum sustainable yield. This will be approximately half A, and the maximum sustainable yield will be equal to about $\frac{1}{2}$ (r—M) × B, where r—M is the net rate of increase at low levels of stock (probably, by comparison with blue and fin whales, around 0·15).

Two possibilities exist for the present state of the stock; the most realistic one (based on the decline in Area II W and catch/effort data in other areas) is that the stock in May 1966 is about 61,000 whales. Since 1960 about 60,000 sei whales have been caught, so that the stock in 1960 (near the beginning of intensive sei catching) was, allowing for some net recruitment, around 115,000. Thus the stock is now around the optimum level giving the maximum sustainable yield, which may be estimated as 0·075 × 60,000 = 4,500. Though 61,000 is the smallest estimate of the present stock we present, there is a definite possibility that the real population is less than this, in which case the stock is already below the level giving the maximum sustainable yield. The present sustainable yield would then be rather less than 4,500 but more important, the catches taken in the immediate future should preferably be less than the sustainable yield, so that the stock can increase towards the optimum level.

The other possibility is that the rather optimistic estimates of there being initially perhaps as many as 200,000 sei whales are correct (i.e. that there are in fact substantial numbers of sei whales in the northern parts of all areas). If this is so, the present stock, say 150,000 whales, would still be above the optimum level which give a maximum sustainable yield of about 0·075 × 100,000 = 7,500; the present sustainable yield may not be very different—perhaps 7,000 and also not very different from the estimate of the present sustainable yield made in the previous paragraph. The important difference is that if this second possibility is true the stock is still greater than the optimum and it would therefore be advantageous now to take more than the sustainable yield. For the figures above, the optimum level is 100,000 and the present stock 150,000, so that the surplus which should be removed is 50,000 whales. Biologically there is no very strong reason for preferring a particular rate at which this surplus can be taken (e.g. a round 10,000, as in the 1965/66 season—the 1965/66 catch less the sustainable yield—or only 5,000 per season). The greatest yield

over a long period would be taken by ensuring that the stock reaches the optimum as quickly as possible, whether the stock is now above or below the optimum; if above remove the surplus at once; if below catch nothing until the stock has recovered. There are practical objections in both cases; the objections to a complete cessation of catching of fin whales for a period until the fin whale stock has recovered have often been stated in the I.W.C.; the objections are probably equally valid to taking catches very much above the sustainable yield for a few years, and then, once the surplus has been removed, having an abrupt fall to the level of the maximum sustainable yield. The most profitable use to which the surplus of sei whales, if it exists, can be put is probably to support a viable Antarctic whaling industry during the period in which the fin whale stock is recovering. However, it must again be emphasized that the existence of a substantial surplus of sei whales, above the optimum level, is only a possibility, based on one estimate of population size; the present sei whale stock may equally possibly be at or even below the optimum level.

4. *Fin Whales*

It has been explained in section 3 above that due to the increased concentration on sei whales, and especially the increased amount of catching in areas where fin whales are scarce, the catch/effort of fin whales (particularly the ratio total catch: total effort) may be a poor index of the abundance of fin whales during the 1965/66 season.

Previous assessments of the state of the fin whale stock showed that the present sustainable yield is in the region of 4,000 whales; the low catches of 1964/65, and especially 1965/66 mean that the stock would be expected to increase by a few thousand whales i.e. by perhaps up to 10 per cent. As always these estimates are subject to a certain degree of error, perhaps of up to some hundreds of whales in the estimate of sustainable yield, but even at the smallest likely level of stock size and sustainable yield, the catches in the last two seasons could at most have reduced the stock by a few percent.

Table 10 gives the measures of catch/effort of fin whales for the seasons 1964/65 and 1965/66, estimated firstly from the ratio of total catch to total effort, secondly from the monthly averages of the catch per effort data for those divisions which were fished in the same months in both seasons, and thirdly as the average of the monthly catch per effort data per division of those divisions fished in the same months in both years and in which the sei whale catches in 1965/66 were less than ten times as high as the fin whale catches, thus leaving out the divisions in which the effort was directed predominantly at catching sei whales (division D IIW in December, January and February, division D IIE in January and February, and A IIE in January, division D IV in December, division D V in December and A V in March). In fact all rejected divisions had sei catches in 1965/66 of at least 26 times and up to more than 100 times as many as the catches of fin whales, whereas of those included more than half had sei catches less than twice those of fin whales.

Table 10 shows a decline in the ratio of total catch: total effort which is inconsistent with any likely stock size in 1964; analysis of the catch/day by divisions and months removes some of this inconsistency, but much still remains. The data from the 1965/66 season therefore cannot be used to improve the estimates already made of the size of the fin whale stock and the present sustainable yield from it. The extrapolation from the earlier estimates taking into account the catches in the 1965/66 season (2,312 whales) and the probable net recruitment (6,000 whales) during 1966, i.e. a stock of 37,700 whales and a sustainable yield of $37{,}700 \times 0{\cdot}12 = 4{,}500$ whales, therefore give the best available estimate of the present situation.

TABLE 10

Indices of stock abundance of fin whales

Season	Total catch / Total effort	Average catch per unit effort	Average catch per unit effort from "non-sci" divisions
1964/65	0·42	0·45	0·45
1965/66	0·18	0·25	0·29
Ratio 1965/66 ... 1964/65	0·43	0·56	0·64

However the data from the 1965/66 season though not providing by themselves satisfactory estimates of abundance, are more consistent with the previous estimates of stock and sustainable yield being over-estimates than of their being under-estimates.

TABLE 11

Effect of a 3,000 B.W.U. quota taken with different proportions of fin and sei whales, assuming the present sei whale stock is 150,000 whales

Sei: Fin Ratio	1:1		9:1		No Fins	
	Sei	Fin	Sei	Fin	Sei	Fin
Annual catches	4,500	4,500	13,500	1,500	18,000	Nil
May 1966 Stock	150,000	36,400	150,000	36,400	150,000	36,400
May 1966 Sust. Yield	5,500	4,400	5,500	4,400	5,500	4,400
May 1967 Stock	151,000	36,900	142,000	39,900	137,500	41,400
May 1967 Sust. Yield	5,500	4,400	6,300	4,800	6,500	5,000
May 1968 Stock	152,000	36,400	134,800	42,400	125,800	45,400
May 1968 Sust. Yield	5,300	4,400	6,500	5,100	7,000	5,400
May 1969 Stock	152,800	35,900	127,800	44,900	114,800	49,400
May 1969 Sust. Yield	5,200	4,300	7,200	5,400	7,400	5,900
May 1969 Combined Sust. Yield (B.W.U.)	3,017		3,900		4,200	

5. *Effects of different quotas*

Previous reports have estimated the probable effects of the various quotas suggested at the Commission's meetings. The calculations involved depend on making some assumption about how the quota is divided between sei and fin whales. In an earlier section it was shown that the ratio of sei: fin whales can vary greatly depending on the position of the expeditions, and cannot be forecast with any great accuracy. Therefore unless it is possible to set separate quotas for each species, the effect of a quota, set in terms of Blue Whale Units, is uncertain. This uncertainty is particularly large if, as is possible, the sei whale stock is greater than the optimum, while the fin whale stock is very much less than the optimum; in such a situation it would be best to catch only sei whales,

and to give the fin whales complete protection for a period, and any fin whales in the catch quota for a season would mean both stocks would, at the end of the season, be further from the optimum. The effect of taking different proportions of the two species within the same overall quota are illustrated in Table 11. This shows the effects of a 3,000 B.W.U. quota taken with ratios of sei: fin whales of 1 : 1 or 9 : 1 or entirely as sei whales. ie., complete protection of fin whales. For the purposes of illustration it was assumed that the present (May 1966) stock of sei whales was 150,000 whales (with the implication that the unfished stock was 200,000 and the optimum level 100,000 giving a maximum sustainable yield of 7,500).

Though this example is based on only one of a range of possible values of the present stock size, it does show that within three years the same quota taken in different patterns can produce sustainable yields, differing by 40 per cent. This gives quantitative support to the recommendation made by the Scientific Committee and various Committees of Scientists, that separate quotas should be set for each species.

Fin whales:

The detailed effects of some different quota systems on the fin whales stocks of 1964 and 1965 have been presented in previous reports. The present (May, 1966) stock is almost the same as them and so, therefore, is the effect of a particular quota system. The sustainable yield is around 4,500 whales, so that annual catches less than this will allow the stocks to increase, but this increase will be very slow, unless the catches are much less than 4,500. Recovery to the optimum level, giving sustainable catches around 15,000 whales annually will be quickest if the catches in the immediate future are zero; this recovery will take about 15 years. (This period is substantially longer than the one indicated in the 14th Report of the Commission, page 112. This is due to the presently lower stock, and in particular to the fact that the recruitment at the time when the previous assessment was made was benefiting from the rather higher parent stock present of around 1960). Catches of half the sustainable yield will approximately double the recovery time.

Sei whales:

The previous sections have shown that there is a wide range of uncertainty concerning the size of the sei whale stock, but a smaller range of uncertainty concerning the present sustainable yield, the estimates of which range from around 4,500 to 7,000. Therefore, it is virtually certain that catches greater than this will reduce the stock of sei whales, and cannot be continued indefinitely. However, it is possible that the sei whale stock is at present still above the optimum level, so that more than the sustainable yield can be taken until the stock has been reduced to the optimum level. If it exists, the harvesting of this surplus should be used to "buy time" to allow the fin whale stock to recover to a level giving a sustainable yield considerably larger than at present. In addition, considering that the maximum sustainable yield of the fin whale stock is greater than that of the sei whales, rational exploitation of the Antarctic stocks of baleen whales, as a whole, may best be achieved by "buying time" for the recovery of the fin whale stocks by reducing the sei whale stocks temporarily below the optimum level. Such deliberate depletion of sei whale stocks could involve a wide range in the pattern of quotas in the immediate future, in both the actual amount, expressed in B.W.U., and the species composition. However, if the year-to-year variations in the size of the quota (in B.W.U's.) should be kept to a minimum, and in particular the smallest quota in any future year should be as large as possible consistent with the final overall objective and if the time when substantial sustained yields of fin whales (5-10,000 B.W.U.) can be taken

should not be delayed more than absolutely necessary, then it becomes clear that the range of possibilities is quite small.

For example, if the sei whale stock is depleted rapidly (i.e. comparatively large quotas for the next two or three years), then by the time the sei whales stocks have been depleted, and the sei catches will have to be reduced, the fin whale stocks will not have increased much, and the overall quota will have to be sharply reduced.

The desirability of rather steady quotas also means that the more conservative estimates of the sei whale stocks shall be used in setting a quota for the 1966/67 and immediately following seasons; while the stock might be tens of thousands of whales above the optimum level, a quota of perhaps 20,000 sei whales set on the assumption that the stock was so large would, if the stock was indeed small, so reduce the stocks and also the catch per unit effort in two or three seasons that only very few whales could be taken in the following seasons.

Although the balance between the rate of building up the stock of fin whales, and the taking of appreciable catches in the immediate future must depend on a variety of economic and other factors, a policy which permits the taking of more than, say, half the present sustainable yield of fin whales during at least the initial phase of the recovery period should be considered as causing unreasonable delay in approaching the optimum level. If this guide to evaluation of policy is accepted, then the possibilities of maintaining any particular quota can be examined. Thus, if a certain quota is desired (e.g. 2,500 B.W.U.), then the stock of fin whales should preferably be completely protected until its sustainable yield is $2 \times 2{,}500 = 5{,}000$ B.W.U. The time taken to build up to this level can be calculated (in the example about 10 years); thus for a calculable period (11 years) only sei whales should be taken (i.e. 15,000 whales annually for 10 years). Allowing for a net recruitment of some 5,000 sei whales, this means that the stock of sei whales would over that period be depleted by 100,000 whales; this would be possible for some, though not for most of the estimated stock sizes. Although there has not been opportunity to enable such calculations with great precision (e.g. allowing for the changes in the net recruitment of sei whales as the stock declines) or for a range of quotas, these preliminary calculations suggest that a quota of 2,500 B.W.U. could be maintained while building up the fin whale stocks if the sei whale stocks were in the upper part of its possible range. Lower quotas, say 2,000 B.W.U., could be maintained for any likely sei whale stock, but appreciably higher quotas could only be maintained if the sei whale stock is improbably large. Other policies, based on the capture of both fin and sei whales in each season, whether or not the sei:fin ratio is predetermined by setting separate quotas, will have no better results and may well be worse, in the sense of requiring a longer period until the fin whale stocks have built up, and involving lower quotas during the interim period.

A regulatory policy based on complete prohibition of the capture of fin whales for a period has therefore great advantages: it avoids the inherent unpredictabilty of the effect of setting quotas by B.W.U's.; something approaching the maximum cumulative catch of fin whales in the long run is taken and the pelagic whaling industry can probably continue at a viable level, until such time as it can thrive on a recovered resource. During the period of prohibition of catching fin whales much better assessments of the sei whale stock could be made while continuing to watch, by sightings, the expected recovery of the fin whale stock. At the end of the period fin whaling at the appropriate level could be begun, and if desired the quotas thereafter gradually increased, and depending on the assessed state of the sei whale stock, special regulations could be made for sei whaling which permit that stock also to recover eventually to its optimum level.

ADDENDUM

Since this report was prepared the following data for the baleen whale catches by two land-stations in Chile from October 1965 to April 1966 have become available to F.A.O. (c.f. Annex I, Table I of the Report of the Joint F.A.O./I.W.C. Working Party on Antarctic Whale Stock Assessment, 1966).

Blue whales	125
Fin whales	223
Sei whales	355

ANNEX

TABLE I—1965/66 *Season : total number of catcher days (uncorrected) by division*

Month	Area / Series	II W	II E	III	IV	V	VI	I	Total
December	D	1153	103	60	204	183	—	—	1703
	A	60	140	168	—	203	—	—	571
	B	—	—	—	—	158	—	—	158
	C	—	—	—	—	—	—	—	—
	Total	1213	243	228	204	544	—	—	2432
January	D	1959	12	207	—	36	—	—	2214
	A	243	30	72	—	148	—	30	523
	B	—	—	—	224	682	100	—	1156
	C	—	—	—	—	—	—	—	—
	Total	2200	192	279	224	866	100	30	3893
February	D	175	1514	333	—	—	—	—	2022
	A	—	52	45	—	275	—	—	372
	B	—	90	255	188	387	240	—	1160
	C	—	—	—	—	—	—	—	—
	Total	175	1656	633	188	662	240	—	3554
March	D	—	70	921	—	190	—	—	1181
	A	120	431	186	—	117	139	—	993
	B	—	45	180	—	154	489	—	868
	C	—	—	—	—	—	—	—	—
	Total	120	546	1287	—	461	628	—	3042
April	D	—	—	70	—	—	—	—	70
	A	—	155	—	—	—	—	—	155
	B	—	—	—	—	—	—	—	—
	C	—	—	—	—	—	—	—	—
	Total	—	155	70	—	—	—	—	225
Total 1965/66 season	D	3287	1699	1591	204	409	—	—	7190
	A	423	808	471	—	743	139	30	2614
	B	—	285	435	412	1381	829	—	3342
	C	—	—	—	—	—	—	—	—
	Total	3710	2792	2497	616	2533	968	30	13146

ANNEX

TABLE II—1965/66 *Season* : *Catches of FIN whales by month and division*

Month	Area / Series	II W	II E	III	IV	V	VI	I	Total
December	D	9	20	48	3	1	—	—	81
	A	15	27	113	—	67	—	—	222
	B	—	—	—	—	23	—	—	23
	C	—	—	—	—	—	—	—	—
	Total	24	47	161	3	91	—	—	326
January	D	76	—	123	—	3	—	—	202
	A	61	—	86	—	18	—	5	170
	B	—	44	—	42	133	33	—	252
	C	—	—	—	—	—	—	—	—
	Total	137	44	209	42	154	33	5	624
February	D	3	35	109	—	—	—	—	147
	A	—	17	11	—	47	—	—	75
	B	—	13	60	18	39	51	—	181
	C	—	—	—	—	—	—	—	—
	Total	3	65	180	18	86	51	—	403
March	D	—	5	322	—	17	—	—	344
	A	20	282	33	—	3	16	—	354
	B	—	8	33	—	35	104	—	180
	C	—	—	—	—	—	—	—	—
	Total	20	295	388	—	55	120	—	878
April	D	—	—	72	—	—	—	—	72
	A	—	9	—	—	—	—	—	9
	B	—	—	—	—	—	—	—	—
	C	—	—	—	—	—	—	—	—
	Total	—	9	72	—	—	—	—	81
Total 1965/66 *Season*	D	88	60	674	3	21	—	—	846
	A	96	335	243	—	135	16	5	830
	B	—	65	93	60	230	188	—	636
	C	—	—	—	—	—	—	—	—
	Total	184	460	1010	63	386	204	—	2312

ANNEX

TABLE III—1965/66 *Season* : *Catches of SEI whales by month and division* (1964/65 *included for comparison*)

Month	Area / Series	II W		II E		III		IV		V		VI		I		Total
		64/65	65/66	64/65	65/66	64/65	65/66	64/65	65/66	64/65	65/66	64/65	65/66	64/65	65/66	65/66
December	D	368	2927	32	17	34	3	497	145	—	29	—	—	—	—	3121
	A	42	32	22	24	6	—	—	—	—	—	—	—	—	—	56
	B	—	—	—	—	—	—	—	—	—	25	—	—	—	—	25
	C	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
	Total		2959		41		3		145		54		—		—	3202
January	D	3944	4836	88	53	85	164	652	—	1	3	—	—	5	—	5056
	A	1997	95	90	7	—	2	38	—	162	38	—	—	26	32	174
	B	—	—	—	41	—	—	21	125	26	265	—	31	—	—	462
	C	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
	Total		4931		101		166		125		306		31		32	5692
February	D	2006	296	47	3708	75	884	66	—	511	—	—	—	—	—	4888
	A	3092	—	995	14	34	3	53	—	310	121	—	—	9	—	138
	B	—	—	—	11	7	5	—	166	485	214	—	169	—	—	562
	C	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
	Total		296		3733		892		166		332		169		—	5588
March	D	552	—	20	20	43	1385	153	—	—	104	—	—	—	—	1509
	A	1658	135	581	443	69	113	47	—	431	79	—	106	—	—	876
	B	—	—	—	8	—	69	35	—	281	139	—	293	—	—	509
	C	—	—	—	—	—	—	—	—	—		—	—	—	—	—
	Total		135		471		1567		—		322		399		—	2894
April	D	8	—	3	—	90	96	—	—	—	—	—	—	—	—	96
	A	—	—	34	86	—	—	—	—	—	—	—	—	—	—	86
	B	—	—	—	—	—	—	21	—	—	—	—	—	—	—	—
	C	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
	Total		—		86		96		—		—		—		—	182
Total 1965/66 *Season*	D		8059		3798		2532		145		136	—		—		14670
	A		262		574		118		—		238		106		32	1330
	B		—		60		74		291		640		493		—	1558
	C		—		—		—		—		—		—		—	—
	Total		8321		4432		2724		436		1014		599		32	17558

ANNEX

TABLE IV—1965/66 *Season* : *Catch of fin-whales per catcher day per month, species and division (uncorrected for tonnage)* (1964/65 *included for comparison*)

Month	Area / Series	II W		II E		III		IV		V		VI		I		Total
		64/65	65/66	64/65	65/66	64/65	65/66	64/65	65/66	64/65	65/66	64/65	65/66	64/65	65/66	
December	D	1·25	0·01	·69	0·19	0·16	0·80	·13	0·01	—	0·01	—	—	—	—	0·05
	A	1·21	0·25	·77	0·19	·96	0·67	1·04	—	—	0·33	—	—	—	—	0·39
	B	—	—	—	—	·18	—	·38	—	·13	0·15	—	—	—	—	0·15
	C	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
	Total		0·02		0·19		0·71		0·01		0·17		—		—	0·13
January	D	·20	0·04	·96	0·00	·75	0·59	·43	—	—	0·08	—	—	2·20	—	0·09
	A	·70	0·25	·46	0·00	—	1·19	·38	—	·66	0·12	—	—	·52	0·17	0·32
	B	—	—	—	0·29	—	—	·62	0·19	·26	0·19	—	0·33	—	—	0·22
	C	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
	Total		0·06		0·23		0·75		0·19		0·18		0·33		0·17	0·16
February	D	·03	0·02	·85	0·02	·19	0·33	·10	—	·11	—	—	—	—	—	0·07
	A	·36	—	·54	0·33	·25	0·24	·32	—	·27	0·17	—	—	1·00	—	0·20
	B	—	—	—	0·14	·53	0·24	·24	0·10	·23	0·10	—	0·21	—	—	0·16
	C	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
	Total		0·02		0·04		0·28		0·10		0·13		0·21			0·11
March	D	·03	—	·01	0·07	1·17	0·35	·16	—	—	0·09	—	—	—	—	0·29
	A	·18	0·17	·48	0·65	·12	0·18	·28	—	·23	0·03	—	0·12	—	—	0·36
	B	—	—	—	0·18	—	0·18	·11	—	·15	0·23	—	0·21	—	—	0·21
	C	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
	Total		0·17		0·54		0·30		—		0·12		0·19		—	0·29
April	D	·02	—	·02	—	·18	1·03	—	—	—	—	—	—	—	—	1·03
	A	·02	—	·93	0·06	—	—	—	—	—	—	—	—	—	—	0·06
	B	—	—	—	—	—	—	·06	—	—	—	—	—	—	—	—
	C	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
	Total		—	—	0·06		1·03	—	—		—	—	—		—	0·36
Total 1965/66 *Season*	D	0·03		0·04		0·42		0·01		0·05			—	—	—	0·12
	A	0·23		0·41		0·52	—		—	0·18		0·12		·0·17		0·32
	B	—		0·23		0·21		0·15		0·17		0·23		—		0·19
	C	—		—		—		—		—		—		—		—
	Total	0·05		0·16		0·40		0·10		0·15		0·21		0·17		0·18

ANNEX

TABLE V—1965/66 *Season* : *Catch of sei-whales per catcher day by month, species and division (uncorrected for tonnage)* (1964/65 *included for comparison*).

Month	Area / Series	II W		II E		III		IV		V		VI		I		Total	
		64/65	65/66	64/65	65/66	64/65	65/66	64/65	65/66	64/65	65/66	64/65	65/66	64/65	65/66	64/65	65/66
December	D	·83	2·54	·12	0·17	·68	0·05	1·70	0·71	—	0·16	—	—	—	—		1·83
	A	1·91	0·53	·03	0·17	·01	0·00	—	—	—	0·00	—	—	—	—		0·10
	B	—	—	—	—	—	—	—	—	—	0·16	—	—	—	—		0·16
	C	—	—	—	—	—	—	—	—	—	—	—	—	—	—		—
	Total	0·62	2·44		0·17		0·01		0·71		0·10		—		—		1·32
January	D	2·81	2·47	·49	4·42	·86	0·79	·67	—	·03	0·08	—	—	·50	—		2·28
	A	1·61	0·39	·30	0·23	—	0·03	·26	—	·53	0·26	—	—	·62	1·07		0·33
	B	—	—	—	0·27	—	—	·02	0·56	·16	0·39	—	0·31	—	—		0·40
	C	—	—	—	—	—	—	—	—	—	—	—	—	—	—		—
	Total	2·25	2·24		0·53		0·59		0·56		0·35		0·31		1·07		1·46
February	D	2·56	1·69	1·74	2·45	·63	2·65	·65	—	1·31	—	—	—	—	—		2·42
	A	1·94	—	1·81	0·27	·33	0·07	·78	—	1·03	0·44	—	—	·41	—		0·37
	B	—	—	—	0·12	·10	0·02	—	0·88	0·80	0·55	—	0·70	—	—		0·48
	C	—	—	—	—	—	—	—	—	—	—	—	—	—	—		—
	Total	2·14	1·69		2·25		1·41		0·88		0·50		0·70		—		1·57
March	D	1·07	—	·11	0·29	·22	1·50	·64	—	—	0·55	—	—	—	—		1·28
	A	1·71	1·13	·84	1·03	·83	0·61	·55	—	·58	0·68	—	0·76	—	—		0·88
	B	—	—	—	0·18	—	0·38	·41	—	·69	0·90	—	0·60	—	—		0·59
	C	—	—	—	—	—	—	—	—	—	—	—	—	—	—		—
	Total	1·48	1·13		0·86		1·22		—		0·70		0·64		—		0·95
April	D	·20	—	·06	—	·47	1·37	—	—	—	—	—	—	—	—		1·37
	A	—	—	·63	0·55	—	—	—	—	—	—	—	—	—	—		0·55
	B	—	—	—	—	—	—	1·24	—	—	—	—	—	—	—		—
	C	—	—	—	—	—	—	—	—	—	—	—	—	—	—		—
	Total		—		0·55		1·37		—		—		—		—		0·81
Total 1965/66 *Season*	D	2·45	—		2·24		1·59		0·71		0·33		—		—	1·39	2·04
	A	0·62	—		0·71		0·25		—		0·32		0·76		1·07	1.05	0·51
	B	—			0·21		0·17		0·71		0·46		0·59		—	0·51	0·47
	C	—			—		—		—		—		—		—		—
	Total	2·24			1·59		1·09		0·71		0·40		0·62		1·07		1·34

APPENDIX D

REPORT OF THE SPECIAL MEETING OF COMMISSIONERS FROM NORTH PACIFIC MEMBER NATIONS HONOLULU, HAWAII FEBRUARY 14th TO 17th, 1966

Commissioners and advisers from the North Pacific Member Nations (Canada, Japan, Union of Soviet Socialist Republics and United States of America) met in Honolulu, Hawaii, from February 14th to 17th to discuss the threat to the whale stocks in the North Pacific area involving condition of the stocks and consideration of whaling regulations. Dr. J. L. McHugh, (Deputy Commissioner U.S.A.), served as chairman of the meeting. A copy of the approved Agenda is attached.

The following representatives were in attendance:

CANADA	W. M. Sprules (Commissioner)		
	K. R. Allen		
	K. F. Fraser		
	G. C. Pike		
JAPAN	I. Fujita (Commissioner)		
	T. Doi	J. Inagawa	H. Omura
	K. Furukawa	A. Ishida	S. Osumi
	K. Hamanaka	T. Nemoto	J. Ozoegawa
	H. Hasegawa	T. Oba	R. Suzuki
	K. Hoketsu	T. Ogiwara	S. Takeda
U.S.S.R.	M. N. Sukhoruchenko (Commissioner)		
	M. V. Ivashin		
	V. G. Lafitsky		
	V. P. Zolotarev		
U.S.A.	J. L. McHugh (Deputy Commissioner)		
	E. L. Bartlett		
	D. G. Chapman		
	W. C. Herrington		
	D. W. Rice		

The North Pacific Working Group of scientists met during the preceding week to review all available data on the condition of North Pacific whale stocks and to discuss stock assessments. The report of the Working Group was received by the Commissioners at their opening session and this report was used as the principal basis for their discussions. Careful consideration was also given to the proposals presented by each delegation.

After very serious deliberation it was found that there were large areas of agreement but the differences which remained prevented the adoption of any recommendations to the International Whaling Commission.

It was agreed that additional stock assessments should be completed by the scientists as soon as possible and that a meeting of the Commissioners of the North Pacific Member Nations should be held one week prior to the 18th Annual Meeting of the International Whaling Commission to give further consideration to North Pacific whaling problems.*

Each delegation presented its views in written form, as follows:

* Chairman's note: It was suggested that the North Pacific Working Group of Scientists might meet in London about June 16, 1966, and the North Pacific Commissioners on June 20.

CANADA

The Canadian position with regard to measures required to conserve the important whale stocks of the North Pacific area was expressed by the Canadian Commissioner as follows:

"After giving careful consideration to the Report of the Sixth Meeting of the North Pacific Working Group of the International Whaling Commission, the Canadian Delegation is prepared to accept the recommendations contained in the report without qualification. The Canadian Delegation is prepared also to discuss any proposals made by the other Delegations."

JAPAN

The following is the statement of the Japanese Delegation concerning the whaling in the North Pacific.

"1. The report on the sixth meeting of the North Pacific Working Group should be given due consideration and be treated as the basis for discussion of the Commissioner's meeting of the four countries.

"2. In taking the above-mentioned report into consideration, Japan wishes to state as follows:

"a. *Humpback Whales*

Japan has no objection to the prohibition of the taking of humpback whales for one more year.

"b. *Blue Whales*

Japan has no objection to the views that no change should be made in the present 5-year closure on blue whales.

"c. *Fin and Sei Whales*

The whale stocks question in the North Pacific has become serious as the result of enormous increase of catches by pelagic operations during recent years. Giving due respect to the recommendations of the scientists for an early adoption of restrictive measures for pelagic operations, we believe that restrictive measures for the catch of baleen whales by pelagic operations be promptly taken as a matter of urgency. A ceiling should be placed on pelagic catch of fin and sei whales from 1966 season. It is also considered appropriate to place a combined total catch limit of fin and sei whales in the form of B.W.U., as adopted in the case of the Antarctic. For the conservation of baleen whale stocks in the pelagic grounds, this total catch limit should be reduced gradually in coming seasons until it will be below the combined sustainable yields of fin and sei whales in 1968.

"d. *Open Season*

No provision has yet been made in the International Whaling Convention regarding the open season of pelagic operation of baleen whales in the North Pacific. However, as a measure for the conservation of whale stocks a reasonably fixed open season should be maintained.

"e. *Implementation of regulations*

A new system for securing the above-mentioned regulations should be introduced so that the countries concerned may comply with them.

"f. *Land Stations*

Japan agrees to the views of the scientists that further assessments are urgently needed on coastal stocks on both sides of the Pacific and is

prepared to cooperate in this field. As a temporary measure until a precise assessment of coastal stocks will be made, Japan wishes to propose that the Governments concerned restrict, through their domestic measures, the catch of baleen whales from their land stations at an average level of three years from 1962 to 1964, in case an agreement is reached at this meeting concerning the regulation of the catches of baleen whales by pelagic operation.

"g. *Sperm Whales*

The scientists' views on sperm whales contained in the above-mentioned report should be given due consideration."

UNION OF SOVIET SOCIALIST REPUBLICS

The statement of the Soviet delegation concerning the whaling in the North Pacific is as follows:

"1. The discussion on the matter of whale stocks reservation* in the North Pacific should be based on the scientific data and recommendations concerning the catches from the land stations and on more precise data concerning the pelagic whaling.

"2. The achievement of any regulations leading to the effective and efficient protection of whale stocks is possible only on the condition that these regulations should apply both to pelagic and coastal catches.

"3. The Soviet delegation states also that:

"a. It completely agrees to the prohibition of the taking of humpback whales for one more year.

"b. It supports the resolution of the Commission forbidding the taking of blue whales in the North Pacific for five years from the 1966 season.

"c. In order to prevent the depletion of baleen whale stocks in the North Pacific the Soviet Union has unilateraly sharply reduced the catches of baleen whales in the last three years. This can be illustrated by the following figures:

Year	Catches of baleen whales (in B.W.U.)
1963	1911
1964	1567
1965	1030

"d. The Soviet delegation agrees to the recommendation of the Scientific Working Group concerning the necessity of reduction of fin whale catches beginning with the 1966 season.

"e. The Soviet delegation has no objection to the opinion of the Scientific Working Group that the catches of sei whales in 1966 should not rise above the level of 1965.

"f. Taking into account the great importance of catches of baleen whales in the North Pacific from the land stations where in 1965 1,066 sei whales were taken, or 33·8 per cent of the total catch of sei whales in 1965 (3,154), the Soviet delegation points out that the proposed measures on the restriction of baleen whale catches in the pelagic whaling grounds should apply adequately also to the land stations and that this is the only way in reaching efficient results in the matter of conservation of whale stocks.

---

* Chairman's note: The word "reservation" in the English version does not appear to fit the context. Perhaps "conservation" was intended.

"Due to the fact that the Sixth Meeting of the Scientific Working Group had no opportunity to make the stock assessment of whales in the coastal areas off Asia and taking into consideration the views of the Commissioners for some countries, the Soviet delegation suggests a compromising proposal which consists in fixing the total catch limit of baleen whales from the land stations of the North Pacific at the level of 1965 until the above-mentioned assessment of coastal stocks will be finished.

"The proposed restriction of baleen whale catches from land stations at the average level of three years, from 1962 to 1964, will lead to the increase of the catches of 1966 to double the amount of 1965 and cannot be accepted by the Soviet delegation.

"g. The Soviet delegation agrees to the recommendation of the Scientific Working Group that it is necessary to reduce the catches of female sperm whales."

UNITED STATES OF AMERICA

"The United States Delegation accepts the recommendations in the Report of the Sixth Meeting of the North Pacific Working Group of Scientists of the International Whaling Commission. The United States Delegation is prepared to agree to any reasonable recommendations, based on the scientific evidence, which will halt over exploitation of whale resources in the North Pacific and which will lead to restoration of those resources to the level of maximum sustainable yield. The United States will endeavour to limit its own land-based catch to a level not exceeding the 1965 catch or the average of the 1964/65 catches, provided that agreement is reached to limit the North Pacific whale harvest to levels not exceeding the sustainable yield of each species.

"The United States Delegation cannot agree to any quotas based on blue whale units which are not consistent with the views expressed in the paragraph above."

APPROVED AGENDA

1. Opening remarks
2. Adoption of agenda
3. Procedures for the meeting
4. Report of scientists on condition of North Pacific baleen whale stocks
5. Consideration of whaling regulations
   (a) Blue whales
   (b) Humpback whales
   (c) Fin whales
   (d) Sei whales
   (e) Other baleen whales
6. Report of scientists on condition of sperm whale resource
7. Consideration of regulations for sperm whaling
8. Recommendations to Commission
9. Other business.

APPENDIX E

REPORT OF THE SPECIAL MEETING OF COMMISSIONERS OF NORTH PACIFIC MEMBER NATIONS LONDON JUNE 23rd TO 30th, 1966

Commissioners and advisers from North Pacific Member Nations (Canada, Japan, Union of Soviet Socialist Republics, and United States of America) held their third meeting in London, on June 23rd, 24th and 27th through 30th to discuss the condition of the whale stocks in the North Pacific and to consider methods of regulating the catch to achieve the maximum sustainable yield. Previous meetings were held in London, June 30th, 1965, and Honolulu, February 14th to 17th, 1966. Dr. J. L. McHugh (Deputy Commissioner, U.S.A.) was re-elected as Chairman. A copy of the approved agenda is attached.

The following representatives were in attendance:

CANADA	W. M. Sprules (Commissioner)
	K. R. Allen
	G. C. Pike
JAPAN	I. Fujita (Commissioner)
	M. Niwa
	H. Yokota
	H. Omura
U.S.S.R.	M. N. Sukhoruchenko (Commissioner)
	I. F. Denisenko
	M. V. Ivashin
	C. G. Lafitsky
	V. M. Nikolaev
U.S.A.	J. L. McHugh (Deputy Commissioner)
	S. Blow
	D. G. Chapman
	D. W. Rice

Dr. Chapman (U.S.A.) is Chairman of the Scientific Committee of the Commission, Mr. Pike (Canada) is Chairman of the North Pacific Working Group of scientists. The Working Group met in London, June 16th to 17th, 1966, and its report was available to the Commissioners. It was estimated that the present sustainable yield of the North Pacific fin whale resource is about 1,800 whales. Separate estimates of sustainable yield were made for the North American coast (50), Area II (150), Area III (250), Area IV (500), Areas V and VI (700), Asian coast (150), East China Sea (no estimate, but very small). It was pointed out that the fin whale catches in the eastern Pacific (North American coast and Areas II to IV inclusive) have exceeded the estimated sustainable yields. It was estimated that the North Pacific stocks of sei whales may still be above the level which will produce the maximum sustainable yield, but that the maximum sustainable yield cannot yet be calculated. There is no evidence that the North Pacific sperm whale resource has been affected seriously or that the level of maximum sustainable yield has been reached. No new population estimates were available on humpback or blue whales. Management aimed at maintaining maximum sustainable catches will require separate regulation for the different species and stocks. This cannot be achieved if a catch limit is fixed in Blue Whale Units alone. The scientists confirmed all recommendations of the Honolulu meeting except the one referring to fin whales.

For fin whales it was recommended that catches should be held below the estimated sustainable yield of 1,800 for the entire North Pacific and that as far as possible catches within the areas listed above should be held below their respective sustainable yields.

The Commissioners agreed unanimously that the current prohibitions on killing blue and humpback whales in the entire North Pacific Ocean should be continued. One delegation expressed the view that the prohibition on humpback whaling should be extended to 1970. It was agreed also that the current regulations on catching of sei and sperm whales are adequate and that no further measures are necessary at this time. Scientific assessment should be continued, so that appropriate regulatory measures for sei and sperm whaling can be taken as required. It was further agreed that the North Pacific fin whale stocks are for the most part over exploited and that the total catch is considerably higher than the estimated sustainable yield for the entire North Pacific. After considerable discussion it was agreed that more effective measures should be found to bring the catch of fin whales in the North Pacific below the sustainable yield by 1969, in order to begin rebuilding the stocks to the level of maximum sustainable yield. This can be accomplished by one or a combination of several different methods, and several such methods were discussed. It was not possible to consider all the alternatives in detail and it was apparent that further exchanges of views will be necessary to work out the mechanisms by which this objective can be achieved. Accordingly, it was agreed that the Chairman of the group should undertake an exchange of correspondence with a view to the possibility of a further meeting prior to the 1967 whaling season.

Formal action will therefore not be possible immediately. For 1966 it was agreed that the nations conducting whaling operations in the North Pacific Ocean will use all reasonable means at their disposal to keep the pelagic catches of fin whales below the level of the 1965 catches and the catches of fin whales from land stations below the average of the 1964/65 catches. It was understood that this agreement does not apply to the stocks of whales in the East China Sea.

AGENDA

MEETING OF NORTH PACIFIC COMMISSIONERS INTERNATIONAL WHALING COMMISSION

LONDON, JUNE 23rd–30th, 1966

1. Opening remarks
2. Adoption of agenda
3. Procedures for the meeting
4. Report of scientists on condition of North Pacific baleen whale stocks
5. Consideration of whaling regulations
   (a) Fin whales
   (b) Sei whales
   (c) Other baleen whales
6. Report of scientists on condition of sperm whale resource
7. Consideration of regulation for sperm whaling
8. Recommendations to Commission
9. Other business.

REPORT OF THE SCIENTIFIC COMMITTEE

APPENDIX IV

1. The Committee met at 10 a.m. on 20th June 1966 and following days in the Ministry of Agriculture, Fisheries and Food, London, under the Chairmanship of Dr. D. G. Chapman.

2. There were present:

AUSTRALIA	Mr. C. G. Setter
CANADA	Mr. G. C. Pike and Mr. K. R. Allen
JAPAN	Dr. H. Omura; Dr. T. Doi; Dr. T. Nemoto
NORWAY	Dr. A. Jonsgard
U.K.	Dr. N. A. Mackintosh Mr. S. G. Brown Dr. R. Clarke Mr. R. Gambell Mr. H. S. J. Roe Mr. J. A. Gulland
U.S.A.	Dr. D. G. Chapman Mr. D. W. Rice
U.S.S.R.	Dr. M. V. Ivashin Mr. O. V. Bakurin

RESEARCH AND INFORMATION

Progress Reports and other Papers

3. Progress reports were available for circulation from:

Canada, Japan, Netherlands, Norway, United Kingdom, United States and U.S.S.R. In addition two reports were circulated by Mr. Rice (U.S.A.) as follows:

"Blue whales in the waters off Baja, California".

"Growth and Reproduction of the Gray Whale".

4. Japan had taken a school of sperm whales under a special permit. Their report on this had been circulated in advance of the meeting. In addition the paper referred to by Mr. Rice (para. 3 above) on gray whales was based on whales collected under special permit. A number of other special permits have been issued but no reports are available on these studies.

Whale Marking

5. Mr. Brown provided a summary table showing the number of whales marked by area and species in the past year, as well as some data on recoveries (Appendix A).

6. The Committee noted the document I.W.C./18/6, Review of the Commission's contribution towards whale marking and the attached appendix, a letter from Mr. R. G. Williams, Secretary of the National Institute of Oceanography to Mr. R. S. Wimpenny, reviewing the whole question. The Committee affirmed its previously expressed view of the need for increased marking particularly of sperm and sei whales. It also agreed on the need for a central organization to co-ordinate whale marking and further agreed that the present

arrangement whereby the N.I.O. acts as this central organization has worked very satisfactorily.

Reports of Other Meetings

7. During the past year there have been two meetings of the North Pacific Working Group (at Honolulu, and London) a meeting of the Sperm Whale Sub-Committee (at Honolulu) and two meetings of the I.W.C./F.A.O. Whale Stock Assessment Group. Reports from these meetings had been circulated and were available at the meeting. Recommendations from these meetings were reviewed by their respective Chairmen.

Sighting Programme

8. The Committee reviewed documents by Dr. Mackintosh and Mr. Brown on whale observations from three ships which had been made as a result of a request to S.C.A.R. The Committee discussed whether these observations should now be discontinued. It was felt that the programme is important and should be continued for at least one more year and that the matter should be reviewed again at the next meeting of the Committee. It is recommended that a report be circulated to observers to encourage their participation and the Secretary of the Commission be asked to send a letter of thanks to participants.

STATUS OF STOCKS

Southern baleen whales

Blue whales

9. Sighting data are so far insufficient to provide any new data on blue whales in the Antarctic. The comparatively large catches of blue whales by Chile and Peru in 1964 and 1965 were discussed. Information as to the timing of these catches suggests that they may be from a local stock which may not migrate to the Antarctic. Some biological information, available to Japan but not fully analyzed, suggests that these may be similar to pigmy blue whales. Dr. Ivashin suggested that it is possible that these are younger whales that have not yet migrated to the Antarctic. Dr. Clarke indicated that a programme of studying this stock is being initiated by Chile and the Committee expressed its agreement that such a study is vitally needed.

No new information is available in regard to pigmy blue whales. In view of the possibility that all Southern Hemisphere blue whale stocks may contribute at least in part to the Antarctic blue whale stocks the Committee reaffirms its recommendation made in 1965 that the protection of blue whales be extended to the whole of the Southern Hemisphere.

Fin whales

10. The Committee had before it the analysis of the 1965/66 catches by the F.A.O. Stock Assessment Group. This analysis points out that "no revision of the fin whale population estimates can be made on account of the swing to sei whales, but extension from the previous estimates gives an estimate of the present stock of 37,700 with a sustainable yield of 4,500."

Sei whales

11. The report of the F.A.O. Stock Assessment Group dealt with the present status of sei whales in the Southern Hemisphere in great detail. Their analysis may be summarized as follows "An estimate of the total Antarctic sei whale

population in May, 1966 (is) 61,000 to 131,000, the lower figure being more probable. If the lower figure is correct the present sustainable yield is about 4,500 sei whales and it would be important not to exceed this figure if the maximum yield is to be maintained. If the upper figure is correct the maximum sustainable yield is about 7,500 and the stock may be still above the optimum level so that catches above this level [i.e. 7,500] would, for a time, be beneficial".

12. The Japanese scientists had made another analysis of the sei whale population using not only catch statistics but also other biological information such as age composition and food distribution. Their analysis yields the following estimates:

Natural mortality coefficient, 0.065. Mean apparent pregnancy rate, 0.60; the true pregnancy rate is lower, perhaps 0.55.

Rate of exploitation in recent two seasons, 0.20 or more (from marking results)

Rate of net recruitment, 0.08 (under the assumption that the pregnancy rate is 0.55)

Their estimates of the number of sei whales in the Antarctic pelagic grounds are quite broad but they suggested the most probable number in the present grounds is about 92,000 and the sustainable yield 7,400. This population estimate is very close to the median of the F.A.O. Assessment Group's estimates. The possibility was raised that the estimate of pregnancy rate could be high because of segregation of stocks. Nevertheless the estimate of net recruitment is in close accord with that of the F.A.O. assessment (0·08 compared to 0·075). These estimates by the Japanese scientists and the F.A.O. Assessment Group are much larger than the estimate in the report of last year. The latter was only a tentative one and now, as discussed in the F.A.O. report para. 33 is clearly an underestimate.

The Japanese scientists also noted that present sei whale stocks would be underestimated if there are sei whale concentrations in areas not yet adequately exploited. On the other hand Dr. Jonsgard suggested that because sei whale stocks seem to be less migratory and more localized the catches may reduce them even more rapidly than other baleen species. He showed a study of catches in Area II in 1964/65 compared to 1965/66 to support this contention.

Land station catches

13. Marking recovery results have shown that some fin whales caught at southern land stations are from stocks found in the Antarctic. While there are some differences in the size distribution of catches in South Africa and the Antarctic, these could be explained by assuming that South African catches are younger animals from stocks that migrate to the Antarctic to feed. On the other hand, sighting in the North Atlantic, particularly, but also in the South Atlantic, suggest that not all fins migrate and consequently some part of the southern land station catches may be from stocks not exploited in the Antarctic. In the case of sei whales, the situation is even more obscure because less is known of their migration pattern and very few marked sei whales have been recovered. Dr. Doi expressed the opinion that the sustainable yield for fin and sei whales in the Southern Hemisphere is slightly more than the sustainable yield in the Antarctic area alone; the difference is not more than 500 for fins and not more than 300 for sei whales.

Sperm whales

14. The Committee reviewed the recommendation of the sperm whales subcommittee on the need for marking of small sperm whales and agreed that such

marking is necessary. Dr. Clarke, however, raised the question of damage to such small whales from indiscriminate marking with the standard Discovery mark.

15. The Committee noted that no new assessment data are available in regard to sperm whales except in the North Pacific despite the large catches of recent years. It therefore recommends that the F.A.O. Assessment Group be asked to make an assessment of sperm whale stocks, particularly at first in respect to those on pelagic grounds. The Committee also endorsed the recommendation of the sperm whale sub-committee that national groups begin or continue analyses.

16. The Committee observed that the 1965 data show reduced pelagic catches of females and a more careful observance of size limits. This has resulted in a substantial increase in the production of oil per whale taken. In view of the fact that if size limits are not observed and too many females are taken, there is a possibility of serious damage to the stocks, the Committee notes the change with satisfaction and expresses hope that this new situation will continue. However the Committee still recommends that any international observer scheme should include sperm whales.

North Pacific Whale Stocks

17. The Committee accepted the report of the North Pacific Working Group and endorsed its recommendations.

18. The Committee discussed what information is available in regard to gray whales. In view of the lack of information about this stock the Committee recommended that more marking be done and that the taking of gray whales under special permit for scientific purposes be encouraged. They further recommended that another census of the type taken in 1959/60 be made.

Data Collection

19. The Seattle report of the F.A.O. Assessment Group drew attention to the fact that age-length and other biological data from antarctic catches have not been made available on a systematic basis to the Commission since the initial compilation for the Committee of Three. The Committee recommended that data for recent years (from 1961/62) should be submitted as soon as possible to the F.A.O. Assessment Group, and that in future such data should be submitted annually and that all such data should be made generally available by exchange between national groups as requested. The Committee noted that the complete submission may require some time and discussed the priority that perhaps might be followed. In particular in view of the increasing importance of sei whales, it was suggested that sei whales data be given first priority.

20. The Committee discussed the difficulties associated with the age determination of sei whales in particular, but also noted the possibility of inconsistent readings with regard to other species. It was agreed that a study should be undertaken to provide consistent age determinations. This would involve exchange of earplugs for readings by biologists from different countries and perhaps a further working meeting at a convenient time on the occasion of the next Annual Meeting of the Commission. Japan agreed to co-ordinate the study for fin whales, Norway (Dr. Jonsgard) for sei whales and Canada (Mr. Pike) for hump-back whales. Australia (Mr. J. Bannister) will continue to co-ordinate the sperm whale age studies.

21. The Committee discussed at some length with Mr. E. Vangstein, Director of the Bureau of International Whaling Statistics, the proposed revision of published summary statistics. Extensive revisions of the Antarctic statistics

had previously been proposed by a subcommittee of the Scientific Committee working with the F.A.O. Assessment Group. A revision of the North Pacific statistics was proposed by the North Pacific Working Group at its London meeting (Appendix B). These revisions were reviewed and it was agreed that a sample of the Antarctic data on the new forms would be distributed to the Committee early in 1967 by Mr. Vangstein, and the whole question reviewed again at the 1967 meeting of the Committee. Mr. Vangstein also agreed to begin the new North Pacific forms in 1967 provided national groups supplied him with the necessary data (on effort and on maturity) as soon as possible after the end of the 1966 season and certainly not later than March 31, 1967. The data collection forms as drawn up by the sperm whale subcommittee were examined and with minor modifications for ease of use, are recommended for transmission of data to the F.A.O. Assessment Group and between national groups. Standard copies will be distributed to those concerned shortly.

Economic studies of whaling regulations

22. No new reports or comments have been made concerning the proposal made last year for the establishment of a special committee to study the economic aspects of whaling. The Committee feels this need still exists and refers to its recommendation of 1965 (Recommendation 13 of the Scientific Report, Page 59 of the Sixteenth Report of the Commission) and to the Appendix 2 of that report (pp. 62, 63 of the Sixteenth Report of the Commission).

Summary and Recommendations to the Commission

1. The Committee reaffirms that a rational scheme of management requires separate quotas for each species. The Committee concurs with the proposal of the North Pacific Working Group that a "combination of blue whale units and specific catch limits (for some stocks) could provide protection where required while providing greater flexibility".

A. ANTARCTIC

2. The best estimate of the present sustainable yields for the whole Antarctic is as follows:—

Fin whales: 4,500: Sei whales 4,500—7,500.

In terms of B.W.U. this means a total of 3,000 to 3,500.

3. The Committee recommends that the Commission should consider setting quotas sufficiently below the level of the sustainable yield so that fin whale stocks can begin to rebuild, rather than be simply maintained at the present low level. This is particularly important since the scientific evidence indicates that the fin whale stocks could be the most productive stock in terms of numbers and economic value.

4. With this point in mind, the Committee recommends that the Commission consider the suggestion of the F.A.O. Assessment Group that complete protection be given immediately and for some time in the future to fin whales to allow this valuable stock to rebuild. This of course would imply that during such protection of fin whales the total burden of catches would fall on the sei whale stock. Some considerations relative to this policy and some possible effects of it are shown in Appendix C. The calculations in the appendix suggest that the sei whale stocks are probably large enough to provide annual quotas of 2,000 B.W.U., or possibly 2,500 B.W.U., until the fin whale stock is large enough to provide these annual quotas and still increase at a reasonable rate.

5. On the understanding that the Commission will carry out its intention of

bringing the catch to a level that "will be less than the combined sustainable yield of the fin and sei stocks as determined on the basis of more precise scientific evidence" the Committee sees no reason for closing the Sanctuary.

6. In regard to the opening date, the Committee wishes to reiterate its recommendation of last year that it would prefer to see no earlier opening date than the one in force now and sees no reason for recommending any change in the closing date.

B. NORTH PACIFIC

7. The Committee has endorsed the recommendations of the North Pacific Working Group. These recommendations are:—

(i) the taking of *humpback whales* should be prohibited for at least one more year;

(ii) no change should be made in the present 5-year closure on *blue whales.*

(iii) for *fin whales* it recommended that catches should be held below the estimated sustainable yield of 1800 for the entire North Pacific and that, as far as possible, catches within stock areas should be held below their respective sustainable yields. Catches of fin whales should not be permitted to rise above these levels until there has been a corresponding rise in sustainable yields verified by further research;

(iv) the catch of *female sperm whales* should not be permitted to rise significantly above the present level;

(v) no recommendations are made on the taking of *sei whales* or *male sperm whales*;

(vi) studies on the state of the stocks of all species should be continued to refine the estimates and to provide a basis for additional recommendations as conditions change.

C. GENERAL

8. The Committee reiterates that it has no additional analyses on sperm whale stocks except those reported on by the North Pacific Working Group. It recommends that the F.A.O. Assessment Group be asked to make an assessment of sperm whale stocks, particularly in respect to those on pelagic grounds and that national groups begin or continue analyses.

9. The Committee reaffirms the need for additional marking particularly of sperm and sei whales.

10. The Committee recommends that studies to ensure standardization of age readings for sperm, fin, sei and humpback whales be initiated or continued. Co-ordinators of such studies have been appointed.

11. The Committee recommends that the taking of gray whales and entire schools of sperm whales under special permits for scientific studies be encouraged. Results of such studies should be made available as soon as possible to the Scientific Committee.

12. The Committee recommends that biological data for the Antarctic (Forms A, C, D, G) since 1961/62, and for sperm whales (Forms SP1 to SP6) be submitted as soon as possible to the F.A.O. Assessment Group and that in future such data should be submitted annually. Furthermore such data should be available for exchange between national groups on request.

13. The Committee recommends that the sighting programme by S.C.A.R. research ships be continued at least for one more year and be reviewed again next year.

14. The Committee recommends that a further census of gray whales be taken.

15. The Committee recommends that the prohibition of the catching of blue whales be extended to the whole of the Southern Hemisphere (para. 9).

REPORT OF SCIENTIFIC COMMITTEE

APPENDIX A

WHALE MARKING—PROGRESS REPORT

The following information is available on whale marking and on marks recovered during the 1965 and 1966 whaling seasons and in the Antarctic season 1965/66.

A total of 287 whales were marked in the southern hemisphere and 303 whales in the northern hemisphere (Table 1). They include 366 sperm whales and 35 sei whales. No marking was carried out in the Antarctic under the International Marking Scheme in season 1965/66.

In 1965 in the North Pacific marks were recovered from 48 whales (1 blue, 23 fin, 5 sei and 19 sperm whales). To date 10 marks from 4 fin and 6 sei whales have been reported from the Antarctic season 1965/66, and 2 from sperm whales taken at stations in South Africa in 1966.

TABLE 1

WHALES MARKED DURING 1965 AND 1966 AND IN ANTARCTIC SEASON 1965/66

	Blue	*Fin*	*Humpback*	*Sei*	*Bryde*	*Minke*	*Right*	*Sperm*	*Killer*	*Total*
SOUTHERN HEMISPHERE										
Australia 1965	—	—	—	—	—	—	—	55	—	55
Australia 1966	—	—	—	—	—	—	—	37	—	37
Antarctic 1965/66 (U.S.S.R.) ...	—	8	—	—	—	—	2	4	2	16 } +24*
Other Regions 1965/66 (U.S.S.R.) ...	—	—	—	4	—	—	16	135	—	155 }
Total	—	8	—	4	—	—	18	231	2	263(+24*)
NORTHERN HEMISPHERE										
North Atlantic Norway, 1965	—	—	—	—	—	8	—	—	—	8
North Pacific Canada 1966	—	8	—	1	—	—	—	34	—	43
Japan 1965	1	22	—	9	—	—	2	31	—	65
U.S.A. 1965/66	46	14	21	7	10	—	—	30	—	128
U.S.S.R. 1965	—	4	—	4	—	—	—	32	—	40
U.S.S.R. 1966	1	—	—	10	—	—	—	8	—	19
Total	48	48	21	31	10	8	2	135	—	303

*24 whales for which species data are not yet available.

APPENDIX B

REPORT ON THE SEVENTH MEETING OF THE NORTH PACIFIC WORKING GROUP. LONDON, JUNE 16TH-17TH 1966.

1. The Seventh meeting of the Working Group was convened on June 16th in the Ministry of Agriculture, Fisheries and Food. London.

2. The following people were in attendance:

CANADA	G. C. Pike (Chairman) K. R. Allen
JAPAN	H. Omura T. Doi T. Nemoto
U.S.S.R.	M. V. Ivashin V. M. Nikolaev O. V. Bakurin
U.S.A.	D. G. Chapman D. W. Rice

3. The following agenda was adopted:

1. Call to order, 10.00 a.m. East Block, Whitehall Place.
2. Adoption of agenda.
3. Meeting schedule and procedure.
4. Exchange and listing of tabulations and papers.
5. Current assessment of whale marking.
6. Progress of stock assessment since February meeting.
   (*a*) Fin
   (*b*) Sei
   (*c*) Sperm
   (*d*) Humpback
   (*e*) Blue
7. Compilation and publication of statistics.
8. Blue whale units.
9. Preparation of report.
   (*a*) Condition of North Pacific baleen stocks
   (*b*) Condition of North Pacific sperm whale stocks
   (*c*) Recommendations on regulation
   (*d*) Compilation and publication of statistics
10. Other business.

4. The following documents were submitted:

CANADA—(C—1) Revised estimates of fin whale populations and sustainable yields for eastern North Pacific areas. K. R. Allen.

JAPAN—(J—1) Third memorandum on results of Japanese stock assessments of whale in the North Pacific. T. Doi, T. Nemoto and S. Ohsumi

U.S.S.R.—(U.S.S.R.—1) Data on biological characteristics of humpback whales taken in 1963 and 1964

U.S.A.—(U.S.A.—1) Proposed summary tables for North Pacific whaling. D. G. Chapman
(U.S.A.—2) Blue whales in the waters of Baja California. Dale W. Rice
(U.S.A.—3) Growth and reproduction of the gray whale. Dale W. Rice
(U.S.A.—4) United States whale marking, June, 1965-June, 1966.

5. Results of whale marking are recorded in the report of the Honolulu meeting. Recent results of Soviet whale marking are recommended for publication in the Norwegian Whaling Gazette. Mr. Ohsumi has replace Dr. Omura as co-ordinator of whale marking results for the North Pacific.

6(*a*) Fin whales. The Group reviewed the additional analyses presented by Japan and Canada (Documents J-1 and C-1, respectively). The best estimates of present population sizes and sustainable yields for North America are shown in the table below where they are compared with recent catches. Estimates for Areas V and VI are not so precise as those for other areas. In the Eastern Pacific catches have exceeded the estimated sustainable yields. Off the coast of Asia (excluding the East China Sea) catches in recent years have been below the estimated sustainable yield.

TABLE

Population Estimates of Fin Whale Stocks, Estimated Suitable Yields and Recent Catches

Area	Population Estimate	Sustainable Yield	CATCHES 1963	1964	1965	Average
North American Coast	300– 900	50	237	287	196	240
II	1,000– 4,000	150	635	310	376	440
III	2,500– 4,000	250	1,149	1,158	901	1,069
IV	5,500– 7,000	500	237	1,610	1,277	1,041
V & VI	7,000–10,000	700	78	426	344	282
Asian Coast	3,000	150	154	132	71	119
E. China Sea	200	—	0	64	0	(21)
TOTAL ...	16,000–27,100	1,800				3,191

(*b*) *Sei Whales.* Some new analyses of sei whale data were presented by the Japanese scientists, (J—1). In particular they gave some estimates of mortality rates and stock sizes of sei whale stocks along the coasts of Asia and North America. Taking these estimates together with those given in the Honolulu report it appears that the stock in the pelagic and coastal whaling areas is in the vicinity of 30 thousand. The Honolulu report stated "the present population of sei whales on the pelagic whaling grounds may be greater than the level at which the maximum sustainable yield may be obtained. The sustainable yield cannot yet be calculated." Essentially the same statement can be made with regard to coastal stocks.

The Group noted estimates of mortality rates and stock size of Bryde whales off the Asian coast presented by Japanese scientists (J1 and Honolulu J–4).

(*c*) *Sperm Whales.* In addition to the estimates given at the Honolulu meeting for male sperms in the pelagic areas, estimates of stock sizes and of mortality rates of sperm whales are given by Japanese scientists (J–1) for stocks off the coast of Japan. These are mainly small males and females which are segregated from the large males which are found on pelagic whaling grounds in higher latitudes. While it must be pointed out that all sperm whale estimates are quite tentative at present, it is agreed that sperm whale stocks are much

larger than baleen whale stocks. There is no evidence that the fishery has seriously affected the stocks or that the level of maximum sustainable yield has been reached.

(*d*) *Humpback Whales.* No new population analyses are available. The U.S.S.R. has made available an age-length key and other biological data from their 1963 and 1964 catch. Unfortunately no data are available from the large 1962 catch. This age-length key shows some differences from that obtained earlier based on samples of Japan and the U.S.A. This may be due to the different areas from which the samples have come or to differences in reading laminations. It is desirable to take steps to standardise the method of lamination counts. Pending resolution of these differences it has not been possible to combine the new and old data and thus no additional information is available.

(*e*) *Blue Whales.* The group noted the new study on blue whales in the waters of Baja California, (U.S.A.–2). It was pointed out that no new catch data on blue whales will be forthcoming during the 5 year prohibition. It is recommended that all whale catchers, both those at coastal stations and those attached to pelagic expeditions, be asked to report sightings of blue whales. Such sightings should be done systematically so that the data may be useful for analyses.

7. *Compilation and publication of statistics.* The proposed draft of summary tables for North Pacific data (U.S.A.–1) was considered, and, after some modifications, agreed to. There was considerable discussion on the duplication of effort to produce such tables in addition to the NP 1, NP 2 and NP 3 tables. The need to produce such tables for all past data and for agreement upon a standard set of basic tables was also discussed.

The revised form of summary tables (U.S.A.–1) is referred to the Scientific Committee for review, co-ordination with recommended forms for Antarctic and sperm whale data, and for consideration by the B.I.W.S.

8. *Use of Blue Whale Units.* The Group's studies have indicated that the stocks of the baleen whales in the North Pacific are in different conditions. For fin whales fairly precise estimates of the sustainable yields of the different stock units are possible and in some areas recent catches have exceeded these estimated sustainable yields. Less precise estimates for sei whales are possible, but these stocks appear to be at or above the optimum level, and present catches probably do not exceed the sustainable yield. In these circumstances management aimed at maintaining maximum sustainable catches requires separate regulation for the different species and stocks. This cannot be achieved if a catch limit is fixed in Blue Whale Units alone, since this could permit over-exploitation of one species and under-exploitation of others. A combination of Blue Whale Unit and specific catch limits could possibly provide protection where required while providing greater flexibility.

9. *Recommendations.* The group reviewed recommendations of the Honolulu meeting, and confirmed all of them but amplify the one referring to fin whales.

For fin whales, the Group recommended that catches should be held below the estimated sustainable yield of 1,800 for the entire North Pacific and that, as far as possible, catches within stock areas should be held below their respective sustainable yields. Catches of fin whales should not be permitted to rise above these levels until there has been a corresponding rise in sustainable yields verified by further research.

C-1. REVISED ESTIMATES OF FIN WHALE POPULATIONS AND SUSTAINABLE YIELDS FOR EASTERN NORTH PACIFIC AREAS

K. Radway Allen
Fisheries Research Board of Canada
St. Andrews, N.B., Canada

The estimates given in this paper replace those included in Document C4 of the papers presented at the Sixth Meeting of the North Pacific Working Group (Honolulu, February 1966). The basic data of age distribution, catch and effort is the same as in that paper. The methods of estimating populations by comparison of actual and expected catches, and of estimating recruitment from the age composition in successive years are essentially as before but have been improved in minor respects. As before estimates have been made for a range of values of the natural mortality rate (M) and for three conversions from ear-plug laminations to years (1 lamination/year, 1 lamination/year to 5 years and then 2 and 2 laminations/year).

The results presented here are confined to the two eastern statistical areas (II and III) and the North American coastal operation, they include various combinations within these areas. For the combination of pelagic area II and the coastal areas separate estimates have been made using Japanese catch per effort and age data, and using North American data, the total catches both pelagic and coastal being used in each case.

Estimates of the initial population, 1965 population, 1966 population, net recruitment rate and 1966 sustainable yield are summarised in the appended table.

It will be seen that as before, the alternative methods of converting laminations to age make no significant difference to the results. There is quite good agreement between the figures for the various combination of areas. In particular the estimates for the coastal areas and Area II separately are, when combined, reasonably close to the estimates for the two fisheries combined. Also the population estimates for Area II and Coastal based on Japanese and North American data are in good agreement. The estimates for present sustainable yield are not quite so close due to the higher estimate of recruitment rate obtained from the Japanese data, but do not differ very greatly (ratio 1·6:1).

(Revised)

AREA	Source of Data: Length Dist.	Source of Data: A/L Key	Source of Data: C/E	Laminations/Year M	1 ·04	1–2 ·04	2 ·08
Canada	Canada	U.S.A.	Canada	Init. pop. (1958)	1,252	1,325	1,370
				1965 pop.	139	158	164
				1966 pop.	62	82	86
				Net. rec. rate	·10	·09	·06
				1966 sust. yield	6	8	5
Canada + U.S.A.	Canada + U.S.A.	U.S.A.	Canada + U.S.A.	Init. pop. (1958)	1,681	1,550	1,526
				1965 pop.	355	325	329
				1966 pop.	185	152	157
				Net. rec. rate	·16	·19	·19
				1966 sust. yield	29	29	30
Area II	Japan + U.S.S.R.	Japan	Japan	Init. pop. (1963)	1,512	1,442	1,488
				1965 pop.	1,090	1,037	1,071
				1966 pop.	849	800	827
				Net rec. rate	·19	·21	·19
				1966 sust. yield	161	168	157
Area II + Coastal (N. Amer. data)	Canada + U.S.A.	U.S.A.	Canada + U.S.A.	Init. pop. (1958)	2,434	2,147	2,098
				1965 pop.	1,524	1,468	1,470
				1966 pop.	1,095	1,058	1,051
				Net rec. rate	·15	·18	·17
				1966 sust. yield	164	191	179
Area II + Coastal (Japan data)	Japan + U.S.S.R.	Japan	Japan	Init. pop. (1963)	2,268	2,219	2,199
				1965 pop.	1,673	1,634	1,622
				1966 pop.	1,355	1,307	1,292
				Net rec. rate	·23	·23	·23
				1966 sust. yield	312	301	298
Area III	,,	,,	,,	Init. pop. (1961)	3,840	3,579	3,759
				1965 pop.	2,589	2,404	2,544
				1966 pop.	1,801	1,713	1,842
				Net rec. rate	·12	·14	·12
				1966 sust. yield	228	238	220
Area IV	,,	,,	,,	Init. pop. (1954)	11,157	7,875	9,990
				1962 pop.	8,571	6,150	7,699
				1966 pop.	7,159	4,761	6,058
				Net rec. rate	·06	·09	·06
				1966 sust. yield	430	428	364

Prepared for the 7th meeting of the North Pacific Working Group in London June 1966.

J-1. THIRD MEMORANDUM ON RESULTS OF JAPANESE STOCK ASSESSMENT OF WHALES IN THE NORTH PACIFIC

TAKEYUKI DOI, TAKAHISA NEMOTE AND SEIJI OHSUMI

ANALYSIS OF COASTAL DATA ALONG ASIAN SIDE

Total mortality coefficient and fishing rate

TABLE 1

Average total mortality coefficients of fin whales caught at Kuril Is. and Japanese north-east coasts—from the age distribution curves, and taking one lamination per one year.

	Kuril Is. ('52–'63)		Sanriku & Hokkaido ('49–'53)	
	Older ages	Younger ages	Older ages	Younger ages**
Males	0·044	0·164	0·052	0·255
Females ...	0·041	0·138	0·047	0·294

* Recruit at 7 or 8 laminations
** Recruit at 3 or 4 laminations

TABLE 2

Average total mortality coefficients of sei whales caught at Kuril Is. and Japanese north-east coasts from the age distribution curves and taking one lamination per one year.

	Kuril Is.(1)	Hokkaido(2)		Sanriku(3)	
		Older ages	(<20 years) Younger ages	Older ages	Younger ages
Males	0·090	0·070	0·043	0·067	0·069
Females	0·121	0·101	0·052	0·111	0·086

(1) 1952, 1956, 1958, 1960
(2) 1955 to 1964

TABLE 3

Total mortality coefficients of sei whales caught at Kuril Is.—from the decline of the year class expressed as C.P.U.E. from 1956.

Year class	Males	Females
10 laminations	—0·003 (0·150)*	0·078 (0·202)
20 ,,	0·132 (0·208)	0·222 (0·240)
30 ,,	0·152 (0·193)	0·149 (0·164)

* The values in brackets are calculated excluding 1962 data.

TABLE 4

Average total mortality coefficients of sei whales caught at Japanese north-east coasts—from the decline of the year class expressed as C.P.U.E. from 1955.

Males (8–28 laminations)	Females (6–26 laminations)
0·019	0·065

TABLE 5

*Average total mortality coefficients of Bryde's whales caught at Japanese coasts—from the age distribution curve and taking one lamination per one year.**

	Sanriku	Kinan	Bonin Is.
Males ...	0·074	0·068	0·072
Females ...	0·059 (1958–1963)	0·075 (1959–1962)	0·085 (1949–1952)

* Preliminary calculations are already presented at Honolulu meeting (J–4).

TABLE 6

Average total mortality coefficients of sperm whales caught at Japanese north-east coasts from the age distribution curves from 1960 to 1965 taking one lamination per one year.

Males	0·113
Females	0·068

TABLE 7

Fishing rates of sperm whales in the Japanese north-east coastal waters—from the marking results.

	m = 0·06	m = 0·08
1951–1965 ...	0·0075	0·0088
1961–1965 ...	0·0098	0·0124

Sustainable yield

TABLE 8

Fishing rates of sperm whales at the sustainable yield in the ground where females are caught (J–4, presented at Honolulu meeting)

Natural mortality rate in the immature stage	Age of recruitment	
	13	25
0·06	0·036	0·306
0·08	0·019	0·236
0·10	0·006	0·180
0·15	—	0·087

Population size

TABLE 9

Preliminary estimates of population size

Species	Area	Estimated year	Estimate
Fin whales	Kuril Is.	1952–1962 Av.	2,000
	Sanriku & Hokkaido (North-east of Japan)	1949–1952 „	700–1,000
	Sea of East China*	1955*	1,200*
Sei whales	Kuril Is.	1956–1964 „	1,500–2,000
	Sanriku & Hokkaido	1964–1965 „	Ca. 10,000
Bryde's whale	Sanriku (Inc. Kinan)	1955–1964 „	5,000–18,000
Sperm whale	Sanriku & Hokkaido	1961–1964 „	120,000–180,000

* Already presented at Honolulu meeting

Canadian and American side

Total mortality coefficient

TABLE 10

Average total mortality coefficients of fin whales caught at Canadian coast—from the age distribution curve taking one lamination per one year

1951–1959	Younger ages	Older ages
Males	0·101	0·050
Females ...	0·145	0·064
1963–1965		
Males	0·170	0·058
Females ...	0·202	0·064

TABLE 11

Total mortality coefficients of fin whales caught at Canadian coasts—from the decline of the year class expressed as C.P.U.E. from 1962

Year class	Males	Females
7 (laminations)	0·556	0·719
17 „	0·437	0·386
27 „	0·450	0·358

TABLE 12

Average total mortality coefficients of sei whales caught at Canadian coasts—from the age distribution curves taking one lamination per one year

	Males	Females
1954–1964	0·084	0·137

Sex Ratio

TABLE 13

Sex ratio in sei whales in the North Pacific, —average from 1962 to 1965*

			Pelagic areas			
	America	Canada	II	III	IV	V
Male %	27·7	61·0	63·2	57·2	57·0	41·1

* The preliminary values for Asian side is already presented at Honolulu meeting.

Population size

TABLE 14

Preliminary estimate of population size of whales along Canadian and American coasts

Whale species	Area	Estimated year	Estimate
Fin whale	Canada	1952–1958	3,600
	"	1962–1964	600
	Canada & America	1965	600–900
Sei whale	Canada	1965	2,000–7,000

U.S.A.—1

Proposed Summary Tables for North Pacific Whaling Statistics

A

TABLE A1

Total Catch by Sex

SPECIES

YEAR	BLUE			FIN			HUMPBACK			SEI			OTHER BALEEN			ALL BALEEN			SPERM		
	M	F	TOTAL	M	F	TOTAL	M	F	TOTAL	M	F	TOTAL	M	F	TOTAL	M	F	TOTAL	M	F	TOTAL
1952																					
—																					
—																					
1966																					

TABLE A2

Catches and effort of pelagic factories by countries

JAPAN

Year	Species								Floating Factories		Catchers			Catcher Days Bal. Sperm Both			Catch per day							
	Blue	Fin	Hump	Sei	Other Baleen	Total Baleen	Sperm	Total	No.	Av. Tonn.	No.	Av. Tonn.	Av. Horse-power				Blue	Fin	Hump	Sei	Other Baleen	Total Baleen	Sperm	Total
1952																								
—																								
—																								
1966																								

U.S.S.R.
etc.

U.S.A.—1

TABLE A.3

Catch and effort of coastal stations by countries

CANADA

Year	Species								Catchers		Catcher Days			Catch per day							
	Blue	Fin	Hump	Sei	Other Baleen	Total Baleen	Sperm	Total	No. Av. Tonn.	Ave. horse-power	Baleen	Sperm	Both	Blue	Fin	Hump	Sei	Other Baleen	Total	Sperm	Total
1952																					
•																					
•																					
•																					
1966																					

JAPAN

etc.

TABLE A.4

Production of Oil and Other Products in the North Pacific by Year

Country	Baleen Oil	Sperm Oil	Meal	Whale Liver or Liver Flukes	Liver Oil	Whale Meal	Whale Solubles	Other products
CANADA								
JAPAN								
U.S.S.R.								
U.S.A.								

Catch and Effort Statistics—Detailed Breakdown

TABLE B 2 M

Area II (120°—140° W Long)

Zone M	Catcher Days			Catch								Catch per day							
Country*	Total	Baleen	Sperm	Blue	Fin	Sei	Hump	Total Baleen	Sperm M F	Sperm Total	Grand Total	Blue	Fin	Sei	Hump	Total Baleen	Sperm M F	Sperm Total	Grand Total

* Broken down between coastal and pelagic catches as necessary

TABLE B 2 N

As above for Zone N

TABLE B 2 P

As above for Zone P

TABLES B3M—B3P

As above for Area III 140°W—160°W Long.

TABLES B4M—B4P

As above for Area IV 160°W—180°W Long.
(Note that B4P would refer to Zone PNP (i.e. excluding Bering Sea)).

TABLE B4Q

As above for Area IV Zone PBS + Zone Q (Bering Sea).

TABLES B5M—B5P

As above for Area V 180°E—160°E Long.
(Note that B5P would refer to Zone PNP, excluding Bering Sea).

TABLE B5Q

As above for Area V Zone PBS + Zone Q (Bering Sea).

TABLES B6M—B6N

As above for Area VI 160°E—140°E Long.
(Note that B6N would refer to Zone NNP excluding Okhotsk Sea).

TABLE B6P

As above for Area VI Zone NDS, P, Q (i.e. all Okhotsk Sea).

U.S.A.—1

TABLES B 7 to B 11

Same data summarized by areas.

TABLE D 1

Length Date by Species, Male

BLUE

Area

Length	Coastal (N.A.)	II	III	IV	V	VI	Coastal (Asia)	Totals
50 • • • • • • • 85			D2—for FIN D3—for HUMP D4—for SEI D5—for SPERM					

TABLE D 6

Length and Maturity Data by Species, Female

Length	Coastal (N.A.)	No. of each length	No. examined for maturity	No. of those examined mature	Percentage of those examined mature	II	III	IV	V	VI	Coastal (Asia)	Totals
50 • • • • 55												

D 7—10 for fins, humpback, sei, sperm

APPENDIX C

Expected Results of Complete Protection of Fin Whales

The Committee has examined some possible consequences of giving effect to the suggestion of the F.A.O. Stock Assessment Group that the stock of fin whales should be allowed to begin to build up by concentrating catching on sei whales for a few years. The Committee believes that such a policy is likely to be sound management both because the fin whales are the largest potential resource, and because it is possible that the present sei whale stock is larger than that giving the maximum sustainable yield so that for a short period catches greater than the sustainable yield should be taken. Also a temporary depletion of the sei whale stocks to a level below the optimum might enable greater combined catches to be maintained, if it gave the opportunity for a more rapid build up of the more valuable fin whale stocks.

If catching of fin whales were completely stopped these stocks would be building up, while at the same time the sei whale stocks would diminish if the catch exceeded the sustainable yield. The simplest system of this kind which would allow the whaling industry to operate with reasonable stability would be to fix a constant catch quota. If this quota were appropriately chosen, then by the time the sei whales were reduced significantly below the optimum level the fin whales would have built up to the point that the same catch (in B.W.U.) could be obtained from them, and from whatever sustainable yield remained from the sei whale stock, with a substantial surplus towards continuing the rebuilding of the stocks.

The Committee has studied the effect of a series of possible quotas operated in this way, in order to determine the approximate maximum level of quota at which the desired results could be achieved. In view of the uncertainty about the size of the sei whale stocks, it has examined the effect for three possible values of the 1966 sei whale stocks. These are:

(*a*) 61,000—the lowest estimate of the F.A.O. Group.

(*b*) 90,000—a central value in the F.A.O. range, and close to that obtained by Japanese scientists.

(*c*) 120,000—close to the upper end of the F.A.O. range.

The attached table shows on the left hand side, the estimated levels of the sei whale sustainable yield (in B.W.U.) in each year for each 1966 population estimate, with each of the fixed catches 2,000, 2,500, 3,000 and 3,500 B.W.U. being taken entirely in sei whales. The centre section shows the sustainable yield of fin whales (in B.W.U.) if no catches of this species are being made.

The right hand section shows what the relation would be between the total available sustainable yield from both species (in B.W.U.) and the catch limit assuming that this limit is to be held at the same level as in the past. The figures actually given are the excess of the combined sustainable yield over the fixed catch, and thus indicate the part of the annual recruitment which will be left to increase the stocks. For example if the quota is set at 3,000 B.W.U. and taken entirely in sei whales and if the present sei whale population is 90,000 then it can be read from the table that by 1969 the sustainable yield in B.W.U. would be: fin whales 3,046, sei whales 933 and the combined yield 3,979 will exceed the quota of 3,000 by 979 B.W.U.

If it were considered that a minimum excess of 1,000 B.W.U. (i.e. an annual increase in the fin whale stock of 2,000) is necessary to permit reasonably rapid build up of stocks, the table shows that this can be obtained with continuing

catches of 2,000 or 2,500 B.W.U. For a catch of 2,500 B.W.U. complete protection of fin whales could be given until at least 1974, if the sei whale stocks are at the upper end of the probable range, but if the sei whale stock is only 61,000, some fin whale catching would have to be started in 1971. If annual quotas of 3,000 B.W.U. were taken, and the 1966 sei whale stocks are 61,000, these stocks would be depleted before the fin whale stock had built up sufficiently to produce both the quota and the desired surplus for further increases, but the 3,000 B.W.U. quota could be continued if the sei whale stocks were larger. A quota of 3,500 B.W.U. could only be maintained with the desired surplus for rebuilding the stocks if the present sei whale stock is at the extreme upper end of its probable range.

For some quotas and initial stock sizes this procedure if pursued too far, would reduce the sei whale stock to negligible proportions—the years by which this would have occurred are indicated in the table by dashes. Brackets indicate that the sustainable yield of the sei whale stock is less than half the optimum, and reduction to this level would involve a long period of rebuilding after catching of fin whales had re-started.

	Sei Whales												Sustainable Yield from Fin Whales (In B.W.U.)
Quota B.W.U.	2,000			2,500			3,000			3,500			
1966 Stock	61,000	90,000	120,000	61,000	90,000	120,000	61,000	90,000	120,000	61,000	90,000	120,000	—
Sustainable yield (B.W.U.) 1967	733	1,000	1,000	717	1,017	1,033	717	1,017	1,050	700	1,017	1,000	2,561
" " " 1968	700	1,017	1,017	667	1,017	1,100	633	1,000	1,117	517	933	1,117	2,801
" " " 1969	667	1,017	1,033	567	983	1,117	433	933	1,117	—	833	1,117	3,046
" " " 1970	583	1,000	1,050	400	917	1,117	—	783	1,050	—	600	1,033	3,300
" " " 1971	450	967	1,067	—	817	1,067	—	583	950	—	—	900	3,624
" " " 1972	(283)	917	1,083	—	683	1,017	—	(367)	833	—	—	700	3,960
" " " 1973	—	833	1,100	—	(467)	933	—	—	677	—	—	(467)	4,326
" " " 1974	—	767	1,117	—	(250)	833	—	—	(433)	—	—	(133)	4,700

Excess of Combined Sustainable Yields Over Quota (B.W.U.)

	2,000			2,500			3,000			3,500		
	61,000	90,000	120,000	61,000	90,000	120,000	61,000	90,000	120,000	61,000	90,000	120,000
1967	1,294	1,561	1,561	778	1,078	1,094	278	578	611	-239	78	61
1968	1,501	1,808	1,818	968	1,318	1,401	434	801	918	-182	234	418
1969	1,713	2,063	2,079	1,113	1,629	1,663	479	979	1,163	—	379	663
1970	1,883	2,300	2,350	1,200	1,717	1,917	300	1,083	1,350	—	400	833
1971	2,074	2,591	2,691	—	1,941	2,191	—	1,207	1,574	—	—	1,024
1972	(2,243)	2,877	3,043	—	2,143	2,477	—	(1,327)	1,793	—	—	1,160
1973	—	3,159	3,426	—	(2,290)	2,759	—	—	1,993	—	—	(1,293)
1974	—	3,467	3,817	—	(2,450)	3,033	—	—	(2,133)	—	—	(1,333)

APPENDIX D

REPORT ON THE SIXTH MEETING OF THE NORTH PACIFIC WORKING GROUP INTERNATIONAL WHALING COMMISSION

Honolulu, Hawaii

7–12 February, 1966

1. The sixth meeting of the North Pacific Working Group was convened on 7 February 1966 at the U.S. Bureau of Commercial Fisheries Biological Laboratory, Honolulu, Hawaii.

2. The following people were in attendance:

CANADA	G. C. Pike K. R. Allen
JAPAN	H. Omura T. Doi S. Ohsumi T. Nemoto
U.S.S.R.	M. V. Ivashin V. P. Zolotarev
U.S.A.	D. G. Chapman D. W. Rice

3. The meeting was called to order by Chairman Pike, and the group was welcomed by J. Marr, Area Director of the Bureau of Commercial Fisheries.

4. The following Agenda was adopted:

1. Call to order, 10.00 hours
2. Address of welcome
3. Adoption of agenda
4. Announcements
5. Exchange and listing of tabulations and papers
6. Stock assessment (includes stock units and marking, age determination, etc.)
   (*a*) Humpback whales
   (*b*) Blue whales
   (*c*) Sei whales
   (*d*) Fin whales
   (*e*) Sperm whales
7. Arrangements for compilation of statistics
8. Preparation of reports
   (*a*) Report on condition of North Pacific baleen stocks
   (*b*) Report on condition of North Pacific sperm whale stocks
9. Other business

5. The following papers and tabulations were distributed, or had been distributed prior to the meeting:

Canada --	(C–1)	Forms NP–1, NP–2, and NP–3
	(C–2)	Progress report on the study of sperm whales from British Columbia, G. C. Pike.

	(C–3)	Comparative zone electrophorograms of muscle myogens and blood proteins of five species of whales from the coastal waters of British Columbia. H. Tsuyuki, E. Roberts and G. C. Pike.
	(C–4)	Estimates of fin whales populations and sustainable yields for the North Pacific area. K. R. Allen.
Japan —	(J–1)	Forms NP–1, NP–2, NP–3.
	(J–2)	Whale marks recovered in North Pacific, 1965, by Japanese vessels. The Whales Res. Inst., Tokyo.
	(J–3)	Summarized report of the whale marking in the North Pacific. The Whales Res. Inst., Tokyo.
	(J–4)	Memorandum on results of Japanese stock assessment of whales in the North Pacific. T. Doi, T. Nemeto and S. Ohsumi.
	(J–5)	Oceanographic conditions in relation to the catch of Bryde's whale in the waters to the Northeast of Japan. K. Nasu.
	(J–6)	Length/Lamination keys for sei, humpback, and Bryde whales. The Whales Res. Inst., Tokyo.
U.S.S.R. —	(USSR–1)	Forms NP–1, NP–2, NP–3.
	(USSR–2)	Progress report on whale research in 1965. M. V. Ivashin.
	(USSR–3)	Summary of paper by A. A. Berzin and A. A. Rovnin: Distribution and migration of whales in the North-eastern part of the Pacific Ocean in the Bering and Ohkotsk Seas (Transactions of TINRO, 58, 1965) .
U.S.A. —	(USA–1)	Forms NP–1, NP–2, and NP–3.
	(USA–2)	Status of humpback whales on their wintering grounds in the southeastern North Pacific. D. W. Rice.

6. *Stock Assessment*

Stock assessments of each species were considered separately under the following headings: (*a*) catches; (*b*) separation of stocks; (*c*) age determination; (*d*) reproduction and natural mortality; and (*e*) past and present population size, and estimate of fishing rates.

7. *Humpback whales*

(*a*) *Catches.* Following the large catches of 1,312 in 1962 and 2,339 in 1963, the catches declined to 280 in 1964 and 307 in 1965.

(*b*) *Separation of Stocks.* Recoveries of marked humpbacks indicate migration between winter grounds in the southwestern North Pacific (the Ryukyu Islands) and summer grounds in the eastern Aleutian area. There are no data to connect the humpback stocks wintering in the southeastern North Pacific (Baja California, etc.) with more northerly summer grounds. However, only 28 whales have been marked in this area, mostly in 1965; furthermore, the catch by shore stations in the eastern North Pacific has been small in recent years. Therefore the lack of positive evidence does not preclude

the possibility that humpbacks which winter in the southeastern North Pacific migrate to the Aleutian area. For these reasons it was decided that, for stock assessment purposes, all pelagic catches of humpbacks should be treated as a single unit.

(*c*) *Age Determination.* No new data were available on age determination in humpbacks. According to Dr. Ivashin, studies are not yet completed by Soviet biologists so no definite conclusions can be reached now.

(*d*) *Reproduction and Natural Mortality.* Catch and effort data were available for the large Soviet catches made in 1962 and 1963. Drs. Doi, Ohsumi and Nemoto (14, Table 9) presented natural mortality coefficients based on age/length keys derived from Japanese and U.S. data, and on the Japanese and Soviet catch figures.

(*e*) *Past and Present Population Size, and Estimate of Fishing Rates.* Dr. Doi, *et al.* presented population estimates based on DeLury's method and on age distribution. The DeLury method gave estimates, for squares P26NP and P27NP, of 1,500-4,500 at the beginning of the 1962 season, 2,100 at the beginning of the 1963 season. It should be noted that 1,910 of the 2,339 humpbacks killed in 1963 were taken in this area. Estimates based on age distribution (J-4 Table 10) gives an estimate of 6,300–8,500 in Areas III and IV at the beginning of the 1962 season. Complete closure for another year (1967 season) is recommended, pending assessment of the effects of catches in recent years; this can be completed when Soviet biological data becomes available (in a few months, according to Dr. Ivashin). Still required are estimates of fishing rates and level of present sustainable yield. The maximum present sustainable yield is not precisely known, but is probably less than 300. Any catches would delay the recovery of the stock to the level of maximum sustainable yield.

8. *Blue Whales*

(*a*) *Catches.* The catch of blue whales was 134 in 1965, compared with 140 in 1964 and 443 in 1963. At the 1965 meeting of the I.W.C., complete closure was established for five years, beginning with the 1966 season.

(*b*) *Separation of Stocks.* Data on catch per unit of effort for Japanese pelagic whaling in areas III, IV, and V, reveal an independent decline in each of these areas, suggesting that these stocks are to some extent distinct. Data are still needed to show the relationship of the blue whale stocks in high latitudes to those occurring in winter in lower latitudes. In early 1965, 49 blue whales were marked off Baja California. Considerable numbers of blue whales are present there at least from January to June.

(*c*) *Age Determination.* No further data on age determination in blue whales are available. Until definite conclusions are reached, alternate calculations should be made assuming one and two ear plug laminations per year.

(*d*) *Reproduction and Natural Mortality.* Drs. Doi, Nemoto and Ohsumi presented calculations of natural mortality coefficients for blue whales. (J4, Table 7).

(*e*) *Past and Present Population Size, and Estimate of Fishing Rate.* Estimates of population size by these methods are given in J4, Table 8. Drs. Doi, Nemoto and Ohsumi presented calculations, by DeLury's method, of population sizes at the beginning of the 1964 season for areas III to V, where most of the pelagic catch has been taken: Area III, 20; Area IV, 1,000; Area V, 400; Total, 1,420; (J4, Table 8); Also included in Table 8 were estimates based on Allen's method and on marking results. On the basis of catch/unit effort, there is evidence for a decline to less than 1/2 of the original population in areas III to V. In 1965 the catch exceeded the sustainable yield. These data justify the 5-year closure established beginning with the 1966 season.

9. *Sei Whales*

(*a*) *Catches.* Beginning with 1961, the total catch of sei whales showed a marked increase to 3,642 by 1964. In 1965 it fell to 3,163. The catch of sei whales by pelagic expeditions was slightly more than 2,000 in both 1964 and 1965. It decreased from about 1,500 to 1,000 from shore stations from 1964 to 1965. Shore station catches of sei whales show marked fluctuation relating to oceanographic conditions and their effect on abundance of preferred food organisms. 1965 was a poor year for sei whales off Japan; it was a good year for sei whales off British Columbia. The catches off British Columbia and California show a reciprocal relationship to the catches of fin whales. Few sei whales were taken west of 180° in 1965.

(*b*) *Separation of stocks.* A total of 49 marks have been recovered from 332 sei whales marked in the North Pacific. The recovery rate is 15·5 per cent. There is a marked segration of sex, age, and maturity classes of sei whales in different areas, especially among females; males are more homogeneous in their distribution. Few young sei whales are taken in the northern parts of Areas II and III by pelagic expeditions. More young sei whales are taken by coastal stations.

(*c*) *Age determination.* No further data are available to indicate whether one or two ear plug laminations are accumulated annually. The Japanese presented a lamination/length key for sei whales taken by their pelagic expeditions and coastal operations.

(*d*) *Reproduction and natural mortality.* Dr. Doi *et al.* (J–4, Table 5) calculated natural mortality coefficients of sei whales in the pelagic whaling areas. Other calculations from catches in Areas II, III and IV and coastal catches from British Columbia and California indicate that mortality rates are about 0·04–0·06, assuming one lamination per year. The coefficient for females was about twice as much as that for males. The value for males may be more representative for the stock as a whole, because of the greater segregation of females by age in different areas, as mentioned above.

(*e*) *Past and present population size, and estimate of fishing rates*: Dr. Doi *et al* (J–4, Table 6) presented population estimates for the pelagic whaling areas based on several methods. The results for the beginning of the 1964 season are as follows:

Area II	5000
Area III	7000
Area IV	5000
Area V	2000
Area VI	1000

Calculations based on marking results give an estimate of 14,000 to 16,000 for Areas III plus IV. The population size is about the same as estimates made in London for fin whales, but the situation is different in regard to sustainable yield because large catches of sei whales have been made only in recent years, and because the stock is more segregated by age. The present population of sei whales on the pelagic whaling grounds may be greater than the level at which the maximum sustainable yield may be obtained. The sustainable yield cannot yet be calculated. Studies on other species have shown that no baleen whale stocks can sustain yields of more than 12 per cent. Therefore, an estimate of the present sustainable yield of North Pacific sei whale stocks on pelagic whaling grounds is approximately 2,000. For Antarctic sei whale stocks the report of the F.A.O. Stock Assessment Section for 1965/66 estimates the net recruitment rate at 0·075. The Antarctic stocks appear to be about the level of the maximum sustainable yield whereas the North Pacific sustainable yield as 2,000 sei whales

should therefore be regarded as an upper limit rather than as a most probable estimate.

10. *Fin Whales.*

(*a*) *Catches.* Pelagic catches of fin whales increased from 2,105 in 1963 to 3,507 in 1964; in 1965 it dropped to 2,898. In recent years about 200 have been taken annually on each side of the North Pacific by coastal stations.

(*b*) *Separation of Stocks.* A total of 874 whales have been marked, and 167 have been recovered. For stock analysis, major areas (II–VI) will be used, as agreed at the 1965 Seattle meeting. These areas may be combined later if necessary. Studies are under way on biochemical methods for distinguishing whale stocks (see "Other business").

(*c*) *Age Determination.* As agreed previously, calculations are being made on the assumptions of one lamination per year, 2 per year, and 2 per year until sexual maturity followed by 1 per year. G. C. Pike and T. Ichihara are currently collaborating on studies to clarify this problem.

(*d*) *Reproduction and Natural Mortality.* Doi, *et al.* (J–4, Table 1) have calculated natural mortality coefficients of about 0·05, assuming one lamination per year, or about 0·10 assuming 2 laminations per year.

(*e*) *Population Size and Estimates of Fishing Rates.* The working group considered estimates of the population of fin whales in the various areas which had been made independently by Japanese and Canadian scientists using different methods and found that there was a substantial level of agreement between them, any differences being as a rule less than the range of probable error. The probable levels of the populations in these areas at the beginning of 1965 were:

Off N. American coast	300 (Canadian estimate only)
Area II	1500–2000
Area III	2500–4000
Area IV	5500–7000
Area V	7000–15000
TOTAL	17000–28000

No definite estimates were made for area VI and the waters adjacent to the Asiatic coastal operations. These studies also showed that neither the method of converting from laminations to age in years nor the natural mortality rate within the probable limits, caused any significant change in the population estimates. There was also fairly good agreement on the estimates of the recruitment and natural mortality rates, and on the basis of these the sustainable yield which could be taken in 1966 without further reduction in the stocks was found to be about 1500–1700, which also confirms the provisional estimate found at the London meeting of the Working Group. The total catch in these areas in 1965 was 3000 so that there was probably a reduction in the total stock of about 1000 fin whales in 1965. Further assessments are urgently needed on coastal stocks on both sides of the Pacific.

The question of allocating the sustainable yields between areas presents some additional problems. In general, the sustainable yields by stock units are probably in about the same proportions as the populations of the respective stock units, but further study is required to provide more reliable definitions of the stock units, and estimates of their populations rates of present sustainable yield, and maximum sustainable yields.

11. *Sperm Whales*

(*a*) *Catches.* Total North Pacific catches of sperm whales have increased

from 7,283 in 1961, to 7,768 in 1962, 10,423 in 1963, 10,314 in 1964 and 12,649 in 1965. In 1965 the pelagic catch was 10,601, including 545 females. In Japanese coastal waters, the catch has been tentatively limited to 1,800 in recent years; this catch includes a high proportion of females. Few sperms are taken by shore stations in Canada and the U.S.

(*b*) *Separation of Stocks.* A total of 3,106 sperm whales have been marked and 148 recovered this and serological studies have suggested that there are three major stocks, one each in the western, central, and eastern North Pacific; these stocks intermingle in the Bering Sea and Aleutian Area. Coastal catches from Canada and pelagic catches from Areas II and III show a similar length frequency, while that of Area IV is different. Separate calculations should be made for each area (II–VI).

(*c*) *Age Determination.* This will be discussed at the special sperm whale meeting.

(*d*) *Reproduction and Natural Mortality.* The sustainable yield of males varies according to the number of mature females per sexually active male in each harem herd. It is important, therefore, to obtain accurate information on the social behaviour of sperm whales. The Japanese have captured one school nearly complete in order to study this problem. More complete schools should be taken in order to obtain information on the problem.

Estimates of natural mortality calculated from age distribution curves by Doi, Nemoto and Ohsumi are presented in J–4, Table 12. Natural mortality figures are given for males in Areas II to V and for females in the Japanese coastal area.

(*e*) *Past and Present Population Size and Estimates of Fishing Rate.* Estimates by Doi, *et al.* of population size for males in North Pacific pelagic whaling Areas II through VI for the period 1959–1964 are presented in J–4, Table 13. For Areas II, III, and IV combined estimates range from 38,500 to 93,000; estimates for Areas V and VI are too broad to use. Estimates of fishing rates for males at the sustainable yield on pelagic grounds and on whaling grounds where females are taken are given in J–4, Table 14 and 15. Off the coast of Japan where females are taken, the fishing rate, as given at previous meetings, is below 0·01.

Large increases in the catch of females would reduce the breeding stock and the potential yield of large males. The recent increased catch of males should not greatly reduce the maximum sustainable yield.

12. *Compilation and Publication of Statistics*

This question was discussed briefly and it was agreed that the present method of exchange of raw data forms NP1, NP2 and NP3 should be continued so that all national groups could have the necessary data for keeping their studies up to date as rapidly as possible. The need for the exchange of additional biological data (e.g. on reproductive condition) was also pointed out.

It was however felt that there was need for the compilation of standard summary tables which could be used as a common basis for all studies, and would be available during working meetings. There was also need for the publication of the data necessary for stock assessment work in permanent form. This would best be done in the International Statistics but it would require modification of the present tables in these in the same manner as is now being arranged for the Antarctic data. Dr. Chapman undertook to prepare and circulate draft tables which could be used as a basis for a discussion at the next meeting of the Working Group.

13. *Other Business.*

(*a*) *Biochemical Methods for Separating Stocks.* National whale research groups are preceding individually with biochemical studies for this purpose of obtaining information on subpopulations. More basic studies by national groups are needed before further consideration is given to the formation of a central unit for biochemical subpopulation studies of whales. A paper by Tsuyuki, Roberts and Pike (C 3) describes preliminary work on electrophoretic studies of whale muscle myogens and suggests that electrophoretic studies of blood serum offers another promising approach to the problems of distinguishing subpopulations. Immunological studies should be continued as a complement to electrophoretic studies.

(*b*) Time and Place of Next Meeting.

It is recommended that the Working Group meet next in London in June 1966, two days before the Scientific Committee of the Commission meets.

SUMMARY OF STOCK ASSESSMENTS

1. *Humpback Whales.* The sustainable yield for the whole North Pacific is believed to be less than 300. Any catches would delay the recovery of the stock to the level of maximum sustainable yield.

2. *Blue Whales.* The stock condition is similar to that noted at the London meeting.

3. *Sei Whales.* The population size of sei whales is about the same as fins in the pelagic whaling area but the stock condition is quite different. The present population of sei whales on the pelagic whaling grounds may be greater than the level at which the maximum sustainable yield can be obtained. The sustainable yield cannot yet be calculated exactly. However from information on other baleen whales an estimate of the present sustainable yield of North Pacific sei whale stocks in pelagic whaling grounds seems to be approximately 2,000.

4. *Fin Whales.* Estimates of total stock size and present sustainable yield are about the same as those given to the Commission in London in June, 1965. The present sustainable yield for Areas II to V is estimated to be about 1,500–1,700. The present sustainable yield off North America is quite small. It is urgently necessary to estimate more accurately the sustainable yield on both sides of the Pacific. Soviet scientists have not yet had time to check these calculations leading to these estimates. Catches in 1966 and following years above this level would cause further depletion of the stocks.

5. *Sperm Whales.* The stock condition of males is similar to that noted at the London meeting. Although catches have increased from about 7,000 in 1961 to over 12,000 in 1965, most of these catches are males which are not needed for breeding, so that the increased catch should not reduce the maximum sustainable yield. Large increases in the catch of females would reduce the breeding stock and the potential yield of large males.

RECOMMENDATIONS

1. The taking of *humpback whales* should be prohibited for at least one more year.

2. No change should be made in the present 5-year closure on *blue whales.*

3. The catch of fin whales should be kept below the sustainable yield of 1,500-1,700 in 1966 in the pelagic grounds, and should not be permitted to rise above this level until there has been a corresponding rise in the sustainable yield as verified by further research.

4. The catch of *female sperm whales* should not be permitted to rise significantly above the present level.

5. No recommendations are made on the taking of *sei whales* or *male sperm whales*.

6. Studies on the state of the stocks of all species should be continued to refine the estimates and to provide a basis for additional recommendations as conditions change.

C-4. ESTIMATES OF FIN WHALE POPULATIONS AND SUSTAINABLE YIELDS FOR THE NORTH PACIFIC AREAS

K. RADWAY ALLEN
FISHERIES RESEARCH BOARD OF CANADA
ST. ANDREWS N.B.

This paper presents estimates of population for each area obtained by the method of comparing actual and expected catches described in Part III of the papers presented to the working group on North Pacific Whale stocks in 1965. It also utilizes estimates of the recruitment rate (proportion of new recruits in the recruited stock in each year) obtained by the method described in Part II of the same series. Effort has been expressed in C.D. W.X. Tonnage/1000, and modified, except for 1965 by weather factors supplied by Dr. T. Nemoto, for pelagic whaling, and by an availability factor based on oceanographic conditions for shore-based whaling on the N. American Coast. No estimates have been made for Area VI including that covered by shore-based whaling on the Asiatic Coast.

The results are set out in Table I which gives the estimates for three methods of cónverting from laminations to years, and for three values of M for each method; the values of M being those believed to cover the most probable range in each case.

The table shows the estimates for the first and last years for which they are available. For Areas IV and V the estimates have been terminated in 1962 and 1961 respectively as the relatively small amount of whaling carried on in these areas in later years causes a lack of adequate data for this period. As a result also it is unlikely that any great alteration has occurred in the population since these dates.

Owing to the differences in the method of classifying effort in the reported data from Japan and U.S.S.R., these estimates have been based only on Japanese effort.

The estimates given are of the initial population in each year. Due to the gradual transfer of effort in Area V from the waters south of the Aleutian chain to the Bering Sea, it is probable that the population in this area declined more rapidly than did the catch per unit effort. The estimates for this area presented here may therefore have an upward bias.

Table II summarizes for each area, and for the most probable mortality rate for each method of converting from laminations to years the estimated populations and sustainable yields at the beginning of 1966. The extension from the end of the original series has been done by subtracting the reported catches and adding recruitment at the appropriate net rate.

The net recruitment rates have been obtained throughout by subtracting the corresponding value of M from the calculated recruitment rate, and the sustainable yields have then been obtained by multiplying the estimated population by the net recruitment rate.

TABLE 1

Fin Whales

Area		1 Lamination/Yr.			2 Lan/Yr. to 5 Yr., Then 1			2 Lamination/Yr.		
		M = ·04	·06	·08	·04	·06	·08	·08	·10	·12
Canada + U.S.A.	1958 pop.	1473	1517	1566	1434	1475	1519	1405	1443	1483
	1965 pop.	280	287	296	276	282	289	268	274	280
	Recruit rate	·24	·24	·24	·26	·26	·26	·30	·30	·30
	Net rate of increase	·20	·18	·16	·22	·20	·18	·22	·20.	·18
	Sust. yield	56	52	47	61	56	52	59	54	50
Canada + U.S.A. + II	1958 pop.	1863	1962	2073	1816	1911	2016	1739	1821	1913
	1965 pop.	1077	1099	1123	1068	1089	1112	1040	1058	1078
	Recruit rate	·23	·23	·23	·23	·23	·23	·28	·28	·28
	Net rate	·19	·17	·15	·19	·17	·15	·20	·18	·16
	Sust. yield	205	187	168	203	185	167	208	190	172
Canada	1958 pop.	668	672	675	636	638	639	588	588	588
	1965 pop.	39	37	35	40	38	36	39	36	33
	Recruit rate	·40	·40	·40	·44	·44	·44	·48	·48	·48
	Net rate	·36	·34	·32	·40	·38	·36	·40	·38	·36
	Sust. yield	14	13	11	16	14	13	16	14	12
II	1963 pop.	2125	2280	2465	1919	2039	2180	2083	2231	2407
	1965 pop.	1513	1625	1759	1368	1459	1557	1484	1592	1720
	Recruit rate	·11	·11	·11	·14	·14	·14	·15	·15	·15
	Net rate	·07	·05	·03	·10	·08	·06	·07	·05	·03
	Sust. yield	106	81	53	137	117	93	104	79	52
III	1961 pop.	3939	4271	4657	3755	4054	4399	3899	4230	4617
	1965 pop.	2882	3062	3270	2683	2838	3017	2867	3047	3257
	Recruit rate	·15	·15	·15	·16	·16	·16	·18	·18	·18
	Net rate	·11	·09	·07	·12	·10	·08	·10	·08	·04
	Sust. yield	317	276	229	323	284	242	287	244	130
IV	1954 pop.	7304	8269	9526	6337	7086	8039	7463	8521	9929
	1962 pop.	5679	6361	7249	5023	5560	6243	5872	6636	7651
	Recruit rate	·14	·14	·14	·16	·16	·16	·17	·17	·17
	Net rate	·10	·08	·04	·12	·12	·10	·09	·07	·05
	Sust. yield	568	509	290	624	667	624	528	465	382
V	1952 pop.	8883	12905	23976	7441	10090	15844	13365	26607	—
	1961 pop.	10463	15182	28168	8868	12013	18844	16447	32743	—
	Recruit rate	·11	·11	·11	·12	·12	·12	·13	·13	·13
	Net rate	·07	·05	·03	·08	·06	·04	·05	·03	·01
	Sust. yield	735	709	845	710	721	754	822	981	—

TABLE 2

Fin Whales

Area		1 Laminated/Yr.	1–2 Laminated/Yr.	2 Laminated/Yr.
Canada + U.S.A.	M	·04	0·4	·08
	1966 pop.	100	95	85
	Net rate	·20	·22	·22
	Sust. yield	20	21	19
Canada + U.S.A. + II	1966 pop.	504	495	467
	Net rate	·19	·19	·20
	Sust. yield	96	94	93
II	1966 pop.	1217	1091	1186
	Net rate	·07	·10	·07
	Sust. yield	85	109	83
III	1966 pop.	2199	1996	2163
	Net rate	·11	·12	·10
	Sust. yield	242	240	216
IV	1966 pop.	3523	3714	4222
	Net rate	·10	·12	·09
	Sust. yield	352	445	380
V	1966 pop.	13513	11844	19935
	Net rate	·07	·08	·05
	Sust. yield	946	947	997
TOTAL SUSTAINABLE YIELD		1645	1762	1695

J-4. MEMORANDUM ON RESULTS OF JAPANESE STOCK ASSESSMENT OF WHALES IN THE NORTH PACIFIC

FIN WHALE

Natural Mortality coefficient

TABLE 1

Estimates of natural mortality coefficients of fin whales

	Males & Females
1 Laminated per year ...	... 0·04-0·06
2 Laminated per year ...	... 0·10-0·12

Population size

TABLE 2

Population sizes of fin whales in the North Pacific

Area	Initial Year estimated	Initial estimate	Estimate at 1965
Off America	no estimation		
Off Canada	no estimation		
II	1963	2,000–2,500	2,000
III	1961	3,000–7,000	4,000
IV	1954	8,000–15,000	7,000
V, VI	1952	less than 10,000	7,000
Off Japanese coast	no estimation		
West coast of Kyushu (Sea of East China)		1,200	200
Other areas	no estimation		

Sustainable yield

TABLE 3

Examples of fishing rates at sustainable yield of fin whales in one mathematical model

M = 0·05 (1 lamination per year)

Pregnant ratio	Natural mortality coefficient before recruit		
	0·05	0·07	0·09
0·45	0·066	0·054	0·044
0·50	0·075	0·063	0·052
0·55	0·084	0·071	0·059

M=0·10 (2 lamination per year)

Pregnant ratio	Natural mortality coefficient before recruit		
	0·11	0·13	0·15
0·45	0·032	0·026	0·020
0·50	0·044	0·037	0·030
0·55	0·055	0·048	0·041

SEI WHALE

Age Constitution

TABLE 4

Age constitution of sei whales in the North Pacific

Sex	Locality	under 15 lami.	16–25 lami.	26 up lami.
Males	Japanese coast	32·46	30·34	37·20
	Canada	15·07	30·06	54·87
	North Pacific (II, III)	20·39	37·04	42·57
Females	Japanese coast	59·18	27·18	13·64
	Canada	44·46	34·49	21·05
	North Pacific (II, III)	22·25	43·43	34·32

Natural Mortality Coefficient

TABLE 5

Natural mortality coefficient of sei whales in the pelagic areas

	Males	Females
1 lamination per year	0·06–0·08	0·10–0·12

Population Size

TABLE 6

*Summarized results of preliminary estimates of population sizes of sei whales in the pelagic whaling grounds in the North Pacific***

Area	Initial year estimated	Initial estimate	Estimate at 1964
II	1963	800–5,000	5,000
III	1963	7,000	7,000 } 14,000–16,000*
IV	1954	4,000–7,000	5,000 }
V	1952	500–2,000	2,000
VI	1956	1,000	1,000

* by making results.

** not including coastal whaling stocks belonging to area II–VI.

BLUE WHALE

Natural Mortality Coefficient

TABLE 7

Natural mortality coefficient of blue whales in the North Pacific

	Males	Females
1 lamination per year ...	0·05-0·06	0·05-0·07
2 laminations per year ...	0·10-0·11	0·11-0·15

Population Size

TABLE 8

Population size of blue whales in the North Pacific

DeLury's Method

	Area III	Area IV	Area V	Total
1952	—	—	600	—
1954	—	1,600	—	—
1960	230	—	—	—
1964	20	1,000	400	1,420
Allen's Method				
1952	—	—	280	—
1954	—	600–1,200	—	—
Marking results				
1954–64	630–910		—	—

HUMPBACK WHALE

Natural Mortality Coefficient

TABLE 9

Natural mortality coefficient of humpback whales in the North Pacific

	Males & Females
1 lamination per year ...	0·05-0·08
2 laminations per year ...	0·10-0·15

Population Size

TABLE 10

Estimates of population sizes of humpback whales in some pelagic whaling grounds

DeLury's Method

Year	P26NP	P27NP
1962	1,500	4,500
1963	2,100	

From Age Distribution

Year.	Area III & IV
1962	6,300–8,500

BRYDE'S WHALE

Total Mortality Coefficient

TABLE 11

Total mortality coefficient of Bryde's whales (1 lamination per year)

	Bonin Is.			Adjacent waters to Japan	
	Males	Females		Males	Females
1950	0·05	0·05	1958	0·07	0·06
1951	0·03	0·06	1959	0·05	0·05
1952	0·05	0·06	1960	0·07	0·08
			1961	0·03	0·05
			1962	0·07	0·06
			1963	—	0·04
Mean	0·04	0·06		0·06	0·06
Age at recruit	13	11		8	7

SPERM WHALE

Natural Mortality Coefficient

TABLE 12

Estimated natural mortality coefficients calculated from age distribution curves

Area	Natural mortality coefficient	
	U.S.S.R. + Japan	Japan
II*	0·10–0·12	0·02–0·06
III*	0·10–1·14	0·08–0·10
IV	0·02–0·08	0·02–0·07
V	0·02–0·11	0·03–0·06
Japanese coastal		0·06–0·08

* Including fractions of dispersal to higher latitude.

Population Size

TABLE 13

Estimated population sizes of the male sperm whales in the North Pacific factory ship whaling grounds (1959–64)

Area	Population size
II	3,000
III	3,500–10,000
IV	32,000–80,000
V, VI	6,600–63,000

Sustainable yield

(1) Male whales in the Subarctic waters

TABLE 14

Fishing rates of males at the sustainable yield, according to the number of females belonged to one sexually active males in harem

Number of females	Fishing Rate
20	0·12
10	0·07
5	0·025

(2) In the whaling ground where females are caught.

TABLE 15

Fishing rates at the sustainable yield in the ground where females are caught

Natural mortality rate in the immature stage	Age at recruitment 13	25
0·06	0·036	0·306
0·08	0·019	0·236
0·10	0·006	0·180
0·15	—	0·087

J-3. SUMMARIZED RESULT OF THE WHALE MARKING IN THE NORTH PACIFIC
THE WHALES RESEARCH INSTITUTE, TOKYO

Whale marking has continued in the North Pacific with the cooperation of Canada, Japan, U.S.A. and U.S.S.R. By the end of 1965 (result in 1965 is not yet final for U.S.S.R.), 4,907 whales were recorded as effectively marked. The number of whales marked by species and nationality is shown in the following table.

Number of Whales Marked in the North Pacific

	Blue	Fin	Sei & Bryde's	Hump.	Sperm	Gray	Right	Others	Total
Canada (1955–65)	—	11	4	4	44	1	—	—	63
Japan (1949–65)	59	798	299	357	2117	1	7	1*	3640
U.S.A. (1962–65)	49	38	13	28	102	5	—	—	235
U.S.S.R. (1954–65)	6	27	16	27	843	30	16	4**	969
TOTAL	114	874	332	416	3106	37	23	5	4907

* Pilot whale
** Killer whale

The distribution of whales marked as summarized in the following figures for each species. In these figures the result by U.S.S.R. is excluded, for records of the position of marking in detail are lacking except those of 1964. Although areas of marking have gradually been expanded comparatively few whales were marked in waters of low and middle latitudes.

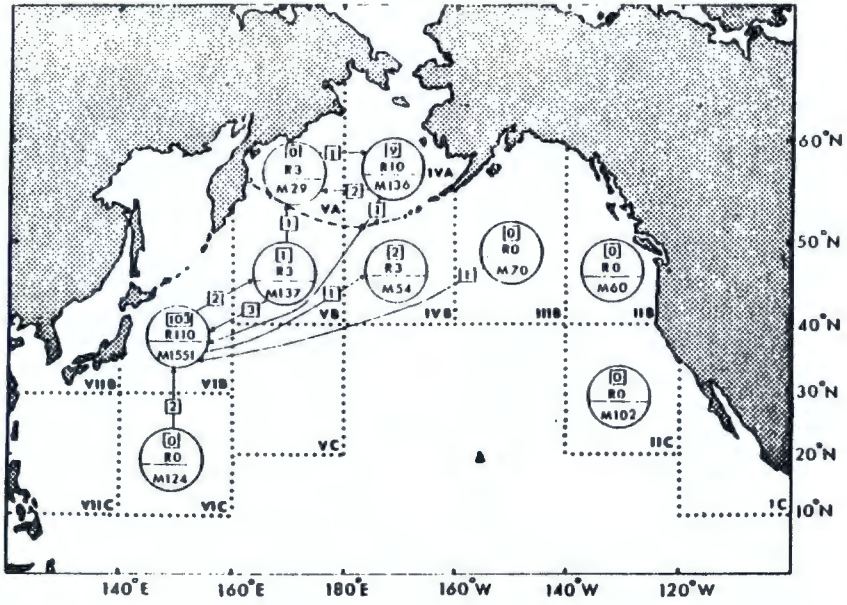
Excluding the marks of U.S.S.R., a total of 13 blue, 166 fin (includes 3 by U.S.A.), 49 sei (or Bryde's), 18 humpback and 130 sperm whales were reported as recaptured. Number of whales recaptured in each area as well as movement from one area to another are also shown in these figures (excludes the U.S.S.R. marks and those of unknown position).

Explanation of figures. Summarized result of whale marking in the North Pacific (excluded the result by U.S.S.R.), and the movements of the recaptured whales. M: Number of marked whales, R: Total number of recaptured whales in each area, Number in square: Number of whales recaptured in the same area, Number in square with arrow: Number of whales moved to different areas.

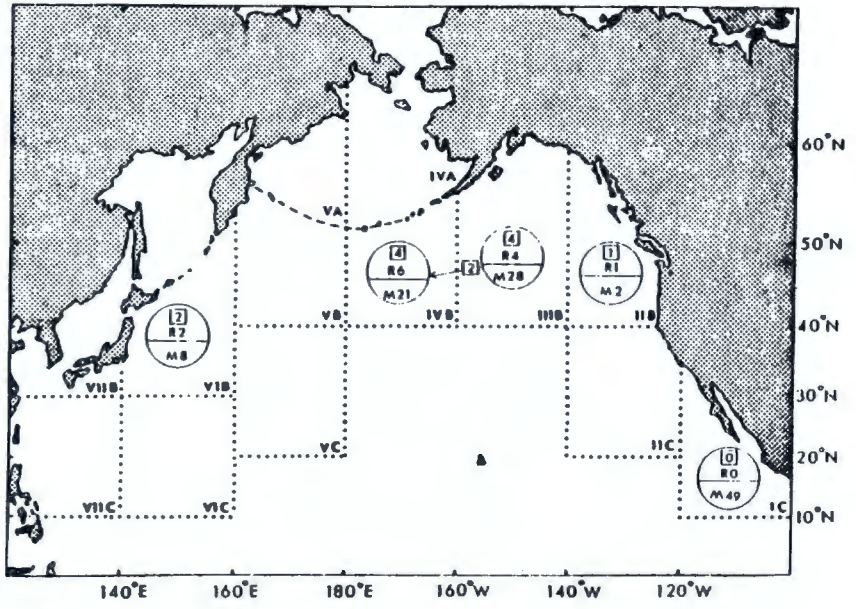
Number of Whales Marked by Japan in North Pacific 1965

Square	Species					
	Blue	Fin	Sei	Right	Sperm	Total
M21					5	5
N25				1	5	6
N26		2	1		1	4
P25NP					1	1
P25BS		4	1		4	9
P26NP		3	2		1	6
P27		3				3
P28	1	6	4	1	11	23
P29		3			3	6
TOTAL	1	21	8	2	31	63

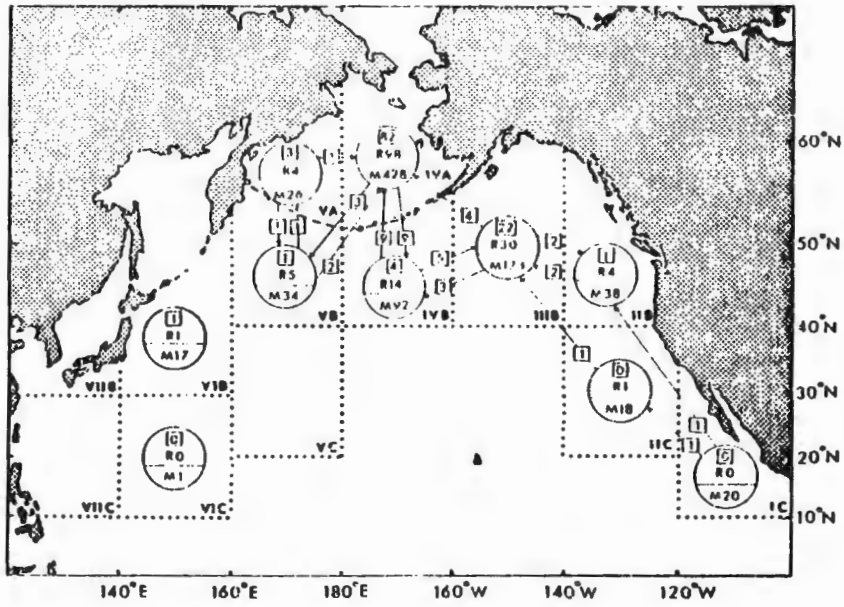
SPERM WHALES



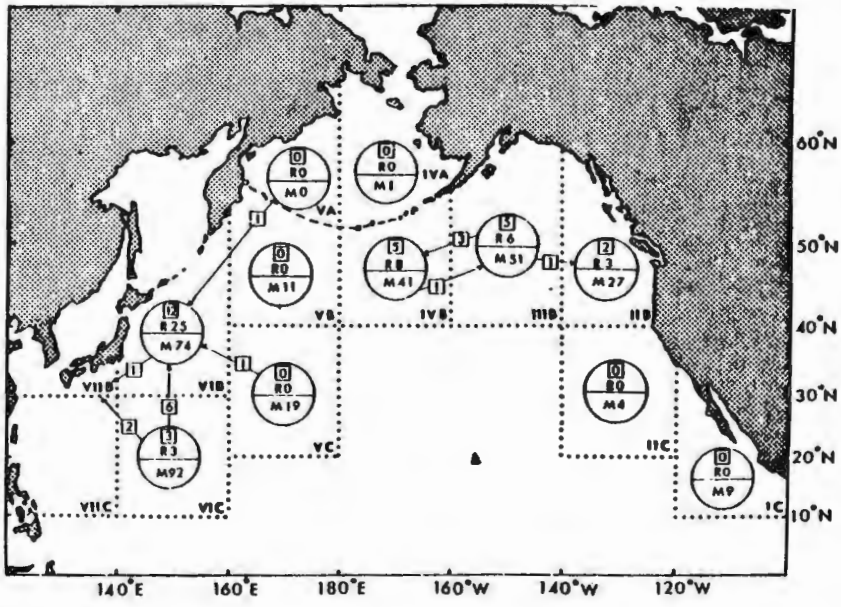
BLUE WHALES



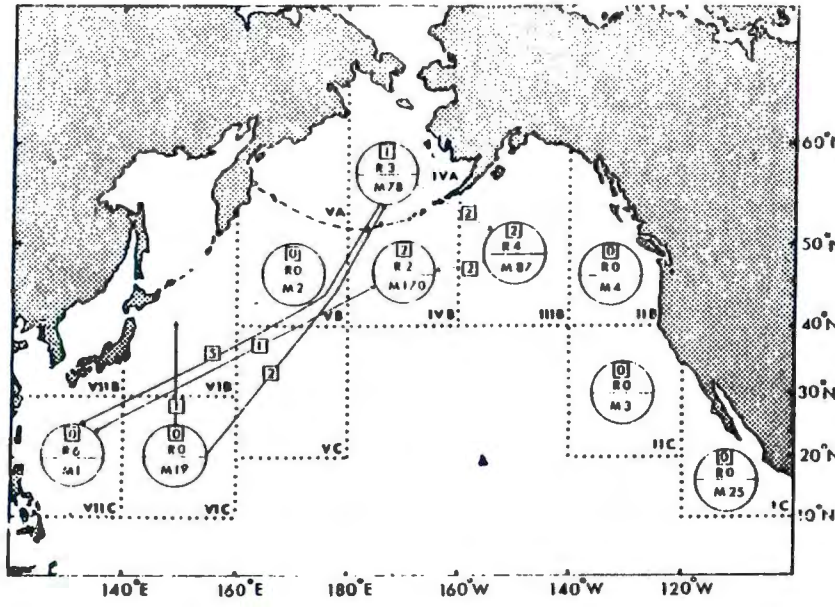
FIN WHALES



SEI & BRYDE'S WHALES



HUMPBACK WHALES



REPORT OF THE SCIENTIFIC COMMITTEE

APPENDIX E

SPERM WHALE SUB-COMMITTEE MEETING REPORT
Honolulu, Hawaii, 10th-18th February, 1966

Participants

Australia	J. L. Bannister
Canada	G. C. Pike
Japan	H. Omura T. Doi S. Ohsumi T. Nemoto
U.K.	R. Gambell (Convenor)
U.S.A.	D. G. Chapman
U.S.S.R.	M. V. Ivashin V. P. Zolotarev

Due to the concurrent meeting of the North Pacific Commissioners, the Soviet delegates attended agenda items 6, 7 and 8 only.

Agenda

The provisional agenda circulated before the meeting was amended slightly, as follows:

1. Review of current programmes
2. Age determination—methods, standardisation of readings, validity
3. Reproductive biology—ages and lengths at sexual maturity, including identification of sexually active males
   —female cycle; timing and duration of gestation, lactation and the resting period.
4. Stock identification and separation—marking and movements
   —blood typing
   —other characteristics
5. Catch and effort statistics—preparation for and methods of stock assessment work
6. Conclusions
7. Recommendations
8. Preparation and adoption of report

During the first two days of the meeting the North Pacific group was in session and there was some collaboration when sperm whales were under discussion.

Report

1. Review of Current Programmes

The progress reports, other background papers and published works available were used extensively in the sub-committee's discussions. The progress achieved in the elucidation of a number of problems of sperm whale biology since the stimulus of the first meeting of the sperm whale sub-committee in Seattle in

November 1963 was noted. But little or no progress has been made in stock delineation (marking and blood studies), or in stock assessments except in the North Pacific. Both of these were the subject of strong recommendations from the first meeting.

2. AGE DETERMINATION

Teeth. Two special methods of preparation of teeth for lamination counts are used in different countries:

(*a*) Etching, as described in document A2.

(*b*) Staining, as described in document C1.

In Japan and the United Kingdom the cut surfaces are not prepared other than by polishing, mainly because of the larger numbers examined in these countries. Both of the latter countries felt that their own methods could be improved by further preparation of the cut surface of the tooth.

Lamination counts on Australian photographs of etched teeth by the workers present showed good agreement. Fifteen maxillary teeth (cut and roughly polished in the U.K.) were examined by the Japanese and good agreement was reached on almost half; for the remainder counts varied by as much as a factor of x2, presumably because of differences in interpretation.

Growth curves obtained from plots of tooth lamination counts against length were compared. There was general agreement between results from the North Pacific (both Japanese and Soviet data), Japanese Antarctic and Western Australian data. The United Kingdom's data from Durban showed a marked difference, particularly over the lower size range, as shown in Table 1, which is to be expected from the results of the direct comparison of lamination counts.

TABLE 1

Comparison of average length (feet) at tooth lamination count (see text)
(Provisional Data)

	Males				Females			
No. of Laminations	N. Pacific (Japanese data)	N. Pacific (Soviet data*)	S. Africa (Durban)	W. Aust. ralia	Antarctic (Japanese data)	N. Pacific (Japanese)	S. Africa (Durban)	W. Australia
10	32·5	—	35	27	—	31	34	27
20	42	42	42·5	38	—	34	35	33
30	44·5	46	48	47	45	34·5	35·5	35
40	47	48·5	—	50	48	35	—	35·5

* Data provided for the 1964 meeting of the I.W.C.

It must be noted that regional differences in growth rate may account for some variations, but it seems likely that large discrepancies are caused by differences in interpretation of tooth laminations.

Further confirmation of the compatibility of tooth lamination counts obtained by different workers was given by data on the age at sexual maturity in males and females (q.v.).

It was decided to extend the comparative work by obtaining a number of teeth from several animals and sending these to the various participants for study by the different methods of preparation and reading used in each country. Mr. Bannister undertook to provide and distribute these teeth.

Considering which tooth is the best to collect for lamination counting purposes, Japanese work has shown that the pulp cavity of the maxillary teeth tends to close before that of mandibular. It was considered therefore that the first mandibular tooth, as used by the Australians, may be the best tooth to examine, unless it is badly worn at the tip in old large whales in which case an unworn maxillary tooth should also be collected.

The interpretation of the laminations in terms of exact age relies on recovered whale marks and studies of incremental growth in the teeth. Both of these suggest that there is one cycle of light and dark bands per year. The relation of the lamination patterns to events in the life history of the individuals needs further study, but it does seem that there may be useful information represented in these patterns.

Ovaries. The use of ovarian corpora counts for age determination was considered as a supplementary method available for sexually mature females. Plots of tooth laminations against corpora counts give an accumulation rate of between 0·4 and 0·5 corpora per lamination for data from Durban, Western Australia, and Canada, but only 0·26–0·31 for Japanese North Pacific records. This difference may be due in part to the method of examination of ovaries in Japan where corpora counts are not obtained by the slicing technique used in other countries, so resulting in lower counts at a given age.

Methods of obtaining ovulation rates independent of tooth lamination counts, from an analysis of data from Saldanha Bay (document SA1), gives a figure of about 0·4 per year, and from British Columbia of about 0·5 per year (document C1). Further work on the breeding cycle is needed before corpora counts can be used with certainty in age determination, since there is some doubt concerning the length of the female cycle (q.v.).

3. Reproductive Biology

Ages and lengths at sexual maturity. The number of tooth laminations at the first ovulation in females ranges from 7 to 11 in the data from Australia, Canada and Japan, but it is only about half this in the United Kingdom's data obtained at Durban (see section on teeth). The length at sexual maturity in females in all areas for which information is available lies in the range 28–30 feet.

The question of sexual maturity in males was discussed. Three categories can be recognized:

(*a*) immature, where all testis tubules are closed

(*b*) pubertal, where the testis contains both closed and open tubules

(*c*) mature, in which all the tubules are open and all stages of spermatogenesis can be found.

The mature males may be further divided into those which are sexually active, and those which, while potentially reproductive, are not in possession of a harem. Canadian work suggests that the former group may be recognised by the weight of a testis, which exceeds 7 kg. Confirmation of this in other areas is needed.

Difficulty has been found in distinguishing between pubertal and mature whales histologically. It was decided that the best definition of sexual maturity in males was the 50 per cent point between immature and non-immature animals. The length at this point is about 30 to 32 feet, but the only estimate of age at maturity from sufficient observations comes from Japanese results, indicating 7·7 tooth laminations.

Female cycle

Gestation period. This is the only phase of the sexual cycle where the duration is known with some certainty (15-17 months). It was agreed in the light of the information contained in document UK2 that biologists' records only should be used in investigations of gestation. Comparison of data on dates of conception and birth, length at birth and the specific foetal growth velocity (*a*) were made for various areas (see Table 2).

TABLE 2

Sperm Whales— Data on gestation (based on biologists' records)

	Average month of Conception	Average month of Birth	Length of gestation in months (t)	Length at birth in cm. (lt)	Specific foetal growth velocity (a)
N. Hemisphere					
W. Canada	April	Aug.	c.16	416	
Kuril Islands (Chuzhakina)	mid April	mid Sept.	17·7	427	0·86±0·01
Japanese coast	April	Aug.	c.16	<426	
Azores (Clarke)	May	early Sept.	16	392	0·87±0·03
S. Hemisphere					
Durban	late Dec.	mid April	15·5	425	0·97±0·01
Saldanha Bay	early Dec.	late Feb.	14·6	408	1·00±0·06
W. Australia	early Jan.	early April	c.15	<427	
S.E. Pacific (Clarke et al)	Sept.	Feb.	17	402	0·83± ?

In the northern hemisphere, the dates of conception and birth are April–May and August–September, respectively. In the Southern Hemisphere, data from South Africa and Australia indicate conception occurring in December–January, and birth from February to April. Some minor differences in these dates and durations are caused by the uncertainties in the exact length at birth, others probably by true regional variations. The Southeast Pacific estimate of conception period is quite different from the other data from this hemisphere.

The best parameter of foetal growth for direct comparison between areas appears to be *a*, which is significantly higher off South Africa than in the North Pacific and around the Azores.

Although a difference of six months would be expected between the dates of conception and birth in the two hemispheres, the Australian and South African data are out of phase with the northern hemisphere data by only four months, possibly because of differences in local climatic factors.

Lactation. Three main methods of estimating the length of lactation were discussed:

(1) Estimations of the age of known weaning animals from growth curves (Ohsumi)

(2) Examination of cyclic patterns in tooth laminations (document C1)

(3) The frequency distributions of corpora albicantia diameters, and mammary gland thickness and the proportion lactating in the catch of adult females (document SA1)

It seems very likely that the lactation period, as estimated by all these methods, is more than one year and possibly two years. Other evidence from the Southeast Pacific and the Azores suggests that it may be 17–18 months. All the estimates depend on certain assumptions which need further checking, bearing in mind that the length of the lactation period may show considerable individual variation.

The resting phase and the length of the breeding cycle. The determination of the length of the resting phase and the total length of the breeding cycle are closely connected. There is little definite evidence on the former, and it has generally been estimated so as to bring the breeding cycle to a complete number of years. South African evidence (document SA1) points to a resting period of 20 months and a total cycle of five years. Japanese and Canadian results suggest a four-year cycle, and a resting season of eight months. None of these estimates is conclusive, and more work is required to clarify the average cycle. It is apparent from date on number of ovulations at age that considerable individual variation will occur.

On the evidence available to it, the sub-committee was unable to decide on the exact form of the breeding cycle, but considered that it was likely to be of four or five years' duration on the average, indicating a pregnancy rate of 0·25 or 0·20. These values are consistent with the estimated true proportions of adult females pregnant in the various regions (see Table 3).

TABLE 3

Values of Pregnancy Rate from Various Regions

	W. Canada	Japanese coast	Azores	Durban	Saldanha Bay	Western Australia
True % pregnant	<35	26–29	c.17	19	21	23

Comparing these results with the value of 0·4–0·5 ovulations per tooth lamination suggests that sperm whales are potentially seasonally polyoestrus, if there is one tooth lamination a year. The Japanese ovulation rate of 0·26–0·31 is more consistent with a monoestrus cycle.

4. Stock Identification and Separation

Marking and movements. Recovered whale marks from the North Pacific area suggest at least three breeding stocks which intermingle in the central area (see document J3). No firm conclusions can be drawn in other regions because of the small number of marks fired and recovered. There is no evidence from observations of seasonal movements to suggest longitudinal mingling of populations, but there is evidence of seasonal latitudinal movement in data from South Africa.

There is an urgent need for increased whale marking of commercial sized animals for delineation of stock units. Efforts should be made to mark whales away from whaling grounds and out of whaling seasons. A number of small whales should also be marked for age-determination purposes.

Blood typing. Immunological and electrophoretic methods for determining sub-populations of sperm whales are showing some promise (see e.g. document C2 and Fujino). More studies on basic methods are required for their development, and could best be done by national groups, because of the prohibitive cost of setting up a central international agency.

Other characteristics. The only other feature which so far has shown any promise is the presence of diatom film, in showing the proportion of whales which may return to the breeding areas (document A1).

It must be emphazised that direct evidence on rates of movement, and migration patterns, can come only from marking returns.

5. Catch and Effort Statistics—Preparation for and Methods of Stock Assessment Work

Because of the recent large catches of sperm whales throughout the world, the sub-committee felt that there was an urgent need for stock assessments to be carried out as soon as possible. These could be done in two ways; by individual national groups, and/or by a special group appointed by the International Whaling Commission.

It was agreed that a combination of these methods would be best; a special group should undertake over-all assessments particularly for pelagic data, but using additional data from land station operations where appropriate. Individual national groups would continue more detailed analyses to provide refined estimates of parameters and would make their results generally available.

With this in mind, the sub-committee decided that the data necessary for these assessments should be tabulated in the following way, on forms to be drawn up by Mr. Bannister.

Form SP 1. Amounts of biological data available for each sex from individual groups or stocks, by seasons. (= Committee of Four, form A)

SP 2. Data on age (number of tooth laminations) at length, or completed age-length key, for males (= form C)

SP 3. Data on female reproductive condition (numbers immature, pregnant, lactating, resting) at age (both tooth lamination and ovulation) (= form D)

SP 4. } Data on catch and effort for pelagic and land station operations, by sex, season, month, 10° square or location (= forms E_1, E_2, and NP_1, NP_2, and NP_3). To be provided by the B.I.W.S. SP 6 would give data on catch length distributions.
SP 5. }
SP 6. }

SP 7. Marking data (= form F) to be provided by N.I.O. or the North Pacific Working Group, as appropriate.

The Bureau of International Whaling Statistics should be asked to indicate the probable cost of transferring data for forms SP 4–6 to punch cards and providing the necessary tabulations for distribution. Land station data where available should be provided by biologists, and the International Whaling Commission should be advised to ask member countries to collect and send to the Bureau their effort data (at least in terms of C.D.W.). It was realized that effort data for sperm whale catches in the Antarctic would probably only be valid for the months outside the baleen whale season.

To facilitate the preparations for stock assessments, exchange of data and results between working groups should be encouraged with special reference to material in forms SP 2 and 3, and refinements of effort measurements. It is particularly desirable to expand the exchange of views on methods of analysis.

Information is also urgently required on social behaviour, with particular reference to the composition of schools and the number of males required to maintain full reproductive efficiency. Valuable results should be gained from analyses of sightings from aircraft and ships, catches of whole schools under permit (see document J2), and from marking results.

Conclusions

Age determination. There is fairly good agreement between tooth lamination counts made by workers in different countries, but further exchange of material is desirable to ensure complete compatibility of results.

The first mandibular may be the most useful tooth to collect, unless worn, in which case an unworn maxillary tooth should also be obtained.

Further work to confirm the rate of lamination formation is required, and also to associate the cyclic tooth lamination patterns with the life history of the whales.

Ovarian corpora counts are a useful supplementary method of age determination, once the annual ovulation rate and female breeding cycle are known precisely.

Ages and lengths at sexual maturity. The most reliable estimates of age at sexual maturity in females range between 7–11 tooth laminations, at a length of 28–30 feet.

Males become sexually mature at a length of 30–32 feet, and this is probably at an age of about 8 tooth laminations. The breeding bulls still need to be more certainly identified.

Female breeding cycle. Gestation can be determined with some accuracy, at between 15—17 months, the range being due in part to the various lengths at birth estimated for different regions. Biologists' records only should be used in analysis of foetal growth, and the best parameter for regional comparison appears to be *a*. A higher specific foetal growth velocity is indicated off South Africa than in the North Pacific and the Azores.

Lactation has been estimated to last about two years or 17–18 months by various methods. More work is needed to confirm the average duration.

The length of the resting phase is uncertain. Estimates range from eight to 20 months, giving a four or five year breeding cycle on average, comparable with the proportion of adult females pregnant, estimated to be 20–30 per cent in different areas.

Stock identification and separation. Little definite evidence is available outside the North Pacific area (where at least three main breeding stocks are recognized) to delineate regional populations of sperm whales. This is due to lack of marking activity and the early stage yet reached in immunological and electrophoretic analysis techniques.

Catch and effort statistics. The compilation of data suitable for future stock assessments by national groups and a special group should be started immediately, and a scheme of tabulations for exchange and comparison is proposed, leaving scope for national initiative in assessing local fisheries and studying important biological and social features of the sperm whale populations.

7. Recommendations

Marking. There is an urgent need for more marking to be done, particularly to delineate stocks, estimate rates of movement, and for age determination, stock assessments and studies of social behaviour. If this cannot be financed by the International Whaling Commission as a whole, individual countries are urgently recommended to increase the numbers of whales marked, particularly outside the whaling grounds and seasons.

Catch and effort statistics and stock assessments. The sub-committee recommends that in addition to analyses by national groups, a special group should be set up to undertake over-all stock assessments as soon as possible. To this end, complete effort statistics should be made available by each country to the

International Whaling Commission. In addition, the tabulations of data (forms SP1, 2,3 and 7) should be prepared as far as possible to be available for the June 1966 meeting of the Scientific Committee. The Bureau of International Whaling Statistics should be asked the cost of preparing data on catch, effort and length (forms SP4–6). The Scientific Committee should then consider the feasibility of immediate stock assessments.

Social studies. It is recommended that special permits should be granted for the capture of entire schools of sperm whales, for studies of social structure. Results of such investigations should be made available as soon as possible to the Scientific Committee.

List of supporting documents:

AUSTRALIA	(A1)	Progress report on research, 1965
	(A2)	A method of preparing sperm whale teeth for age determination
CANADA	(C1)	Progress report on the study of sperm whales from British Columbia
	(C2)	Comparative zone electrophorograms of muscle myogens and blood proteins of five species of whales from the coastal waters of British Columbia
JAPAN	(J1)	Recent studies on the sperm whale in Japan
	(J2)	Report on the catch of a school of sperm whales for scientific purpose in 1965.
	(J3)	Summarized result of the whale marking in the North Pacific
	(J4)	Memorandum on results of Japanese stock assessment of whales in the North Pacific
SOUTH AFRICA	(SA1)	Some observations on the female sperm whale sexual cycle, west coast of South Africa
U.K.	(UK1)	Progress report on sperm whale research, United Kingdom
	(UK2)	Foetal growth and the breeding season of sperm whales
U.S.A.	(US1)	Progress report on sperm whale research, United States
U.S.S.R.	(USSR1)	Progress report on whale research in 1965.

APPENDIX V

INCOME AND EXPENDITURE ACCOUNT FOR THE YEAR ENDED 31st MAY, 1966

I. ORDINARY BUDGET

Previous Year £ s. d.	EXPENDITURE	£ s. d.	£ s. d.	*Previous Year* £ s. d.	INCOME	£ s. d.
	Secretary's Remunerations—				*Contributions for* 1965/66	
550 0 0	Fees	550 0 0		5,100 0 0	17 Contracting Governments at £350 each	5,950 0 0
200 0 0	Allowance in lieu of travelling expenses	200 0 0	750 0 0	682 6 9	Contribution from Extra-Ordinary Budget	— — —
17 4 10	National Health contributions		34 2 6			
	Administrative, Clerical and Typing Staff provided by Ministry of Agriculture, Fisheries and Food;					
1,445 6 3	Rent for the Secretary's Office, and overhead expenses of the Ministry		1,655 0 0			
1,081 11 0	*Stationery, Printing and Postage*		721 16 8			
	Cost of Meeting					
1,761 7 8	17th Annual Meeting, June/July, 1965		1,392 0 10			
682 6 9	Special Meeting, May, 1965		— — —			
	Whale Marking					
500 0 0	Contribution to National Institute of Oceanography ...		500 0 0			
— — —	Contribution to Extra-Ordinary Budget		850 0 0			
	Balance, being excess of income over expenditure, transferred				Balance, being excess of expenditure over income, transferred to Balance Sheet ...	
— — —	Balance Sheet		47 0 0	455 9 9		— — —
6,237 16 6			5,950 0 0	6,237 16 6		5,950 0 0

II. EXTRA-ORDINARY BUDGET

Previous Year £ s. d.	EXPENDITURE	£ s. d.	*Previous Year* £ s. d.	INCOME	£ s. d.
1,584 5 0	Stock Assessment Work: Travelling and Subsistence. Expeness of Scientists	536 8 8	3,359 11 7	Balance brought forward from 1964/65	1,032 2 6
20 9 11	Costs of Data Processing, Computer Programming, etc. ...	240 16 9			
40 7 5	Costs of preparation of data & transfer to punch cards ...	221 6 5	— — —	Contribution from Ordinary Budget ...	850 0 0
682 6 9	Contribution to Ordinary Budget—Cost of Special Meeting ...	— — —			
1,032 2 6	Balance, being excess of income over expenditure, transferred to Balance Sheet	883 10 8			
3,359 11 7		1,882 2 6	3,359 11 7		1,882 2 6

BALANCE SHEET 31st MAY, 1966

Previous Year £ s. d.	LIABILITIES	£ s. d.	£ s. d.	Previous Year £ s. d.	ASSETS	£ s. d.	£ s. d.
	Creditors:						
108 15 5	Ministry of Agriculture, Fisheries & Food	1,722 18 4		1,841 9 8	Cash at Paymaster General		2,439 15 1
855 0 10	Others	564 12 11					
			2,287 11 3	500 9 8	Payment in advance ...		— — —
	Contribution received in advance						
297 9 10	(from Mexico)		— — —		Outstanding contributions:		
	Income & Expenditure Account:			85 6 5	Argentine 1965/66 (balance)	310 1 10	
2,028 10 4	Balance at 31st May, 1965 ...	1,573 0 7		— — —	Australia 1965/66 (balance)	50 0 0	
				300 0 0	*Brazil 1965/66 (balance)	50 0 0	
Less							
455 9 9	*Add*			— — —	Mexico 1965/66 (balance)	52 10 2	
	Balance transferred from			— — —	*U.S.A. 1965/66 (balance)	50 0 0	
	1965/66	47 0 0		— — —	*Norway 1965/66 (balance)	350 0 0	
			1,620 0 7		Panama 1961/62 (balance) 1962/63, 1963/64, 1964/65, 1965/66	1,488 15 5	
							2,351 7 5
1,032 2 6	Extra-Ordinary Budget ...		883 10 8	1,138 15 5			
				- 8 0	Debtors		— — —
3,866 9 2			4,791 2 6	3,866 9 2			4,791 2 6

(*Signed*) L. GOLDTHORPE,
Acting Secretary, International Whaling Commission
18*th November*, 1966

Note. **Contribution arrears*

Remittances in settlement of the above arrears, were received from the Governments of Brazil, U.S.A. and Norway in June, 1966.

I have examined the above Account and Balance Sheet. I have obtained all the information and explanations that I have required, and I certify, as the result of my audit, that in my opinion the above Account and Balance Sheet are correct.

Exchequer and Audit Department
16th *January*, 1967

(*Signed*) B. D. FRASER
Comptroller and Auditor General

APPENDIX VI

SUMMARY OF INFRACTIONS

(The following details of infractions reported for the 1965/66 season (Antarctic) and 1965 season (Outside the Antarctic) should be regarded as an addition to the summaries contained in the Commission's Eighth–Sixteenth Reports.

YEAR	Antarctic Season						YEAR	Outside Antarctic				
	Whales taken	Undersized whales		Lactating whales	Whales lost	Whales remaining in sea over 33 hours		Whales taken (2)	Undersized whales		Lactating whales	Whales lost
		No.	%						No.	%		
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)
						BLUE WHALES						
1965/66	1	—	—	—	—	—	1965	143	5	3·49	—	—
						FIN WHALES						
1965/66	2,535	48	1·89	7	8	4	1965	3,793	31	0·82	3	1
						OTHER BALEEN WHALES						
1965/66	17,583	47	0·26	10	25	3	1965	4,714	29	0·61	5	15
						SPERM WHALES						
1965/66	6,115 (1)	183	2·99	6	8	6	1965	17,064	251	1·47	19	66

NOTE.—(1) The number shown of sperm whales taken in the Antarctic season includes the catch of the Antarctic pelagic expeditions north of 40° South Latitude.

(2) The numbers shown of whales taken outside Antarctic do not include the catch of countries from whom no infractions reports were received.

APPENDIX VII

List of Reports received by the Commission during the year ended 31st May, 1966 (arranged under countries or organizations alphabetically with the date of receipts in brackets)

Food and Agriculture Organization of the United Nations

Current Bibliography for Aquatic Sciences and Fisheries. General Subject Code and Physical Oceanography Classification. F.A.O. Fisheries Technical Paper No. 46. Rome 1965 (2.7.65).

The State of Food and Agriculture, 1965 (6.10.65).

Bulletin of Fishery Statistics. Summaries: Catches and Landings 1964 (29.11.65).

Yearbook of Fishery Statistics. Catches and Landings 1964 Vol. 18 (29.11.65)

Bulletin of Fishery Statistics. Summaries: Fishery Commodities 1964 (14.2.66).

Yearbook of Fishery Statistics. Fishery Commodities 1964 Vol 19. (14.2.66).

Bibliographic Material on the Fishes of Colombia and North Western South America. Compiled by Enrique L. Diaz, Rome 1965. (7.3.66).

Report on the effects of fishing on the Peruvian stock of Anchovy by L. K. Boerema and G. Saetersdal, F.A.O. Fisheries Division and I. Tsukayama, J. E. Valdivia and B. Alegre, Instituto Del Mar Del Peru, Rome 1965. Fisheries Technical Paper No. 55. (13.4.66).

Report on the effects on whale stocks of pelagic operations in the Antarctic during the 1964/65 season and on the present status of those stocks by F.A.O. Fisheries Division, Biology Branch, Rome 1965. Fisheries Technical Paper No. 59.

Establishment, structure, functions and activities of international fisheries bodies. III—Regional Fisheries Advisory Commission for the South West Atlantic (CARPAS). Rome 1966. Fisheries Technical Paper No. 60 (25.4.66).

Indo-Pacific Fisheries Council

Proceedings 11th Session. Kuala Lumpur, Malaysia 16th-31st October 1964. Section III, Symposium on increasing fish consumption through improved handling and distribution. I.P.F.C. Secretariat, F.A.O. Regional Office for Asia and the Far East, Bangkok 1965. (17.3.66).

Inter-American Tropical Tuna Commission

Annual Report for the year 1964. (11.6.65). Bulletins Vol. 11, Nos. 1, 2, 3 and 4.

International Commission for the Northwest Atlantic Fisheries

Statistical Bulletin, Vol. 13 for the year 1963. Issued from the Headquarters of the Commission, Dartmouth, N.S., Canada 1965. (23.8.65).

Annual Proceedings, Vol. 15 for the year 1964-65. Issued from the Headquarters of the Commission, Dartmouth, N.S., Canada. (14.2.66).

International Council for the Exploration of the Sea

Co-operative Research Reports Nos. 1-6. (4.4.66).

Co-operative Research Report. Series B—Liaison Committee Report. (4.4.66).

International North Pacific Fisheries Commission

Bulletin No. 16 (8.10.65).; Bulletin No. 15 (9.11.65); Bulletin No. 17 (9.5.66) Statistical Yearbook 1964. (7.12.65).

National Institute of Oceanography

Discovery Reports Vol. XXXIII, pp. 335-384 Development of the Stolon in Salpa Fusiformis Cuvier and Salpa Aspera Chamisso by R. M. Sawicki 1966. Cambridge University Press. (4.4.66).

National Oceanographic Council

Annual Report 1964-65. Cambridge University Press. (7.4.66).

North Pacific Fur Seal Commission

Proceedings of the Eighth Annual Meeting, February 22nd-26th 1965. Tokyo, Japan. Issued from the Headquarters of the Commission, Washington, D.C. January 1966. (30.3.66).

Permanent Commission of the South Pacific

IXa. Reunion ordinaria de la Comision Permanente del Pacifico Sur. Documentos Paracas, I.C.A., Peru 1–14 Enero 1966. (9.3.66).

United Nations Educational, Scientific and Cultural Organization

Intergovernmental Oceanographic Commission; International Indian Ocean Expedition Information Paper No. 13. (6.7.65); Information Paper No. 14. (18.10.65). Technical Series Manual on International Oceanographic Data Exchange 1965. (12.8.65).

Technical Papers in Marine Science No. 1 First Report of the Joint Panel on Oceanographic Tables and Standards held at Copenhagen 5th-6th October 1964 sponsored by U.N.E.S.C.O., I.C.E.S., S.C.O.R., I.A.P.O. (12.8.65).

Technical Papers in Marine Science No. 2 Report of the First Meeting of the Joint Group of Experts on Photosynthetic Radiant Energy held at Moscow 5th-9th October 1964 sponsored by U.N.E.S.C.O., S.C.O.R., I.A.P.O. (12.8.65).

International Marine Science, Volume III, No. 2 June 1965. (6.9.65). International Marine Science, Volume III, No. 3 October 1965. (19.11.65). International Marine Science, Volume III, No. 4 February 1966. (15.3.66).

Brazil

Boletim Da Estacao De Biologia Marinha Da Universidade Do Ceara Nos. 1-4. (2.7.65); No. 5 1962. (2.7.65); No. 6 1964. (2.7.65).

Arquivos Da Estacao De Biologia Marinha Da Universidade Do Ceara Volume I No. 1 Junho 1961. (2.7.65); Volume I No. 2 Dezembro 1961. (2.7.65); Volume II No. 1 Junho 1962. (2.7.65); Volume II No. 2 Dezembro 1962. (2.7.65); Volume III No. 1 Junho 1963. (2.7.65); Volume III No. 2 Dezembro 1963. (2.7.65); Volume IV No. 2 Dezembro 1964. (28.9.65); Volume 5 No. 1 Junho 1965. (17.1.66).

Canada

The Canadian Fish Culturist, Issue Thirty-Four, May 1965. Published at Ottawa by the Department of Fisheries of Canada. (5.8.65). Issue Thirty-Five. (24.3.66).

Exploitation and conservation of Harp and Hood Seals by D. E. Sergeant, Fisheries Research Board of Canada, Arctic Biological Station, Ste. Anne de Bellevue, Quebec. The Polar Record, Vol. 12 No. 80 p. 541-551. (14.9.65).

Migrations of Harp Seals Pagophilus Groenlandicus (Erxleben) in the Northwest Atlantic by D. E. Sergeant, Fisheries Research Board of Canada, Arctic Biological Station, Ste. Anne de Bellevue, Quebec. Journal Fisheries Research Board of Canada, Vol. 22, No. 2, 1965. (14.9.65).

Cranial Variation in the Harp Seal Pagophilus Groenlandicus (Erxlen 1777). A. V. Iablokov and D. E. Sergeant, Institute of Animal Morphology of the Academy of Sciences of the U.S.S.R. (Moscow) and the Arctic Biological Station of the Fisheries Research Board of Canada (Montreal). (14.9.65).

France

Annee Geophysique Internationale: Expedition International de l'Ocean Indien. Circulation Superficielle dans L'Ocean Indien. Resultats de mesures faites a l'aide du courantometre a electrodes remorquees G.E.K. entre 1955 et 1963. Mesures et depouillements effectues par Jean Martin, Pierre Guibout, Michel Crepon et Jean-Claude Lizeray. Presentation des Observations par Michel Crepon, Laboratoire d'Oceanographie physique du Museum national d'Histoire naturelle. Extrait des Cahiers Oceanographiques, XVII, Supplement No. 3 (1965). (18.10.65).

Japan

Ocean Research Institute: University of Tokyo. Catalogue 1964-1965. December 1965. (28.4.66); Collected Reprints 1964 Volume 3. (28.4.66).

Scientific Reports of the Whales Research Institute. No. 19, April 1965. The Whales Research Institute, Tokyo, Japan. (2.8.65).

Korea

Annual Reports of Oceanographic Observations. Volume 12 1963 (1.10.65); Volume 13 1964 (9.3.66); Fisheries Research and Development Agency, Republic of Korea.

Netherlands

Netherlands Commission for International Nature Protection. A Hundred Years of Modern Whaling. Prof. Dr. E. J. Slijper. (12.4.66).

Waarnemingen Van Walvissen Door Opvareden Van Schepen Door. Prof. Dr. E. J. Slijper, Drs. W. L. van Utrecht, Dr. C. Naaktgeboren. Workgroep Walvisonderzoek Zoologisch Laboratorium der Universiteit Te Amsterdam. (12.4.66).

Walfang und Angewandte Walforschung. Von Prof. Dr. Everh. Johannes Slijper, Amsterdam. (12.4.66).

Norway

Hvalrådets Skrifter, Scientific Results of Marine Biological Research. Edited by Universitetets Institutt for Marin Biologi and Statens Institutt for Hvalforskning No. 48 Essays in Marino Physiology. Presented to P. F. Scholander in honour of his sixtieth birthday. Oslo 1965. (6.12.65).

A Right Whale (Balaena Sp.) in all probability a Greenland Right Whale (Balaena Mysticetus) observed in the Barents sea by Åge Jonsgard. Reprinted from Norsk Hvalfangst-Tidende 1964, No. 11 p. 311-313. (6.12.65).

Evidence for mass strandings of the False Killer Whale (Pseudorca Crassidens) in the Eastern North Pacific Ocean by Edward Mitchell, Los Angeles County Museum. Reprinted from Norsk Hvalfangst-Tidende 1965, No.8 pp. 172-177. (25.1.66).

Progress Report on Sperm Whale Research in the Southeast Pacific Ocean by Robert Clarke, National Institute of Oceanography, United Kingdom, Anelio Aguayo L., Estacion de Biologia Marina de Montemar de la Universidad de Chile and Obla Paliza G., Instituto del Mar del Peru, Peru. Reprinted from Norsk Hvalfangst-Tidende 1964, No. 11 pp. 297-302. (26.5.66).

Bryde's whale in the Southeast Pacific by Robert Clarke, National Institute of Oceanography, United Kingdom and Anelio Aguayo L. Estacion de Biologia Marina de Montemar de la Unidersidad de Chile, Chile. Reprinted from Norsk Hvalfangst-Tidende 1965, No. 7, pp. 141-148. (26.5.66).

Southern right whales on the coast of Chile by Robert Clarke, National Institute of Oceanography, United Kingdom. Reprinted from Norsk Hvalfangst-Tidende 1965, No. 6 pp. 121-128. (26.5.66).

U.S.A.

Oceanography from Space. The Woods Hole Oceanographic Institution, Woods Hole, Massachusetts, U.S.A. (8.6.65).

Catalogue of Data in World Data Center A Oceanography. Supplement No. 2 1st July 1964-31st December 1964; Supplement No. 3 1st January 1965-30th June 1965. (23.12.65). Supplement No. 4 1st July 1965-31st December 1965 Washington, D.C., U.S.A. (7.4.66).

Catalogue of Publications in World Data Center A Oceanography. Publications received during the period 1st July 1957-31st December 1964. Washington, D.C., U.S.A. (23.12.65).

Ciencia Interamericana Vol. 6 No. 3 Mayo-Junio 1965. (6.9.65); Vol. 6 Nos. 4-5 Julio-Octubre 1965. (23.12.65); Vol. 6 No. 6 Noviembre-Diciembre 1965. (16.5.66).

Contributions in Science No. 78 December 30th, 1963. Los Angeles County Museum. (25.1.66).

Bulletin Vol. 62 Part 4. Southern California Academy of Sciences, Los Angeles. (25.1.66).

Fossil collecting on San Clemente Island: Edward D. Mitchell, Jr., and Jere H. Lipps. Reprint from Pacific Discovery (Vol. XVIII No. 3 May-June 1965, pp. 2-8). California Academy of Sciences, San Francisco. (25.1.66).

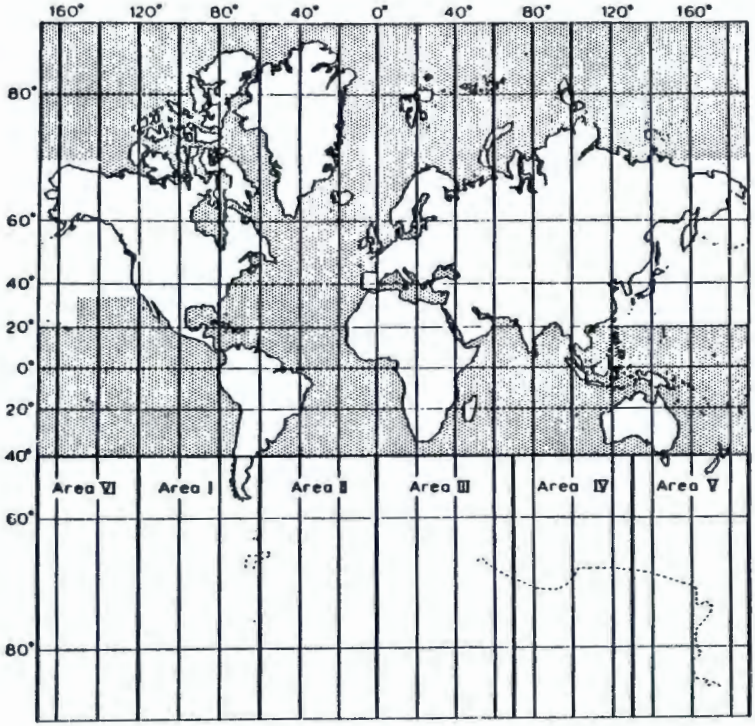
Venezuela

Boletin del Instituto Oceanografico de la Universidad de Oriente Volumen I Numeros 1 and 2, 1961; Volumen II Numeros 1 and 2, 1963; Volumen III Numeros 1 and 2, 1964; (15.6.65); Volumen IV Numero 1, 1965 (12.5.66). Lagena Numero 6, 1965, Lagena (Indice) 1964. (25.8.65); Lagena Numero 7, 1965. (12.5.66).

Year (1)	ANTARCTIC PELAGIC WHALING						Land Stations South Georgia	Outside the Antarctic	TOTAL
	Baleen season	No. of floating factories	No. of catchers	No. of humpbacks taken (3)	No. of blue whale units (4)	Oil production in barrels (2)	Oil production in barrels (2)	Oil production in barrels (2)	Oil production in barrels (2)
1955/56	7 Jan. 56–4 Mar. 56	19	257	1,432	14,874	2,134,808	172,363	604,445	2,911,616
1956/57	7 Jan. 57–16 Mar. 57	20	225	679	14,745	2,098,854	148,068	682,163	2,929,085
1957/58	7 Jan. 58–16 Mar. 58	20	237	396	14,850	2,146,206	171,432	731,331	3,048,969
1958/59	7 Jan. 59–16 Mar. 59	20	235	2,394	15,300	2,050,241	102,418	761,988	2,914,647
1959/60	28 Dec. 59–7 April 60	20	220	1,338	15,512	2,050,892	97,546	733,192	2,881,630
1960/61	28 Dec. 60–7 April 61	21	252	718	16,433	2,123,157	109,727	692,852	2,925,736
1961/62	12 Dec. 61–7 April 62	21	261	309	15,253	2,001,961	49,815	744,376	2,796,152
1962/63	12 Dec. 62–7 April 63	17	201	270	11,306	1,495,779	—	925,045	2,420,824
1963/64	12 Dec. 63–7 April 64	16	190	2	8,429	1,299,476	41,282	887,722	2,222,917
1964/65	12 Dec. 64–7 April 65	15	172	—	6,987	1,017,611	45,805	929,194	1,992,610
1965/66	12 Dec. 65–7 April 66	10	128	1	4,090	633,747	9,964	(not yet available)	643,711

1. The years indicated in this column cover not only the Antarctic Season, but also the catches outside the Antarctic in the second of the two years. The 1965/66 figures are provisional.
2. Barrel—170 k.g. (Barrel—abt. $\frac{1}{7}$ long ton—1/016 kg.).
3. The catch of humpbacks 1955/56 to 1962/63 was confined to certain days and thereafter prohibited.
4. The blue whale unit catch limit was 15,000 in 1955/56 and 14,500 in 1956/57 to 1957/58. In 1958/59 to 1959/60, the limit governing the Antarctic pelagic whaling countries was 15,000 units. The limit was suspended in 1960/61 and 1961/62, and reduced to 10,000 units in 1963/64. No catch limit was agreed upon for the 1964/65 season, but the limit was further reduced for the 1965/66 season to 4,500 units.

APPENDIX IX



Map of world showing Antarctic areas and (dotted) regions closed to factory ships for the purpose of taking and treating baleen whales

Printed for Her Majesty's Stationery Office by Elliott Bros. & Yeoman Ltd., Speke, Liverpool
Dd. 018374 500 5/67 Gp. 474