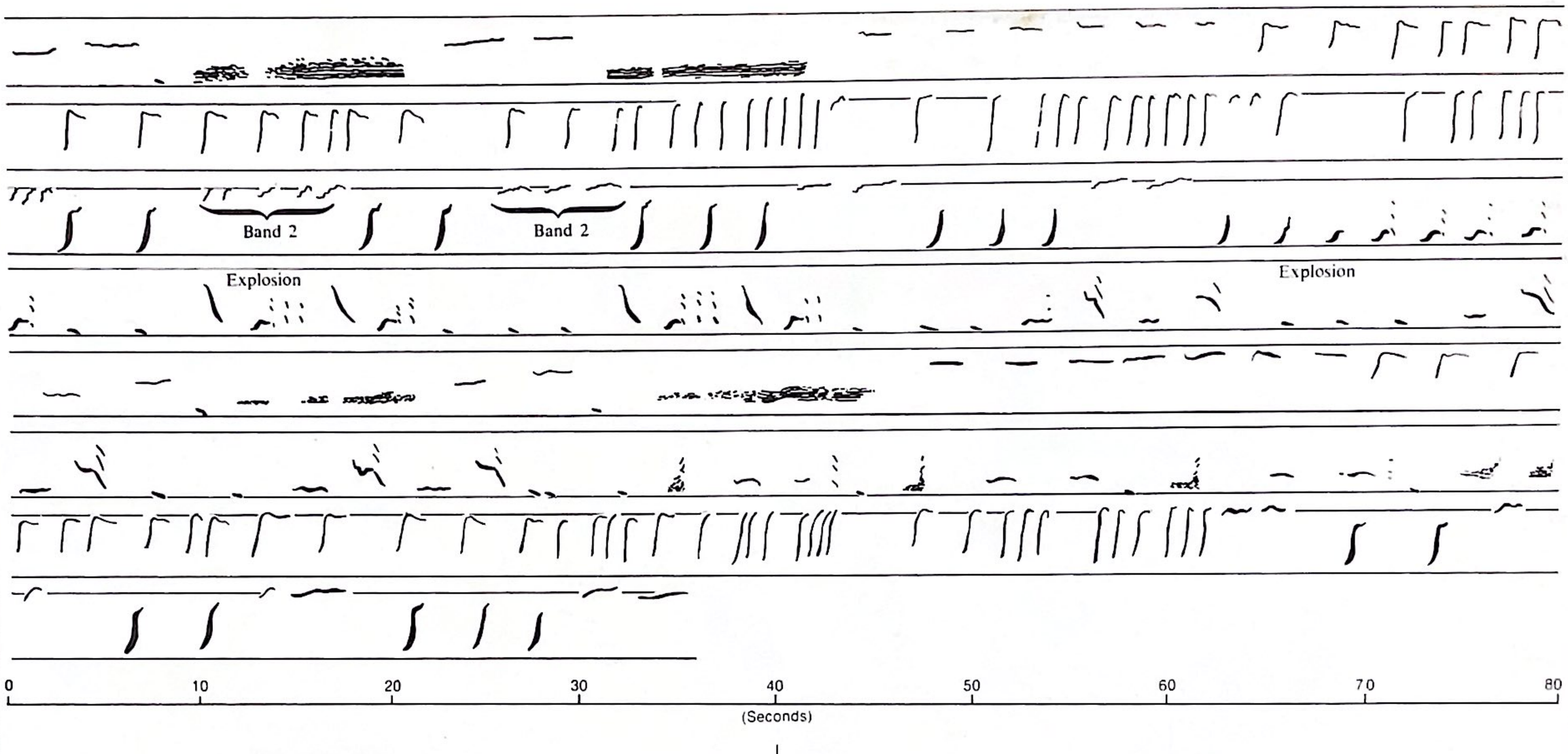
Songs of the Humpback Whale



Listening Instructions

If possible, listen to the whale record through stereophonic headphones. Side II, in particular, becomes a totally different experience when heard through headphones. There is a lot of extraneous noise on this or any recording of ocean sounds. This can't be helped. Earphones seem somehow to reduce the distracting effect of the noise, giving a pleasant sense of vast echoey space—a mystical feeling that is very hard to describe. For some reason, this effect is seldom experienced fully with even the best loudspeakers.

When heard through headphones, the ocean noise seems a natural part of the whales' world. Some of the ocean noise is generated by waves, earth tremors, distant breakers, rain, grinding ice, stones tumbled by the tide, passing ships, various shrimp, fish, seals, and whales themselves. The sea in most places is alive with sound. The quietest parts of the sea are beneath the polar ice caps, far from industrialized man. The noises that most interfere with the Humpback whale songs are the low-pitched ones, and in recent years ship traffic noise has become a constant roar of low-pitched noise in the ocean, even far from shipping lanes.

As you will read in the booklet, noise pollution of the ocean may already be changing the lives of some whale species.

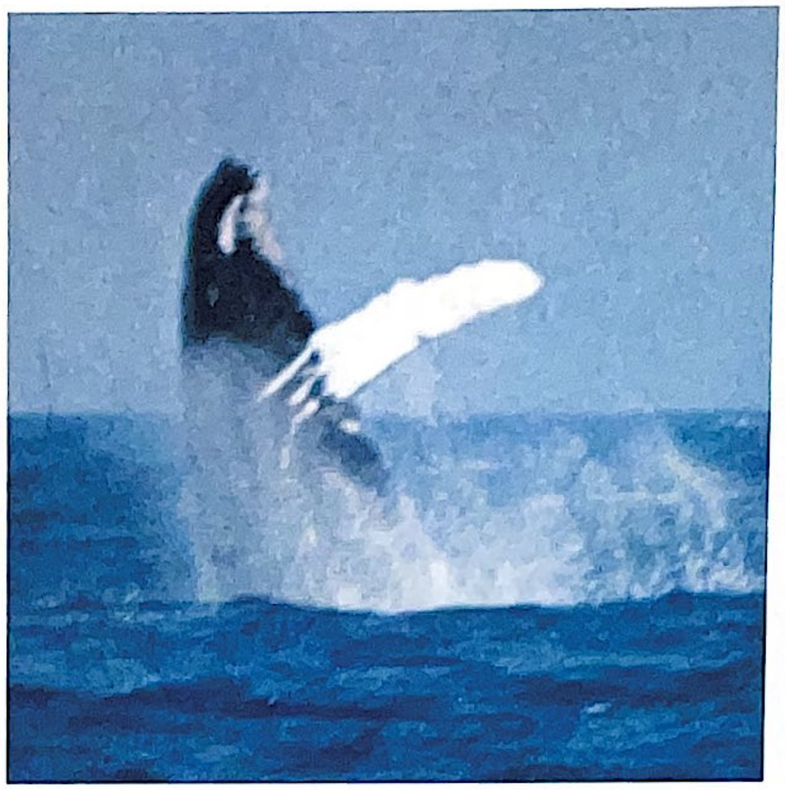
The quality of ocean sounds heard in a recording is affected strongly by the bottom topography of the area where the recording was made. In deep water there are chains of echoes from the surface and bottom following each loud sound. In shallow water the echoes return so quickly that they are seldom heard as distinct sounds. You will notice these differences in the separate tracks on the record.

Side I, Band 1 — Solo Whale
This is a portion of a recording made by Frank Watlington of the Columbia University Geophysical Field Station at St. David's, Bermuda. His underwater microphone (called a *hydrophone*) was in water about 1,500 feet deep, with a cable leading ashore to the recorder in his office. One day a whale happened by and remained throughout the afternoon, singing its song over and over again. Two songs have been selected for this record; they have been slightly edited by cutting out parts of two long, repetitive sections. Except for these deletions, the sounds have not been altered in any way—there is no speeding up, slowing down, or other modification of the sounds made by the whale. Presumably, this is the way the songs would sound to other whales.

The pair of songs is transcribed above in a form similar to musical notation (see page 13 in the book). You will find it quite easy to read this notation, and can follow the song on the transcript to see how the whale repeats itself. In each case, the loudest sounds are followed by a series of echoes from the surface and the bottom. You can hear the propeller noise of a large freighter passing far away; it is audible only as a very faint, high-pitched, wavering sound. You can also hear, in addition to this whale, the occasional soft, low cries of a distant whale.

Near the end of the band, there are two rumbling explosions. These were probably made by dynamite being used in acoustic experiments. The whale apparently did not respond to these sounds, for its song is the same as it was in other recordings when there were no explosions.

With the exceptions noted above, everything on this band is the song of a single whale. The sound that follows the first two cries—a noise that sounds to many people like a motor running—is part of the whale song. It is made up of a series of rapidly repeated low pulses.



DR. ROGER S. PAYNE, whose work produced the accompanying record and forms the basis of this booklet, has spent the last fifteen years doing research in biological acoustics and is currently at the Institute for Research in Animal Behavior operated jointly by the New York Zoological Society and The Rockefeller University. His studies began with work on the directional sensitivity of the ears of bats, which he did while still an undergraduate at Harvard University. He later received his doctorate in biology from Cornell University for brilliant work on the ability of owls to find their prey in complete darkness by hearing. He then did equally important work on moths, discovering their ability to judge the direction of bat sonar and thus evade capture. When asked how he reached the decision to do research on whales Dr. Payne replied, "The decision reached itself really. It was something I had wanted to do for a long while. Certainly, I wasn't first led to it through any particularly inspiring encounter with whales. I've had any number of wonderful days among wild whales since, but at the time I decided to study whales I hadn't even seen one. In fact, the first whale I did see was a dead one and the encounter was anything but inspiring.

"I was working in a laboratory at Tufts University one March night during a sleet storm when I heard through the local radio news that a dead whale had washed ashore on Revere Beach. I wanted to see it so I drove out there. The sleet had turned to rain when I reached the place. Many people had come to see the whale earlier but there were only a few on the beach when I arrived and by the time I reached the tidal wrack where the whale lay, the beach was deserted.

"It was a small whale, a Porpoise about 8 feet long with lovely subtle curves glistening in the cold rain. It had been mutilated. Someone had hacked off its flukes for a souvenir. Two other people had carved their initials deeply into its side, and someone else had stuck a cigar butt in its blowhole. I removed the cigar and stood there for a long time with feelings I cannot describe. Everybody has some such experience that affects him for life, probably several. That night was one of mine.

"At some point my flashlight went out, but as the tide came in I could periodically see the graceful outline of the whale against the white foam cast up by the waves. Although it is more typical than not of what happens to whales when they encounter man, that experience was somehow the last straw, and I decided to use the first possible opportunity to learn enough about whales so I might have some effect on their fate."

このレコードと本のもとゝなった研究をした人、ペイン博士は過去15年間生物音響学の研究に従事し、現在ニューヨーク動物協会とロックフェラー大学によって共営されている動物行動研究所に属しています。博士の研究は、ハーバード大学の学生として、こうもりの耳の指向的感性の研究にはじまりました。その後、ふくろうの研究、完全なくらやみの中でも聴覚によってえさをとらえる能力についての秀れた研究によって、コーネル大学から生物学の博士号を受理しました。次いで同様に重要な蛾の研究、こうもりの出す音から方向を判断する蛾の持つ能力により捕獲されることをのがれる発見、があります。どうして鯨の研究を取り上げる気になったかとの我々の質問に、"その決定は実際のところ私の関与しない時点でなされたようなものです"と博士は鯨との出逢いを次のように話しています。"鯨の研究には長い間関心を持っていましたが、特別にこれといって、ふるい立つような鯨との出逢いから、その研究へと導かれたわけでないのです。研究をはじめて後、野生の鯨の中で素晴らしい多くの日をすごしましたが、研究に取り組むことがきまった時には鯨を一頭すら見たこともありませんでした。そうして実際に、はじめて見た鯨は死んだそれで、ふるい立たされるとは決して云えないものでした。"

"タフト大学の実験室で仕事をしていた三月の、みぞれまじりのあらしの或る晩、ラジオでリーベル海岸に死んだ鯨が打ち上げられたときゝました。みてみたいと思ったので車でのり出し海に着いた時は、そのみぞれが雨にと変っていました。鯨をみに沢山の人が来たらしいのですが、私がついた時は、すでにほとんどの人が去り鯨の横たわる潮漂着物に達した時は、海辺からすっかり人気が絶えていました。"

"そこで見たのは8フィートばかりの小さな鯨いるかで冷い雨の中に名状しがたい曲線を描いて、ひかる体を横たえているのでした。その体のこの部分、あの部分と切り取られていました。鯨の尾は誰かがスウヴニールとして持ち去ったらしくひれの先の破片はたゝき切られ、その側面には人々のイニシァルが深くほられ、噴水口には巻煙草のすいがらがつっこまれているのです。私は巻煙草をとりすて、云いようもない感情にとらわれて立ち続けたものです。人間は誰でも人生の中で一生にわたって忘れることが出来ないようないくつかの経験をするものですが、この夜の経験は私にとって忘れ難いものとなったのです。"

"懐中電燈はいつの間にか消えてしまっていましたが、潮が満ちて来るにつれ、その中で波によって持ち上る白いあぶくに対して鯨の優雅なりんかくが、みえたりかくれたりしていました。この鯨の死は、人間に出逢った後、鯨の上におきる結果としては典型的なものとしりつゝ何故かこの経験は耐え得る限点でした。そうして私は鯨について少しでも学ぶ機会がやって来れば、その最初のチャンスにとびつくことによって鯨の運命に何らかの力を尽したいと思ったのです。"

Blue Whale
しろなが十鯨

Fin Whale
なが十鯨

Right Whale
せみ鯨

Sei Whale
いわし鯨

Humpback Whale
ざとう鯨

Grey Whale
こく鯨

Little Piked Whale
こいわし鯨（ミンク鯨）

Baleen Whales ひげ鯨

Toothed Whales 歯鯨

Sperm Whale
まっこう鯨

Bottlenose Whale
きたとっくり鯨

Killer Whale
しゃち

Pilot Whale
ごんどう鯨

Narwhal
いっかく鯨

Bottlenose Dolphin
ばんどういるか

Porpoise
いるか

Brontosaurus
ブロントソラス

0 10 20 30 40 50 Feet 60 70 80 90 100

0 3 6 9 12 15 Meters 18 21 24 27 30

The Whale

鯨

The Nature of Whales

WHEN WE THINK about the ocean, we are usually considering only its uppermost, thinnest film—a small fraction of the total volume. We think of a place with ceaseless motion, bright light, sparkling waves, and brilliant sunshine. But beneath the turmoil and light of the first 600 feet lies a different ocean, a profoundly peaceful place of constant darkness and nearly uniform temperature where there are no waves—only slow, drifting currents. It is the domain of whales—the largest animals that have ever existed.

The Blue whale, largest of them all, reaches a size three times greater than Brontosaurus, the largest dinosaur. Its mammoth heart, pumping 2,000 gallons of blood through a 150-ton body100 feet long, is so large that a human child could crawl through its aorta and a full grown trout could swim comfortably through most of the major blood vessels.

In the first seven days of life, a baby Blue whale, born at about 2 tons, doubles its weight, for a net increase of over 500 pounds a day. When it is weaned, at about 7 months, it weighs 24 tons and has reached a length of 52 feet—considerably longer than the average American suburban house.

To tip up on end for a dive, a large Blue whale must be in more than 100 feet of water. At the point in its dive when it is perpendicular to the ocean's surface, it experiences pressure 3 atmospheres greater on its lips than on its tail. In a deep dive the Sperm whale can reach depths of 3,000 or perhaps 7,000 feet and return to the surface unharmed.

Whale species are conveniently placed in two categories, the toothed whales and the baleen whales. Most toothed whales are relatively small—Porpoises, Dolphins, Narwhals, Belugas, and Killer whales, for instance. The largest of the toothed whales is the Sperm whale, with some fully grown males reaching lengths of 65 feet. It is also the best known of all whales, having been the most frequently killed of the five species that sustained the nineteenth century whaling industry.

The larger baleen whales are so named because of the comblike structure that descends from the roofs of their mouths. It is made of closely spaced parallel strips of hornlike substance called baleen. The inner

鯨の性質

海、海と想う時、我々は、明かるい太陽の照りかがやく下で きらめく波と、ゆらゆらと絶えまなく ゆれ動く、それを想い浮べることでしょう。が、この海は、広く深い海全体の小部分、ごくごく表面の、最も、薄い膜の部分です。そのきらめきと、光の底深く600フィートの所には、全く異った海が、あるのです。そこは、常に真暗で、温度は変わることもなく、ゆらめき動く波のかわりに、ゆったりと潮流の漂う、この上もなく、静かな場所。この海が、かって生存した生物の中で、最も大きい動物、鯨の生活領域なのです。

鯨の中でも、最も大きいしろながす鯨は、あの中生代の爬虫類、恐竜の中で一番大きいブロントソラスの3倍にも当ります。150トン，100フィート長さの体全体に、2000ガロンの血液を送り出す巨大な心臓は、人間の子供なら、その大動脈の中を這うことが出来、十分に成長した鱒が、その主な血管の中を自由に泳ぎまわれる程に大きいものです。

赤坊のしろながす鯨は、2トンの重さですが、生後7日目には、その2倍の体重となり、1日に500ポンド以上増えるわけです。こうして7ヶ月後の離乳時には、体重24トン，長さ52フィートに達し、これは、アメリカ郊外住宅よりかなり大きいものです。

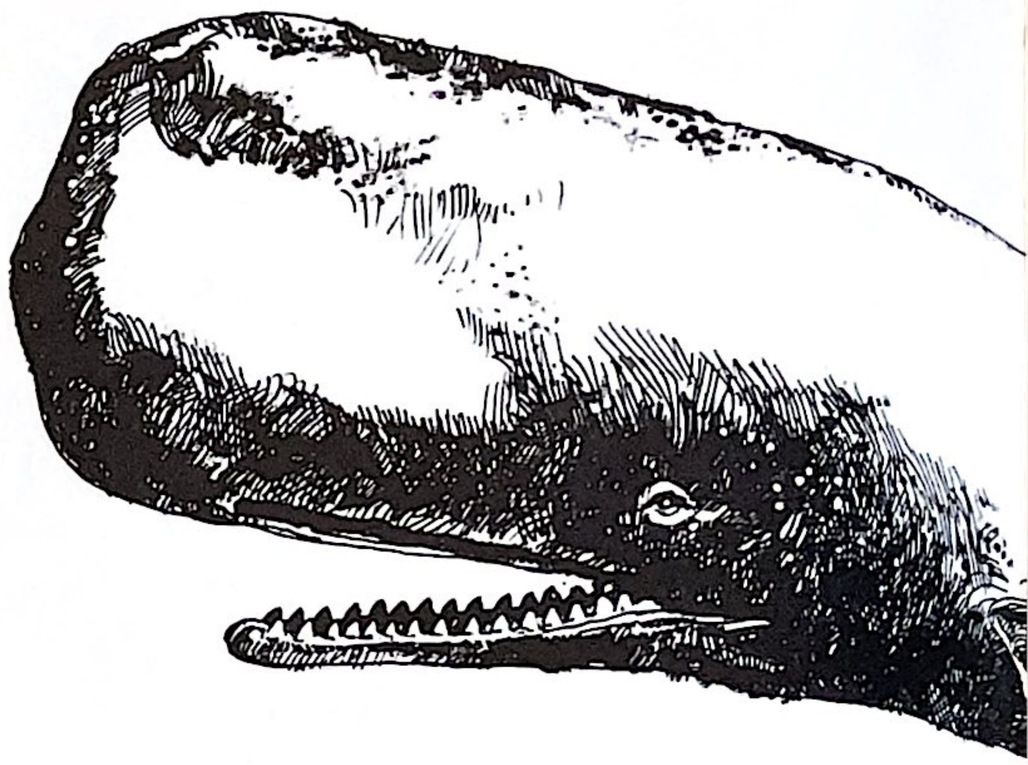
大きい、しろながす鯨がダイビングする為に逆立ちした時は、水深100フィート以上でなければなりません。そうして海面に対して垂直になる、ダイビング時点では、鯨はその口の部分に、尾部での3倍強の圧力を経験することになります。まっこう鯨は、ダイビングにより、3000フィートから、恐らく7000フィートもぐり、傷付くこともなしに海水表面に戻って来ることが出来るのです。

鯨は便宜上、歯鯨と、ひげ鯨に分類されています。前者の多くは比較的に小さく、ねずみいるか，まいるか，いっかく鯨，しろいるか，しゃち，がこの例で、一番大きいまっこう鯨の成長した雄の中には、65フィートに及ぶのも居ます。まっこう鯨は最もしばしば殺害され、19世紀の捕鯨産業を与えた5種類のうちの1つで一番よく知られた鯨です。

これより大きい　ひげ鯨は、口腔の上部から下っている　くしのような構造のせいで、こう名付けられています。これは狭い間隔で

The baleen whale (left) captures its food by sieving small organisms from the water that is forced through its rigid baleen comb. The toothed whale (right) probably captures larger prey by biting it and then swallowing it whole. Little is known about the detailed mechanisms of feeding.

ヒゲ鯨（左）は固いヒゲの間で餌となる小さな生物を戸過してとらえます。歯鯨（右）は比較的大きな獲物を噛みついて捕えてからそれを呑み込んでしまいます。食物摂取機構の詳細については殆んど知られていません。



edges of these long, thin slats fray out into a thickly matted net of hair that lines the entire inner surface of the comb so that, as the whale swims through fields of plankton or schools of fish, it sieves out and swallows whatever food, large or small, the sea contains.

The throat and belly of most baleen whales, like the Humpbacks, is deeply furrowed by long pleats from chin tip to navel, which probably allow the whale's throat to expand, engulfing great quantities of water from which its food is strained. Baleen whales without these pleats, like the Right whale, have longer baleen strips and probably strain their food by swimming, with their mouths part way open, directly into masses of small marine life, thus collecting the tons of krill and plankton they feed on.

But this is only speculation based on whale anatomy. No one knows for sure how whales feed or how they live in their deep domain, for no one has yet found a way to study whales directly in the ocean depths. Thus, although we have a considerable knowledge of whale anatomy—whale corpses have been plentiful for centuries—we know next to nothing about their behavior in the wild.

We do know that most species of whale are social animals and that they move about the oceans in groups that vary in size from small families of a few animals—some of them coming together only during part of the year for pairing and mating—to large groups, for instance, Porpoise herds, numbering in the thousands.

The large Sperm whales are highly social and travel in very tight groups. They wander the world's oceans in two types of herds. There are harem herds of females and their young, dominated by one large, outriding bull, and there are bachelor herds of younger, smaller males. The harem herds stay in the warmer latitudes, principally in calm equatorial waters, and almost never range beyond the 40° North to 40° South latitudes. Bachelor herds, however, roam far outside those breeding grounds into the icy latitudes of the Arctic and Antarctic oceans, presumably returning seasonally to challenge the harem bulls for their wives.

並列した、鯨ひげと呼ばれるつののような物質から出来ていて、その内側は部厚くからみ合った毛がネット状になり、くしの内側全体をおゝっているのです。これでもって、鯨がプランクトンや、魚群の中を泳ぎ抜ける時、海にある大小の食物をすいこみ、ふるいにかけて、のみこむのです。

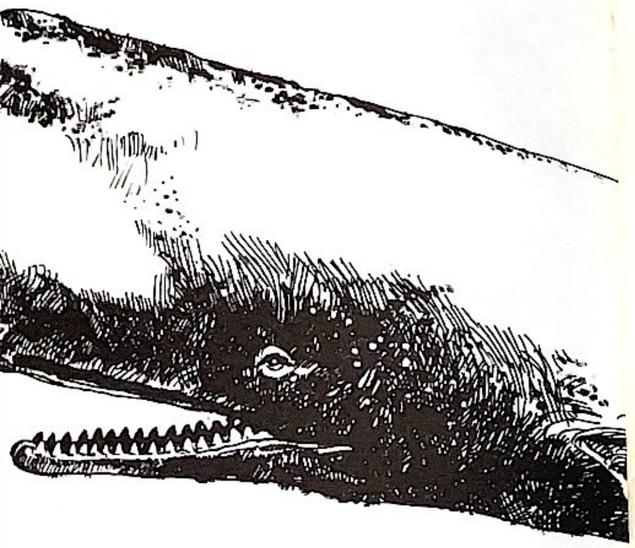
多くのひげ鯨は、その口喉部と腹部にはざとう鯨に見られるよう、あごの先から中心にかけて、長いひだが入っています。鯨の口喉の拡大は、このひだによって可能となり、大量の水を、すいこむことが出来、これから食物をこすのです。ひげ鯨の中でも、せみ鯨のようにこのひだを持たない鯨は、より長いひげを持ち、大量の小さい海生生物の中をその口を半分あけた状態で泳ぐことにより、何トンにも及ぶプラントン等の食物をこすのだろうと考えられます。

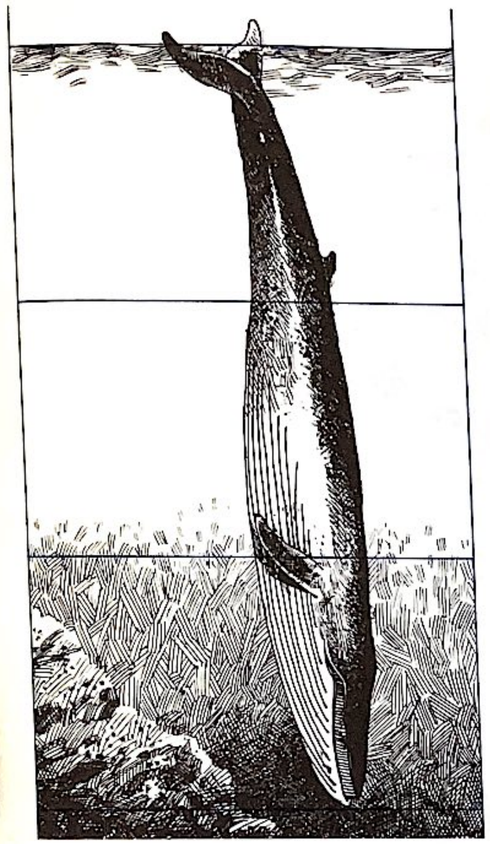
しかしこれは、いづれも、鯨の解剖上の構造に即した推論で、深い海底で鯨を直接に研究する方法が未だ見つからないせいで、実際には何如に鯨が食物をとり、何如に深い海底で生活をするのかは知られていません。

鯨の死がいは、何世紀にもわたって十分にあったせいで、その構造についてはいろいろと知識を持っているのにもかかわらず、彼らの自然における行動については、何一つ知らないと云っても云い過ぎではありません。

多くの種類の鯨は、社会的動物で、海を数頭の家族から（その中のいくつかは、一年のうち一定期間のみ、つがいとなり、こう配の為に一緒になる）、数千匹の大群集をなすねずみいるかのように、サイズは異なるものの群をなして海を移動することはわかっています。

まっこう鯨は特に社会的で、交配の為にまとまったグループとして移動します。世界の海を二種類の群をなしてさすらうのです。雌とその子供からなるハーレム群は、1匹の雄に支配され、他の群は、若い小さい雄からなる独身群です。ハーレム群は、あたたかい緯度、主として赤道付近の静かな領域に止まり、北緯40度から南緯40度の外にはいきません。一方独身群は、この繁殖圏より　はるかに遠く、北極と南極の氷水圏を徘徊し、周期的に繁殖圏にもどり、彼らの配偶者を獲得する為に、ハーレム群に挑戦すると考えられます。





The whale drives itself through the water with powerful up-and-down strokes of its flukes. The flukes form a broad horizontal surface, whereas the body just forward of the flukes is compressed to a narrow form that knifes smoothly up and down through the water.

鯨は水中を尾の強い上下打動で自体を進行させます。尾は広い水平面をなしていますが、尾のすぐ前部の胴体は、ナイフが水中でスムーズに上下するように、タテ細に圧縮されたようになっています。

のののような物
部厚くからみ合
の内側全体を
って、鯨がブラ
ける時、海にあ
いにかけて、の

後部と腹部には
の先から中心に
す。鯨の口喉の
となり、大量の
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Yet even with the relatively stable herd structure of the Sperm whale, it is rather difficult to say what a herd is. No one knows what behavior constitutes membership in one herd and not another, or how much ocean may lie between the members of a herd. Whales swimming miles apart may still be in acoustic contact with each other and may thus be operating at what is for them sufficiently close quarters.

Dr. Roger Payne, whose new and important studies have produced the accompanying record and the substance of this book, has observed a line of twelve Pilot whales apparently in some herd formation, although they were spaced out along a front about 3 miles wide. No one whale was closer than a quarter mile to another, yet all twelve breathed and submerged within a few seconds of each other.

There is no chance that these whales could have seen each other through the water, so the synchrony of their breathing had to be achieved by some other means—probably sound. If whale herds do somehow use sound to govern their behavior, as Dr. Payne's observation seems to suggest, and if the sounds made by large whales can in fact travel for many miles through the ocean, as this book indicates Finback sounds might, then the larger whale species may actually be traveling in coherent groups even when individuals are separated by tens or perhaps hundreds of miles.

But again, we can only speculate at this point about such possibilities. Dr. Payne's fascinating studies of the song of the Humpbacks are among our first steps toward an understanding of the behavior of whales.

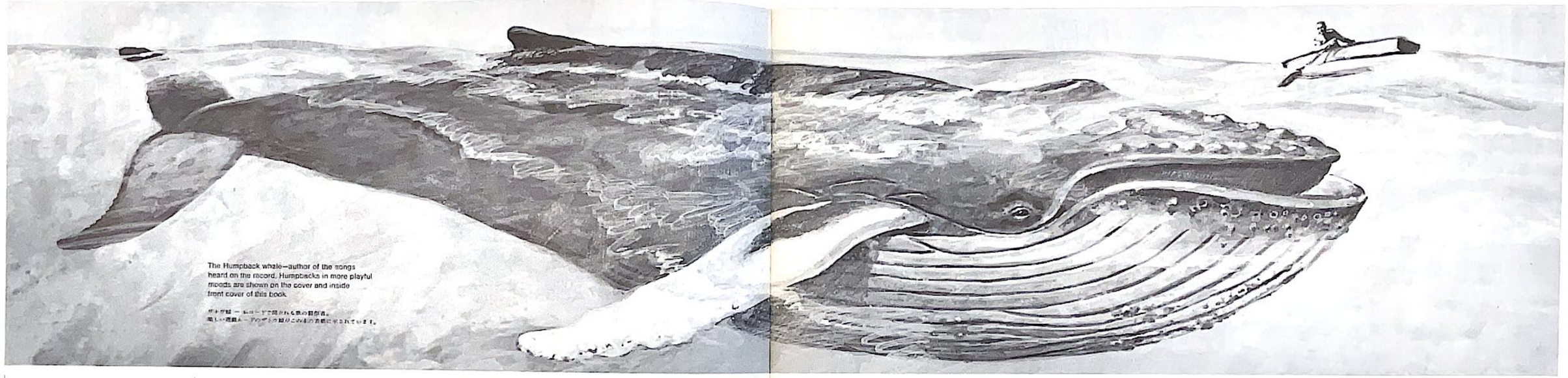
まっこう鯨の比較的安定した群構造についてすら、一体群とは何んであるかとなると、むずかしい問題です。何故なら、どのような行動が1つの群のメンバーを生み他の群から区分するか、或は群をなすメンバー間の距離はどの位かとなると、誰れも知らないからです。数マイルあけて泳いでいても、聴覚的に互いの鯨の間に接触のあることも可能で、従って群として行動することも考えられます。

この本の内容と、これに伴うレコードを生み出した重要な研究者、ロジャー・ペイン博士は、約3マイルの間隔があるにもかかわらず、明らかに1つの群をなす一連になった12頭のパイロット鯨を目撃したことがあります。この12頭は、いづれとして互いに、¼マイルより近くにはいないのですが、それでいながら全頭が数秒間のひらきをおいて、一様に息をふき出し水中に没してゆきました。

この12頭の鯨が海水の中で互いを見たと云うことはあり得ません。そこで彼らの呼吸の同時性は、他の感覚、恐らく音によるものと考えざるを得ないのです。

ペイン博士の観察が示唆するように、鯨群がその群の行動を統制するのに、音を使うとすると、この本がながす鯨の音について示すように、大きい鯨によってつくられた音が、事実海を何マイルにもわたって伝わるとすると、大きい種類の鯨は、例え一頭一頭が数10マイル、数100マイル と離れていても、実際は1つにまとまったグループ となって移動しているのかもしれないのです。

しかしながらこれ又、現在の時点では、こうした可能性を推測するに過ぎないのです。ペイン博士の魅惑的な、ざとう鯨の歌の研究は鯨の行動の理解にむかっての我々の第一歩なのです。



The Humpback whale—author of the songs heard on the record. Humpbacks in more playful moods are shown on the cover and inside front cover of this book.

ザトウ鯨 ― レコードで聞かれる歌の製作者。
楽しい遊戯ムードのザトウ鯨がこの本の表紙に示されています。

The Humpback Whale

ALTHOUGH WE HAVE at least some behavioral observations about Sperm whales—made primarily by men bent on killing them—we know far less about the Humpbacks whose astonishing songs have been recorded.

Humpbacks reach 55 feet in length and have long, lithe flippers, which give this whale its scientific name, *Megaptera*, meaning "broad winged." In the North Atlantic these flippers are white. In other seas they range from gray to glistening ebony.

Like other baleen whales, Humpbacks have large heads, but unlike other whales, the Humpback's head is studded with rows of rivetlike knobs. Each of these knobs is surmounted by a single hair. No one knows why the knobs are there or what the hair is for.

Humpbacks have been brought to near extinction in the Southern Hemisphere, which was once the principal portion of their range. They now exist in vestigial numbers in some North Atlantic and Pacific waters. Their principal migrations in the Southern Hemisphere were well mapped, but not much is known about their routes in the North Atlantic except that they have summering grounds on its eastern and western edges and wintering grounds in the Caribbean and off the coast of Africa. Almost nothing is known, however, about the routes they travel to reach these points.

One of the few things we do know about the Humpbacks' travels in the North Atlantic is that a herd of them appears off Bermuda in April, passing to the south of that island on its northward spring migration. The number of individuals in this herd has not been determined, but it is probably quite small. Reports that it might be fairly large were based on the assumption that each whale observed was passing through and thus being seen only once. The evidence now, however, is that the same whale may be seen many times, for the waters off Bermuda appear to be a vicinity in which the migrating Humpbacks pause in their migration, perhaps to rendezvous. Thus, some members of the herd may remain in the area for several days or even weeks. This is where they have been recorded, as they linger

ざとう鯨

まっこう鯨については、主として捕鯨者によって、少なくともいくつかの行動が観察なされていますが、その驚くべき歌が記録されたざとう鯨については、はるかに少ししか知られてません。

ざとう鯨は、55フィートの長さに及び、しなやかな前びれを持っています。これ故に、'*Megaptera*'つまり"広い翼"との科学名がついているのです。この前びれは北大西洋では白色で、その他の海では、灰色から、きらきら輝く漆黒におよびます。

他のひげ鯨と同様に、ざとう鯨も大きい頭をしていますが、違う点は、その頭一面に、こぶのようなびょうが打ちつけられていることです。そして、このこぶの1つ1つに一本毛がかぶさっています。どうしてこの毛があるのか又何の為の毛なのかは誰も知りません。

かつてこのざとう鯨の主生息地域であった南半球では、現在ではほとんど死滅に近い状態で、名残りの小数が北大西洋と太平洋に存在します。彼らの南半球での主な移動コースは、十分に詳しく図表につくられていましたが、北大西洋における彼らのルートは、その東と西の果てを夏場とし、カリビアンとアフリカ海岸の沖合いを冬場とすること以外はあまり知られていないのです。そうしてこの二点間をどのルートで移動するかについては、全く何も知られていないと云っても云いすぎではありません。

ざとう鯨の北大西洋における移動について我々の知っている数少い事実の1つは、北方への春期移動時に、この群が島の南側を通過しつつ、4月にバーミューダ沖合に現われることです。この群の数は、確定されていませんが恐らくかなり少数と考えられます。多数の群であろうとの報告は、観察された各鯨が、横断しつつあり、従って一度のみ、みられたと云う見方に基づいたものでした。

しかしながら現在では、どうやらこのバーミュダ沖合が、移動するざとう鯨の移動中休息地で、恐らく集合のために、同じ鯨が頻度にもわたって見られたのではないかと考えられます。集合地、休息地故に群をなす鯨の何頭かは、数日に、或いは数週間にわたってこの地

off the island shores, singing their enthralling songs.

Besides their song, the most extraordinary behavior so far observed in Humpbacks is breaching—their exuberant leaps into the air. They burst up through the surface of the sea in a massive column—for one awesome moment nearly free of the water—then wheel majestically, and, belly uppermost, crash backward into the ocean with a thunderous eruption that hurls sheets of spray glistening into the air. Because Humpbacks are so large, they take a quite noticeable time to breach, which makes each stunning leap seem to take place almost slowly. One Humpback may leap twenty times in a row.

Humpbacks are also seen lobtailing—raising their broad tails high in the air and slamming the flukes down flat on the surface with a resounding crack that can be heard for miles. And sometimes they lie quietly at the surface on their backs or sides languidly finning, waving their supple flippers like enormous palm fronds in the wind. Occasionally, they slap a flipper on the water so that spray shoots out from beneath the blow like skeet shot.

No one knows why the Humpback does these things. Yet no one watching him could help but feel a fondness for this whale, as Melville did when he wrote of Humpbacks:

> "He is the most gamesome and lighthearted of all the whales, making more gay foam and white water generally than any other of them."

There is less gay foam and white water now than in Melville's day. Although the remnant herd is presently under worldwide protection from the signatory nations of the International Whaling Commission, it may be that too little was done too late for Humpbacks to reach a herd size that, in our generation, would permit even the casual observer to see them leap. Today they are seldom seen at all, except in a few areas for a few days or on scientific expeditions mounted specifically to find them.

域に居るかもしれません。鯨の数は、この地点で島海岸の沖合をその心を奪う歌をうたいつつふらつき泳ぐ所で、レコードされました。

この歌の他に、これまで観察されたざとう鯨の最も驚嘆に価する行動は、その呼吸、空中への豪壮な飛躍です。それは、ほゞ水から離れたすさまじい瞬間、どっしりとした柱となって突如として海の表面につき現われ、次いで堂々と回転し、腹部を一番上に高くして、雷のとどろくような爆発音と共に、四方八方へときらめく水滴の霧を射出しながら、海に向ってどうしろ向きにつっこみます。

ざとう鯨のその大きさのせいで、水上に飛び上るのにかなりの時を費やすためこの驚くべき飛躍が、ほとんどゆっくりにすら見えます。この飛躍は続けて20回繰り返えされることもあります。

ざとう鯨は又、空中高くそのひろい尾をあげ、びしゃりとあたりにひびきわたる鋭い音と共に、その先端を海水面にたたきつけるのが見られます。その音は、数マイルにわたって聞くことが出来るのです。時には又、あおむけに或いは横むきの状態で、しなやかな前びれを風の中の巨大な葉のように揺り動かしつゝ、ものうげに海を打ち、静かに横たわっています。そうして時々、前びれでびしゃりと海水をうち下からスキートショットのように、水しぶきをふき散らすのです。

何故、ざとう鯨が、こうした事をするのかは誰れもしりません。それでいて、この鯨を眺めるものは、メルヴィルがざとう鯨に感じたように、又書いたように、この鯨に対して愛着を覚えずにはいられないのです。

> "彼は鯨のうちで最も遊び好きで、陽気であって、おおむね他の鯨よりも明らかに水泡を立てて、遊ぶ"（メルヴィル白鯨　阿部知二訳）

メルヴィルの時代に比べると、陽気な白い水は、それ程陽気でもなく白くもありません。残された群は現在、国際鯨委員会の加盟国によって、世界的に保護されているものの、彼らの跳躍を気軽に見られる数の群に我々の世代内に戻るために打たれた手はあまりなく、あまりにも遅すぎるのです。

今日では、特定領域に数日にわたって見られる以外、特別に彼らを見出すために計画された研究旅行以外には、鯨を見ることは全くまれです。

The Song of the Whale

鯨の歌

The Discovery of the Humpback Whale Songs

WHALE SONGS have probably been heard, though seldom recognized as such, ever since man began to make voyages by sea. In the literature of whaling alone there are many accounts of strange, ethereal sounds, reverberating faintly through a quiet ship at night, mystifying sailors in their bunks. Long after such experiences were first mentioned, scientists were able to explain what caused them.

Sound travels by creating vibrations between molecules. How well it travels depends, among other things, upon the density of the medium through which it passes. Because water is a much denser vehicle than air, an equally loud sound travels much farther in water than in air. But although a whale sound may be quite loud and may carry great distances in water, it hardly transmits at all from the sea surface into the air because the distance moved by vibrating water molecules is very small, whereas air molecules must move a relatively greater distance (at lower pressures) for a sound of the same loudness.

Therefore, vibrations made by ocean sounds can only move the air above the surface very feebly and thus very little sound energy gets across the barrier between water and air. Wood, however, is intermediate in density between water and air so it serves, though rather poorly, as a transformer between them through which sound can travel more effectively from one medium to the other.

This process is called coupling or impedance matching. The coupling of sound from water to air occurs at all times through the hull of a wooden boat at sea, but the sounds are seldom heard, either because the vibrations that reach the air are too weak to be picked up or because there is too much noise on board for the sea sound to be noticed. Occasionally, however, when a marine sound is loud enough and the ship is quiet enough, it can be heard on board quite clearly. Thus, whalers could occasionally

ざとう鯨の歌の発見

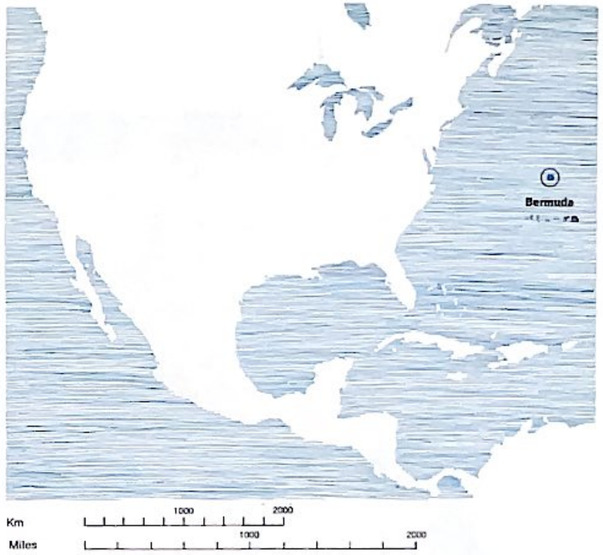
鯨の歌は恐らくその昔、人間が船で旅をしはじめて以来、ずっと長くにわたって、聞かれたものと思われますがこれを 鯨の音と考える人は稀だったのです。捕鯨を主題とした文学の中だけでも、夜中の静かな船の中で寝台の中の船員の心を迷わせるように、微かに震動して来る不思議な霊妙な音についての記述が、いくつもあります。こうした経験が最初に書かれた後、長い時を経てやっと、科学者は、この音が一体何によってひき起されているか、つきとめたのでした。

さてこの音ですが、これは分子間に震動をつくり出すことにより伝わります。いかによく伝わるかは、いろいろとある中で、音がその中を通ってゆく、媒介物の密度によりきまるのです。水は空気よりも、ずっと密度の高い媒質ですから、水中と空中で、同じ音の伝わる距離を比較すると、水中でのそれが、うんと長く伝わるのです。従ってかなり大きいと思われる鯨の音は、長距離にわたって伝わるものと思われる一方、水面から空中へと達することは、ほとんどありません。何故なら、水の分子が震動によって動いた距離が非常に短かいのに対して、空中の分子は 同じ音の為に、比較的長い距離を低圧力の下で、動かなければならないからです。

従って、海の音によってつくられた震動は、水表面上の空気をかすかに動かし得るだけで、音エネルギーが水と空気の間の障壁をこえることは、ほとんどありません。木はしかしながら、その密度において水と空気と中間にあるので、トランスホーマーとして、音が1つの媒体から、もう1つの媒体へと、より効果的に動かす為に使われます。

この過程は、結合とか、インピーダンスと呼ばれています。水から空気への音の結合は木の船の船体から常に起きているわけですが、空中に達したその震動がとらえるにはあまり弱いか或いは、この海 からの音が 船上で キャッチされる為にはあまりにも雑音がありすぎると云ういづれかの理由で、聞こえることは甚多にありません。しかし時として、海の音が十分に大きく、船がかなり静かな時は、船でこれをはっきり聞けることもあります。このようなわけで、時々捕鯨者は鯨の音を聞いたわけですがこれが鯨の出す音とは思いも及ばなかったものでした。

鯨が音を出すのではないかとの知見は、この数年間に知られたことで、この中で少くとも1種の出す音が、歌の形をとるとわかったのは、この数ケ月内のことなのです。この発見は、



hear whale sounds though they often had no idea it was a whale making them.

Knowledge that whales might make sounds has evolved only in the last few decades, and it has been shown only in the last few months that the sounds of one species, at least, occur in true song forms. This discovery was made by Dr. Payne and Scott McVay.

Dr. Payne learned from Dr. H. C. Frick, a trustee of the New York Zoological Society, that Humpback whales could be found off the coast of Bermuda. He was offered the opportunity to join Dr. Frick there on his boat and, with his wife, Katy Payne, he made his first trip to observe Humpbacks in April of 1967. While in Bermuda, Dr. Payne also met Mr. Frank Watlington, an engineer with the Columbia University Geophysical Field Station at St. David's, Bermuda. Dr. Payne had learned that Mr. Watlington, while studying sound propagation in the ocean, had recorded a great number of extraordinary marine sounds, which he had later determined were made by Humpbacks. Dr. Payne and his wife were eager to hear these sounds and found Mr. Watlington more than willing to aid their research.

"We met," said Dr. Payne, "at Watlington's invitation, on an oceanographic vessel he was using that day for research. In a small compartment of the ship, among a number of items in a relay rack, Watlington had a tape recorder containing the whale sound reel. He was installing equipment in that compartment when we arrived and, since there was no place else to listen to the tape, Katy and I first heard Humpback sounds over the roar of a generator and blower. Even so, what we experienced in that crowded, noisy compartment were the most fascinating and beautiful sounds of the wild world I had ever heard. Watlington gave us a copy of the recording and when we returned to New York we played it hundreds of times.

"I was impressed by the variety of sounds on the tape. At first, I assumed they were being uttered in wholly random sequences, but after weeks of listening to the tape I one day became aware that the sequence of

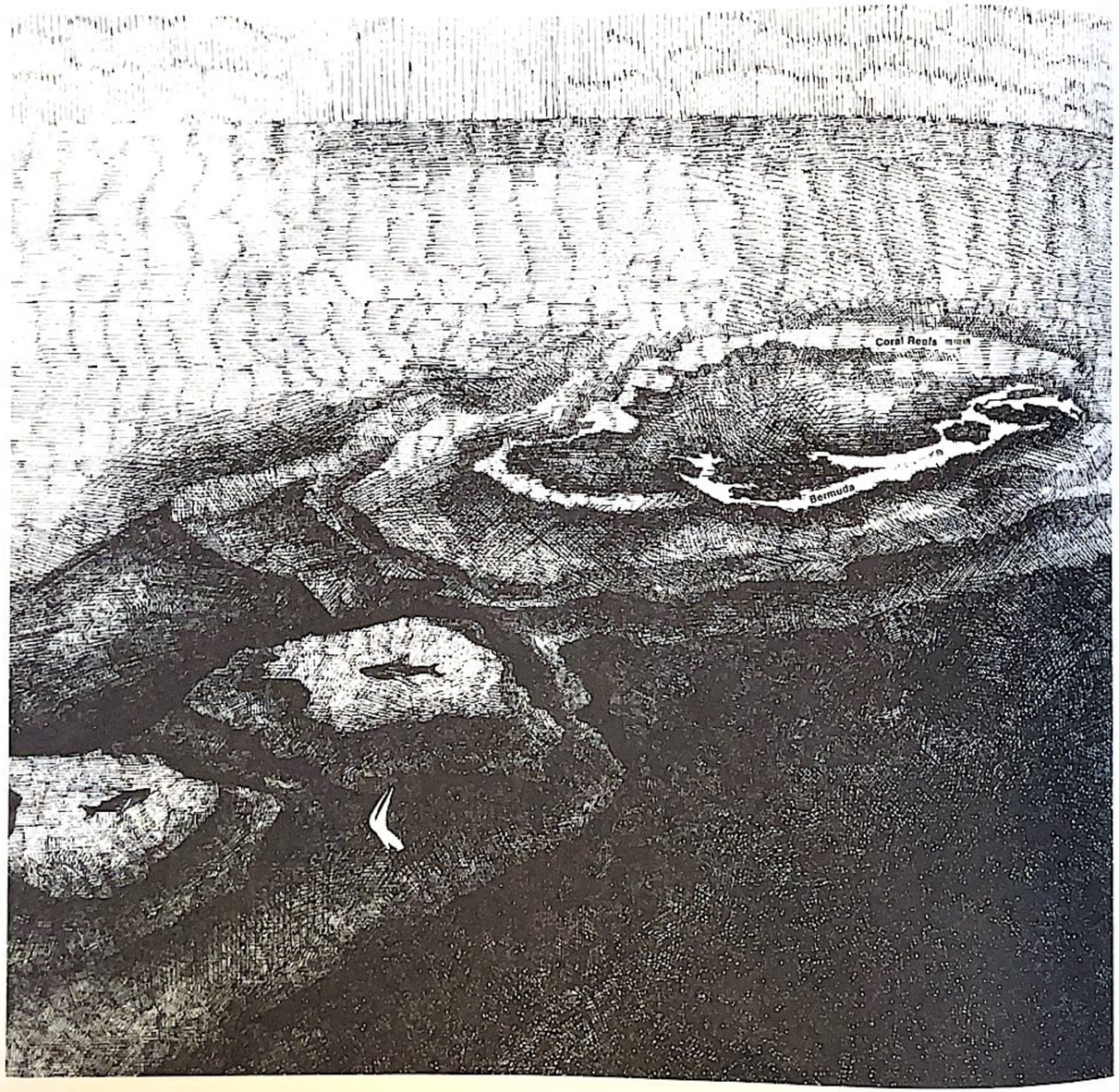
ペイン博 士とスコット・マックベイ博士によってなされました。

ペイン博士は、ニューヨーク・動物協会 の理事である H.C.フリック 博士から、バーミュ ダ海岸沖で、ざとう鯨が見つけられることを知りました。こうして博士は、博士夫人ケイティと共に、フリック博士のボートでバーミュダに参加するように招かれ、1967年の四月はじめて、ざとう鯨の観察に出掛けたのです。バーミュダにいる間に、そこで博士は、バーミュダのセイントディヴィスにあるコロンビア大学地球物理学付属研究所のフランク・ワトリントン氏に出逢いました。この人から博士は、氏が海に於ける音の伝播を研究中、驚くべき数の海生物の音(後にざとう鯨の音であると学ぶのですが)を記録したことを知ったのです。ペイン博士とその夫人ケイティーは、是非これを聞きたいと願い、ワトリントン氏は、この2人の研究に役立つことなら何んでも出来ることはしようと申し出たのでした。

博士は こう云っています"こんな風にして我々は、ワトリントン氏の招きを受けて、彼がその目研究に用いる、海洋調査船上で 運ったのです。船の小さな室の棚には沢山のものがあり、その中に鯨の音を収録したテープレコーダーが置かれてありました。我々が到着した時氏はテープレコーダーを使う準備中でした。聞く場所があいにく、他にないことから、発電機と送風装置のたてる大きい音の中で、はじめて私とケイティは、ざとう鯨の出す音を聞いたのです。混んだ、やかましい室にもかかわらず、この中で経験したものは、野性世界のかつて聞いたことのない、この上もなく魅惑的な、すばらしい音だったのです。ワトリントン氏からレコードのコピーをもらい、ニューヨークに持ち帰った後我々は、これを何百回と聞いたことです。"

"こうして聞いているうちに、テープの音が実に様々であるのに印象付けられました。はじめは、これらの音がでたらめな順序だと思ったのですが何週間か続けて聞いた後のある日長い間隔をおいて、これらの音が一定順序で繰り返されることに気が付いたわけです。そこでバーミュダにもどり、他のこともありますが、このアイディアを直接観察からテストしようと決心しました"

こうしてペイン博士は、次の4月に、ナショナル・サイエンス・ファウンデーションか



The ocean floor near Bermuda, looking northward. Three mountain peaks rise from the nearly level deep ocean floor. In the distance, part of the flat top of the tallest peak rises just above sea level to form Bermuda Island. The northwestern portion of this plateau is covered by a complex network of coral reefs lying just below the water surface. The other two peaks also are flat-topped, but these plateaus lie 160 to 180 feet below the water surface. In the foreground is Plantagenet Bank; the central peak forms Challenger Bank. The sounds on the record were captured along the slopes of these three peaks.

北に向いてみたバーミュダ 付近の海底。3つの山峰がほぼ平らな深海からそそりています。遠景に最高峰の平頂な頂上がやや海面に現われバーミュダ 島となっています。この平頂域の北西部は海面下にある複雑な網目状の珊瑚礁に覆われています。他の2つの峰も頂上は平坦ですが、この頂は海面下160から180フィートに位置します。手前はプランタジネット堆；中央峰はチャレンジャー堆を作っています。レコードの音はこれら3つの峰の斜面沿いのところで録音されました。

sounds seemed to repeat after a long interval. So I decided to go back to Bermuda and, among other things, test that idea through direct observation."

Dr. Payne returned to Bermuda the following April on a grant from the National Science Foundation. Among the other things he wanted to find out on his 1968 trip was whether he could approach the Humpbacks in a small boat and, by attaching a device that would enable him to remain near them, gain the acceptance from them that would permit closer study. During one such experiment a coincidence confirmed Dr. Payne's inference that the sounds he'd been listening to for so many hours were in fact being cycled through recurrent patterns.

Dr. Payne's discovery occurred not through the electronic equipment he later used to corroborate it but through the process of sound coupling that had brought the sound of whales to human ears for centuries.

"On that day," he recalls, "I was well off the coast in a plywood rowboat. For hours I'd been trying, with no success, to get closer than 50 feet to the Humpbacks surfacing around me. I was rowing with muffled oars so that I wouldn't frighten the whales. I was just beginning to gain on a pair of Humpbacks I'd been chasing for quite a while when they went down for a long dive. As I sat quietly at the surface I heard Humpback whale sounds, coupled directly through the speakerlike hull of my rowboat. I had no hydrophone with me then so I couldn't record what I heard, but the sounds were very clear and startlingly familiar. I recognized the sounds the diving whale was making as being like those on Watlington's tape. And I slowly realized that the sounds were occurring in the same sequence I had heard so many times on one section of the tape. Considering the great variety of sounds Humpbacks make, it was a lucky coincidence that the whale diving beneath my rowboat had produced the same sequence Frank Watlington recorded years earlier."

After he had discovered that the Humpbacks produce their sounds in song forms, it remained only for Dr. Payne to demonstrate such occurrences by spectrographic analysis of the Watlington tape. The first spectrographic printout was made by Mr. Scott McVay, an assistant to the president of Princeton University, who, though without formal scientific training

らの補助金で、バーミュダに戻りました。この1968年、ペイン博士がしたいと思ったことのうち小さなボートでざとう鯨に近付き、彼らの近くに止まったまま取付けた装置によって鯨を近くで研究することが可能となるかどうか試すという問題がありました。

博士の推定 — 何十時間にわたって聞いた音が、事実、周期的パターンで繰返されること — が確かめられたのは、こうした実験の1つの中で偶然に起ったのでした。

博士の、このような発見は、精密なエレクトロニクス装置 — 博士はその発見を確証する為、後にこれを用いていますが — によったものでなく、何世紀にもわたって、鯨の音を人間の耳へと運んだ音の結合過程によってだったのです。

"あの日"と博士は思い出します。"私は合板のボートに乗って海上遠くに漕ぎ出しました。何時間にもわたって、水面にあがってくる、ざとう鯨の50フィート以内に近付く試みを繰返し、成功しませんでした。鯨が驚かないようにと、オールをおって漕いでいました。長時間にわたって私が追いかけていた二頭の鯨に少し近付くのに成功した時、彼らは深く長くもぐってゆきました。静かに水表面にすわっているその時に、ボートをとおしてスピーカーのように潜水した鯨の声を私の耳に運んできたのです。水中聴音器をもっていませんでしたから、聞いた音を記録することは出来ませんでしたがその音は、とても明らかで驚く程耳なれたもので、ワトリントン氏のテープのようだと気付き、さらに、そのテープの一定部分で、度度も聞いたと同じ順序で、起きていることに次第に気がついたのです。ざとう鯨の出す音が、実に様々であることを考えると、このボートの下に潜水した鯨の出す音が、数年前にフランク・ワトリントン氏の記録したものと同じ順序であったことは、運のいいことでした。"

こうして、ざとう鯨が、その音を歌の形でつくり出すことが明らかになった後は、ワトリントン・テープの分光写真を分析することにより、実証することがペイン博士に残された仕事でした。最初の分光写真の現像をしたのは、プリンストン大学学長補佐役の、スコット・マクベイ氏です。マクベイ氏は、特別科学領域に於ける学問をした人ではありませんが、鯨の保護に大きな関心を持つ人で、ペイン博士と共に働いていました。

分光写真の分析結果が、かなり明らかに

Dr. Payne made his recordings of whale sounds from the sloop *Twilight*. The hydrophones were towed on 150-foot cables, suspended from bamboo poles on the stern.

ペイン博士はスループ・タングレ号から鯨の歌を録音しました。水中聴音器は船の尾部につけた竹ザオに保持され、150フィートの綱で曳航されました。

himself, has taken a great interest in the conservation of whales and has worked with Dr. Payne. The spectrographs showed quite clearly the recurring sequences of sound, and Dr. Payne determined to make a third trip to the whale grounds the following April in order to make more recordings.

"The experiences I had in my first two seasons off Bermuda," he said, "persuaded me that if I wanted to learn anything more about Humpbacks, I would have to be at sea as much of the time as possible and particularly at night. I'd learned that Humpbacks are vocal both in day and night. So I needed a boat in which I could remain at sea day and night. And, of course, I needed hydrophones and recording equipment through which to listen and take down the sounds."

With a generous grant from the New York Zoological Society, Dr. Payne chartered the *Twilight*, a 35-foot sloop owned by E. M. Gosling of Bermuda. He outfitted the boat with amplifiers and recorders and rigged it so that hydrophones, which are underwater microphones, could be trailed behind the boat on about 150 feet of wire. The object was to hang two hydrophones off the stern of the boat on trolling polls, keeping them far enough apart to allow some sense of a whale's direction by listening in stereo. This method produced excellent stereo recordings but did not work very well as a method of finding the whales.

There were six members of the *Twilight*'s crew on the April 1969 trip. "It was a delightful group," Dr. Payne said, "with quite varied backgrounds. The captain, Anthony Kaesbey, is a retired Canadian Naval officer who teaches school in New York City. The mate, Paul Hyslop, is a Nova Scotia forester who has had a great deal of experience aboard sailing boats. And there was Ron Johnson, an extraordinary engineer who has a laundry business in Los Angeles; Victoria Rowntree, an assistant to the curator of wasps at Harvard's Museum of Comparative Zoology; me; and my wife, Katy, an artist and scientist who by now knows more Humpback whales by their songs than does anyone alive."

The usual pattern followed on the recording trips was to leave in the morning or afternoon, stay out the whole night, and return at dusk the following day. The trips concentrated on areas in which local observers had seen Humpbacks in previous years. On reaching such an area, the *Twilight* would crisscross back and forth over an offshore bank recording the sounds and

繰返される音の階層を示したので、翌年の4月さらに多くの音を記録する為に、第3回目の旅をすることに、ペイン博士は決心しました。

"2度にわたるこれまでのバーミュダ沖での経験は、ざとう鯨についてさらに知る為には、出来るだけ長時間、特に夜海上に居なければならないことを痛心させました。そしてざとう鯨がひるも夜も声をだすことを知りました。そんなわけで、昼も夜も止どまれる船が必要でした。物論音を聞きとり録音する為に、水中聴音器と録音装置が必要でした。"

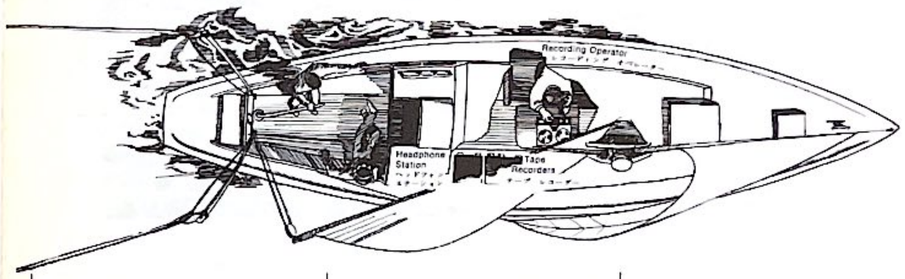
ニューヨーク動物協会からの寛大な助成金によって、バミューダのE.M.ゴスリン氏が所有する35フィートのスループ"たそがれ号"を雇い、これに増幅器とレコーダーを用意し、水中マイクロホンを船尾から約150フィート、ひきづるように取り付けました。船尾の流し釣りの竿に二つのマイクロホンをつけた目的は、この二つの間に距離をおき、ステレオで音をとらえることによって鯨の方向をなんとか知ろうとしたわけです。この方法は、すばらしいステレオ録音をすることに成功しましたが、鯨を発見する手としては役に立ちませんでした。

1969年四月の"たそがれ号のクルーは6人でした。博士はこのグループについて、次のように述べています"この5人はすばらしいグループでした。そのバックグランドは様々でキャプテンのアンソニー・ケーズビイは、退役カナダ海軍士官で、ニューヨーク市で教えていました。メイトのポール・ハイスロップは、ノーベスコシアの森林業者で、ヨットの海上経験豊かな人です。ロン・ジオンソンは秀れたエンジニアで、ロスアンジェルスに、ドライ・クリーニングを所有しています。ヴィクトリア・ローントリーは、ハーバート大学付属美術館、比較動物のジガバチ課の職員です。これに私と妻のケイティー（芸術家であり、科学者である妻は、この時すでに他の誰より詳しくざとう鯨の歌を知っていました）が参加したわけです。

録音旅行の日課は、朝、或いは午後に出かけ、一晩すごして次の日の朝方帰って来るのです。こうして出かけた領域は、ローカル、オブザーバーが、今までに、ざとう鯨を見かけたと云う範囲に集中しました。こうして選んだ領域に近付くと、ジグザグに行きさしてその音を録音し、ざとう鯨がその浅い水の下に眠っているという仮説をテストするのでした。

This plan shows the equipment carried on the *Twilight* during Dr. Payne's research voyages. The sloop was designed by Arthur Robb, and built by Cheoy Lee Shipyards in Hong Kong.

ペイン博士の研究航海時にタングレ号に搭載された器機類を示してあります。このスループはアーサー・ロブが設計し、香港のチョイ・リー・ドックで作られました。



testing a theory that the Humpbacks were roosting at night there in the shallow water. "During these trips," Dr. Payne said, "we began to build up a faint picture of the daily cycles of the whale's activity, but it is still very sketchy and it may be years before I have any deep confidence in what I have to say about what they are doing in the Bermuda vicinity."

When asked about the safety of the recording trips taken at night in the midst of such big animals, Dr. Payne said, "I suppose people ask about that because they've read descriptions about the perils of whaling. You know, Sperm whales biting a boat in half or smashing it to splinters with their flukes. But what most people know about such things comes out of novels and adventure stories. In fact, when events of that sort did occur during a whale hunt, it was because the whale had been harpooned and, usually, because it was being lanced—when someone with a piece of steel 6 feet long was thrusting it into the whale's body, trying to pierce its lungs or heart. Anyone near such a large animal writhing in the final agony of that kind of torture would obviously get hurt if he got in the way. It's hardly a sign of viciousness if a whale down to its last defenses bites at anything in reach.

"I have never killed a whale, nor tried, nor will I try, so my experiences with them have all been pleasant. They are like cows, really, and seem to me to be the most beguiling, gentle creatures on earth.

"The main problem in studying them is getting close enough. I don't think there is much possibility of being harmed by them. I'm sure they're too alert not to notice my boat in their area so I have never felt the slightest worry that some whale might smash into me from below when it's breaching. I have had a Humpback whale breach within a few yards of a small rowboat I was in—so close I was splashed by the spray. That's not a story of bravery but rather of a delightful encounter, and if I can survive the part of my life I spend in a city, I am sure I will survive those portions spent at sea.

"Everyone on that trip with me feels as I do about the docility and the great charm of those Humpbacks. It was interesting that, regardless of our dissimilar walks of life, we were all moved by their songs. There was often a perceptible feeling aboard that someone else had had the headphones long enough and really should pass them on.

"During our five weeks in the vicinity, we began to learn some few things about the whale's behavior and we made hundreds of hours of recordings. Every moment that we were out on the ocean someone was always listening."

"この期間中に、鯨の日課について、ぼんやりした輪かくがつかめましたが、これは大ざっぱなもので、バーミュダ近辺で鯨がどんなふうに日を送るか確心持って云えることはづっと先のことでしょう"と博士は述べています。

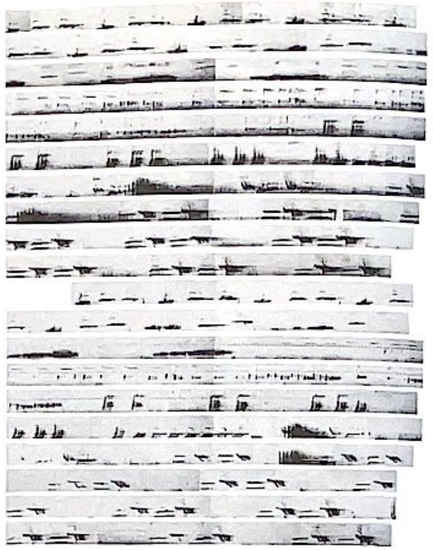
このように大きい動物、鯨の真中でする録音旅行の安全性について博士は"この問題は捕鯨の危険さについて、まっこう鯨がボートを二つにさいたとか、尾の先で、こっぱみじんにしたと云う風に描写されているから起るのだと思いますが、これは冒険話しや小説の描写で、実際にこうしたことが起るのは、大体の場合、捕鯨で、もりをうちこむからであり勿論心臓をつきさそうと、6フィートもあるやりを鯨の体につっこむからです。こんな死の苦悶を受けてのたうつ大きい動物の前にゆけば、誰でもきづ付くことは、眼に見るよりも明らかです。最後の手段として、なんでも手あたり次第かんだとしても、鯨が敵意のある動物である証拠とはいえません"と云っています。

"私は鯨を殺した経験はありませんし、又殺そうと試みたこともありません。これからさきも殺す気はありません。従って、鯨との私の経験は、心地よいものです。全くのところ彼らは牛のようで、地上に於ける最も退屈しのぎの、やさしい動物なのです。

"鯨の研究で一番問題になるのは、どのようにして十分彼らに近付くかと云うことですが鯨の為に傷付くと云う心配はあまり必要なさそうです。彼らの領域の中で、鯨が私のボートの存在に気づかない程鈍感とは思われないので、下から浮き上って来る際、私にぶつかるという心配は少しもありませんでした。ざとう鯨が私の小さいボート、数ヤードの所にやって来て、その水しぶきを浴びたことがありますが、これは勇敢な出来事と云うよりは、喜ばしい出違いと云ったものです。都市で生活し、生き残ることが出来るなら、海のこの地域でも生きのびれると確信がもてるのです。"

"この旅をしたものは、鯨の従順性と、チャームについて私と同じ様に感じています。歩んだ人生の違いにもかかわらず、一様に鯨の歌に感動し、その歌をきく際に、1人の人が長時間きくようなことをすると、1人占めしないで受信機を次の人に譲るべきだと云う、気持が満めたものです。"

"こうして5週間、この付近で、すごしている間に少しづつ、鯨の行動について知り、数百時間にわたり、録音をとりました。海上にいる間、いつも誰かが、鯨の歌にき入っていたものです。"



The Study of the Songs

IF THE IDEA of a whale "singing" seems odd, the cause may lie in the several meanings of the word "song." Quite apart from any esthetic judgment one might make about them, the sounds produced by Humpback whales can properly be called songs because they occur in complete sequences that are repeated. Bird sounds are called songs for the same reason. Birds sing songs that are repeated fairly exactly and Humpback whales too are very faithful to their own individual sequence of sounds. Humpback whale songs are far longer than bird songs. The shortest Humpback song Dr. Payne has recorded lasts six minutes and the longest more than thirty minutes. The pauses between Humpback songs are no longer than the pauses between notes within the song: in other words, they are recycled without any obvious break. Again, in contrast with birds, who complete a song before pausing, it doesn't seem to matter where in its song the Humpback starts or stops, although they usually start in a section that includes low frequency pulses followed by sustained tones.

Because Humpbacks appear to interrupt and resume their songs at any point in the sequence, it is impossible to say at present what is the beginning and what is the end of a song.

To see how the sounds fit into a song you can follow the shorthand representation of the song shown here. A spectrograph machine was used to analyze the sounds, and the charts it produced are very like musical notation. The pitch of a sound is represented by its vertical position on the page—the higher the pitch, the higher its mark appears on the page—and time is represented by the length of the mark. The machine advances at a constant rate, with its sensitive marking point riding on a continuous roll of paper. It keeps printing a mark as long as the tone lasts, following it through whatever pitch range it covers. Thus, a short line represents a brief note, a longer one a longer note, and

歌の研究

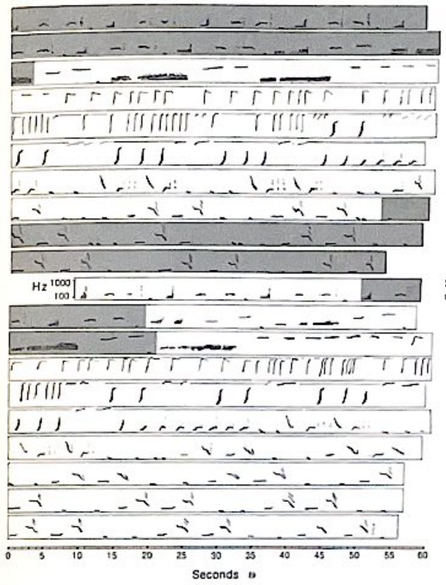
鯨が"歌をうたう"という考えがぴったり来ないと思われるのは"歌"のもつ、いくつかの意味によるものかと思われます。その審美的判断は別として、ざとう鯨のつくり出す音は完全な順序を持ち、そうしてこれが繰返されることから歌と呼ぶことが出来得るのです。これと同じ理由で、小鳥の出す音も歌と呼ばれます。かなり正確に繰り返えされるこの歌を小鳥はうたい、又ざとう鯨も同様に、その種特有の音を忠実に繰り返えします。ペイン博士の収録したそれは、最も短いもので6分もあり、長い歌となると30分にもなります。が、ざとう鯨の歌と歌の間の休止は歌の中の音符間よりも短かく、つまり明らかな休止なしに循環が繰り返えされるのです。又小鳥との比較になりますが、小鳥が休止の前にきちんと歌を終らせるのに対してざとう鯨の歌は一体どこが始まりで、どこが終りか関係ないのです。が、大体はページの分類にみられるように、続いた音の後の低い置動音をふくむ部分から始まります。

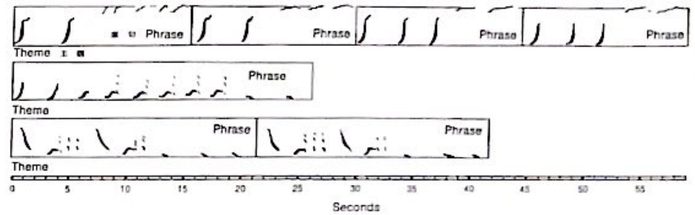
このように、ざとう鯨はその歌の順序の中の好きなところで中断し、再び続けますからどこが歌の始まりで、どこが終りなのか決めることは現在の所不可能なのです。

ここでどんなふうに音が歌にはまるか、ここで示される歌を、速記で書きあらわしたもので、たどってみましょう。

音の分析に分光写真機が使われました。その結果作られたチャートは音符にとても似ています。音の高さは上下の線の長さであらわされ、音が高い程、長い線で書かれています。時間はしるしの長さであらわされています。機械は、巻かれた紙の上に細いペン先で、次々と記録しながら、一定の速さで進みます。このペンは、その音の高低範囲を示しながら、音の続く間中、しるしをつけます。こうして短い線は短い音を意味し、長い線は音が長い間続いたことを示しており、その線の上り下りは、音の高低を示すわけです。

例えば、 ∫ との線は、低い音から高い音へと上昇することを意味しています





At the far left is the original notation of the whale sounds and sea noises, as produced by the sound spectrum analyzer. On this page is a tracing of the whale sounds alone. Harmonic tones have been eliminated from the tracing, except where the tone heard by the human ear is an effect of the noise pulse (a complex group of harmonics). The shaded portions are the repetitive sections eliminated from the version heard on the record (Side I, band 1). The high notes printed in color are reproduced at one-quarter speed on the record (Side I, band 2). Two songs are noted here. Typical phrases and themes have been indicated in the excerpts enlarged above. Notations for the portions of the songs included on the record are reproduced in larger size in the Listening Instructions.

左端は鯨の歌と海の騒音の音響波分析器による原記録です。この図には鯨の音だけが記録されています。人間の耳で聞かれた音程が騒音パルス（複雑な調和音）の効果であるとき以外高調音は録音から消されています。影をつけた部分はレコード（1面1部）で聞かれた版から消された反復部分です。色刷りの高音はレコード（1面2部）に4分の1の速度で再現されています。類型的要旨と主題は上に拡大されて説明として出されています。レコードに含まれている歌の部分の音程は、レコードの聴き方のなかにもっと大きく再現されています。

the vertical position of the line tells you how high the note is.

For example, ∫ represents a note that starts low and sweeps to a higher pitch. ∫ represents a note that starts low and reaches a higher pitch more gradually. ⌞ represents a note that starts at a high pitch and sweeps down to a low pitch. ═ would be two notes of constant pitch, one low, one higher, which occur for the same length of time at the same moment. ▬▬ is a series of pulses that sound like bursts of noise without any particular tonality.

The spectrograph prints everything it hears—all the extraneous noises as well as the sounds of the whale, plus harmonics of those sounds. If you want to see only the whale sounds, you have to copy them out, leaving the noise behind, as we've done in the second illustration here.

There are several song types. Any one song type consists of a constant number of themes given in the same order. Each theme is composed of phrases. The principal difference between successive songs is the number of phrases in each theme. No theme is ever completely omitted, but sometimes a whale will repeat a phrase many times before going on to the next theme. Thus, songs, while composed of the same number of themes sung in the same sequence, may be longer or shorter depending on how long the themes are—that is, how many times a phrase is repeated in any given theme. There is a further complication in that the phrases of some themes slowly change with each repetition, so that those near the end of a theme are quite different from those at the beginning.

Different Humpback whales sing different songs, sometimes on the same pattern of themes as Side I, Band 1, but sometimes not.

Katy Payne has analyzed a great many songs and has discovered that although there is a very rough overall species pattern, individuals have enough specificity to their songs that they can be recognized by their voice patterns. The evidence for this is indirect and is based on the fact that the Paynes have repeatedly heard the same song sung in the same place near Bermuda day after day. The simplest assumption is that it is the same whale.

∫ これは低い音から始まり、次第に高い音に近づくわけです。 ⌞ は逆に高音から始まり、低音に終ることを意味しています。 ═ は、2つの音が、同時に同時間続き、1つの音は他よりも、幾分高音であるわけです。 ▬▬ は、特別の音調なしの音が、一斉にふき出した様な、一連のパルスを意味しているのです。

分光写真は、単に鯨の音だけでなく、その他の様々の雑音、その雑音間の調和音の一切合切をプリントします。そして鯨の音だけを聞こうとするなら、こゝで我々が第2の説明でしたように、雑音を抜いて、それだけを取り出さなければなりません。

歌には、いくつかのタイプがありますがどの歌も、いくつかの小節からなる楽句をもつ一定の主題が一定の順序で繰り返されます。そして各歌の主な相違は、各主題の中の楽句の数の差で、どの主題も完全に、オミットされるということはありませんが、時として鯨は、次の主題に移る前に、何回となく楽句を繰り返します。従って各歌は、同じ数の主題が、同じ順序で繰り返されるもの、各主題の長さ、つまり一定時間内に、何回にわたり楽句が繰り返されるかによって長くもなり短かくもなるのです。さらに、複雑な点は、主題のいくつかは各楽句が1回繰り返されるごとに、少しづつ変化し、その結果終りにちかい主題は、始めのそれと比べるとかなり違ったものになります。

各鯨は、時として第一曲第一節の主題と同じパターンで、またある時は別なふうに、それぞれに異った歌をうたいます。

ケイティ・ペインは、多くの歌を分析し種の歌のパターンというものがあると同時に各鯨はその鯨と認められる特異性をもっていると云っています。しかしこれについての証拠は、間接的なもので、夫妻がバーミュダの一定の場所で毎日毎日同じ歌を聞いたという事実に基づいています。最も簡単な説明はこれらの歌がつまり、同じ鯨によってつくられているとの見方です。

We know very little about whale songs. For example, we have no idea which sex produces the songs, or whether both do. We know nothing about the behavior that accompanies the singing. We do know that whales can hear, for they dive suddenly after a loud noise, yet we really have no direct evidence that they respond in any way to the songs of other whales.

Most people who have just heard the songs for the first time seem eager to believe that the whales have some form of meaningful communication. But as yet we cannot really say whether that is true.

We do know something about the transmission of sounds through the ocean, however, and speculations based upon this knowledge may be useful in considering what the whale might be capable of.

Douglass Webb, an engineer at the Woods Hole Oceanographic Institution, has had a lot of experience in designing and producing equipment that can be tracked in the ocean by the sounds it emits. He and Payne have made a few preliminary calculations of the distances the loudest sounds of another species of large whale, the Finback, might be transmitted under the best of circumstances. They are presently preparing a more thorough discussion of this topic, but surprising conclusions are already emerging. It seems hard to believe, but one Finback may be able to hear sounds made by another tens or—under the best circumstances—even hundreds of miles away.

In the early days of radio, it would have been hard to believe that a hand-held box weighing a few pounds would allow someone in New York to talk with someone in California. Yet under the most favorable atmospheric conditions, radio operators have communicated over that range with very low-power transmitters. As we all know, conditions can also be so bad that even powerful stations relatively close at hand are drowned out by static and noise. However, if you were a Finback whale and had a very simple message to get across with no particular urgency—say, a message that simply indicated, "someone is here"—perhaps you would be willing to wait out the long periods of unfavorable circumstances for the occasional relatively short periods when transmission over long distances was possible.

It seems possible that, like Finback sounds, the Humpback's low tones might be used to maintain some form of contact among widely scattered individuals traveling as a herd. Sounds would provide the best means for such contact in the ocean, where visibility is very limited. Such a system would work only if the animals using it were vocal much of the time and Humpbacks are. Wild Porpoise herds are highly vocal, and probably use some of this activity to keep in contact. We now know that Humpbacks sing songs during at least part of their migration in the North Atlantic and Pacific, but probably do not sing on their shallow-water summer feeding grounds. These songs may turn out to be the way that the herds are called or kept together as they move slowly northward, while spread out over a relatively broad area of the ocean.

"These speculations may seem of little consequence," says Dr. Payne," but they give some idea of the kind of things we hope to find out in the future—the possibilities that seem worth investigating. For such investigations, I hope to develop equipment to follow herds of whales and to live with them for long periods while studying their behavior. This will require support and lots of time. The funds obtained from sales of this record will be used in part for such studies.

"My major concern at this time is to prevent the destruction of these delightful animals. It would be sad indeed if their numbers were so reduced that we could not learn more about them, now that we have reached a point in history where we may be able to learn something significant about their behavior. The other part of whatever funds we can raise will be used to push for the significant survival of whales."

我々は鯨の歌について殆んど何も知っていません。例えば我々はメスかオスのどちらが歌を唱うのか、またメスもオスも唱うのか全くわかっておりません。我々は鯨が歌うときにとる行動についても何にも知りません。鯨が大きな音がしたあと急きょ海にもぐることから、鯨が聞くことができることを知っていますが、べつの鯨の歌に反応することを示す直接的証明はまだありません。

鯨の歌をはじめて聞いたばかりの多くの人は鯨がなにか有効なコミュニケーション形態をもつと信じたくなってしまうようです。しかしまだ私共はそれが本当であるか、はっきりと云いきることはできません。

しかし私共は海洋中の音の伝達については多少知っており、この知識に基づいた推定は鯨にとって可能でありえそうなことを考察するのに役立つでありましょう。

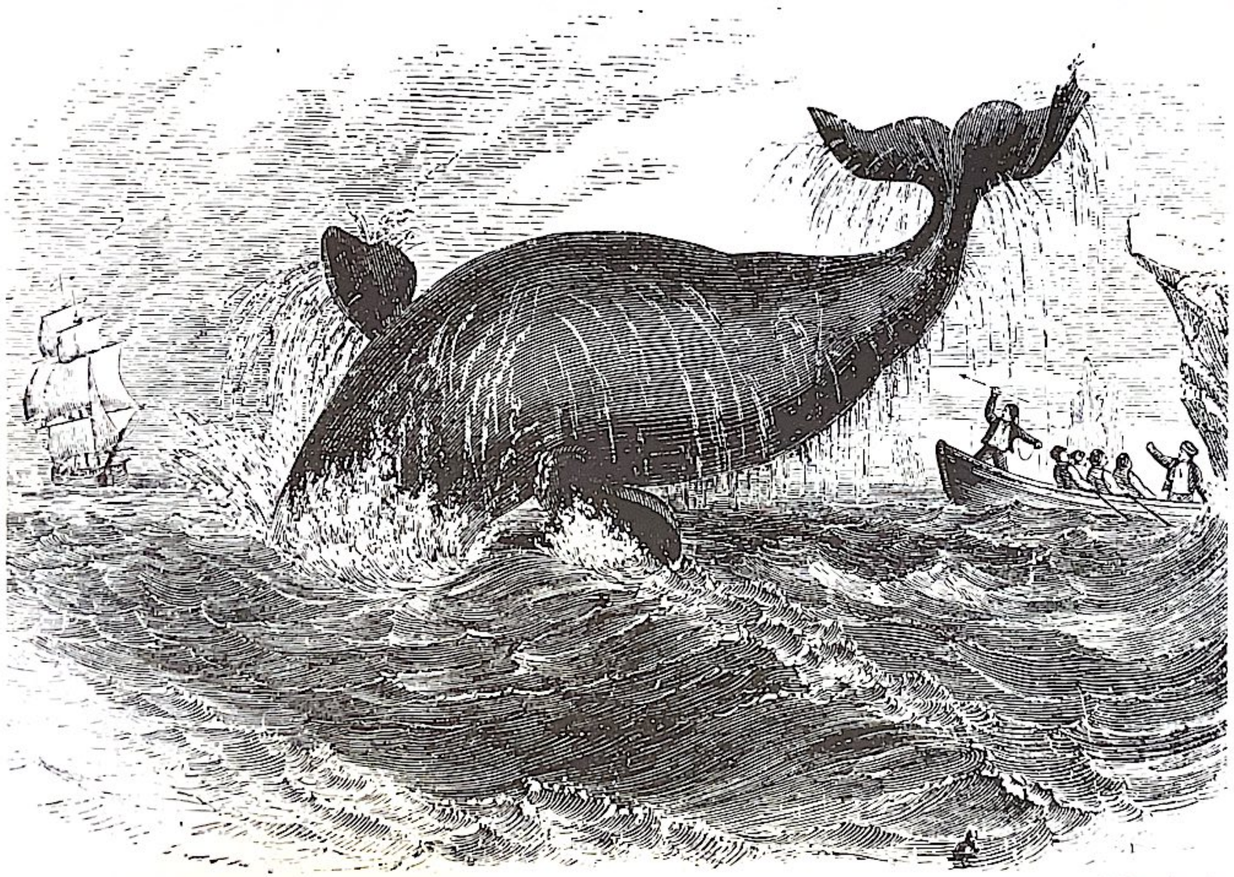
ウッズホール海洋研究所の技術者ダグラス・ウエブは海中で音を発し、その音を追跡できる計器の設計・製作に多くの経験をもっていました。ダグラス・ウエブとペインは最良の条件下で鯨のだす最大音が伝達される距離について、いくつか予備計算をしてみました。彼等は目下この問題について、より徹底した論議をすすめていますが、驚異的な結論は既に得られています。信じ難いことですが、鯨は、べつの鯨が何百マイルから何千マイルはなれたとこでだすいくつかの音を聞きとることができるのです。

初期時代のラジオで、手にもてる数ポンドの小箱でニューヨークにいる人とカリフォルニヤにいる人とお話ができるとは信じ難いことでした。しかし最適な気象条件下でラジオ技師は非常に低出力発信器で、このような遠距離間の通信をしました。また誰もが承知のように、比較的近距離にある強力な電波局の電波も空電と雑音にのみこまれてしまうような悪条件もあります。とはいえ、もし、みなさんが特別緊急でなく非常に簡単なメッセージ ― "誰それここにあり"と簡単に示すだけのものを伝えようとするなら、比較的短い時間でも、長距離交信の可能な時迄、長い悪条件期間をじっと待ち続けるでしょう。

ながす鯨の音と同ように、ざとう鯨のだす低音は一つの群として移動しているが、広い範囲に分散している個々の鯨間に何らかの形で連絡を保つのにつかわれているようです。このような方法はこれを利用する動物が多くの時間音を発しているときにだけ役立つのですが、ざとう鯨は多くの時間にわたって音を発しているのです。野生イルカの集団は非常に発声的で、この行動のうちの、いくらかは多分連絡を保つのに使っているでしょう。現在、私共は、ざとう鯨が少くとも北大西洋と北太平洋を移動する途中で歌を唱うけれども、多分夏季エサ場では海面近くで歌わないことを知っています。これらの歌は、集団をよびあつめるときや大洋を比較的広範囲に広がって、ゆっくりと北上するときに集団を保つ方法であるのかもしれません。

"このような推測は殆んどなんの意味もないかもしれません"とペイン博士は云われます"が、しかし将来解明したいこと ― 例えば研究するにたる可能性について幾つかの考えを与えます。そのような研究のため、私は鯨の行動を研究している長い間、鯨の集団を追跡し鯨と共に生活するための器具を発明したいと望んでいます。これには、援助と永い時間が必要でありましょう。このレコードの売上げから得られる資金はこのような研究の一部に利用されましょう。"

"私の現在の主な関心は、このよろこばしい動物の死滅を防ぐことにあります。歴史の中で、鯨の行動について重要な何事かをしることが、可能な時点に達している現在、その数が著しく減少したために、鯨について学べないまでにへらされては、かなしい話しです。我々の集めうる募金の一部は、この鯨の意味ある生存をおしすゝめるためにつかわれることになっています。"



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The Tragedy of the Whale

Most people, if asked today, would probably say that the whaling business disappeared with the sailing ship. They might explain that like sailing ships, which were abandoned because steamboats could keep going in a calm, whale oil was abandoned because kerosene was cheaper as a source of light. Thus, the quaint, somewhat barbaric practice of whaling died out about 100 years ago. But this is entirely wrong, and it is a tragic misconception, for the ignorance it represents may well cost the world its whales.

THE TRUTH IS that the whaling industry is at its height right now. This century far outstrips all others in the numbers of whales taken. The total of whales killed in the 1960s was the greatest ten-year kill ever made! The whaling that occurred 100 years ago cannot begin to compare with the slaughter going on today.

A century ago an average three-year whaling voyage brought back the oil of thirty-seven whales, for an average of about one whale killed a month. Today's catcher boats kill, on the average, between one and two whales a day. In the 1860s the best three-year cruise on record lists a kill of eighty-five whales. In 1967 the total kill for that year of Sperm whales alone was 25,911, and the total kill of all whale species for that year was 52,046, not including 20,000 porpoises taken by Japan. The business of killing whales did not peak and die out 100 years ago. It is peaking now, and it is in this decade that it is fated to die out, for there is no possibility that it can go on for more than a few years at its present rate of slaughter.

Compare the kill and yield of 1933 with the kill and yield of 1966. In 1933 the slaughter of 28,907 whales produced 2,606,201 barrels of oil. In 1966 the slaughter of 57,891 whales produced 1,546,904 barrels of oil. Notice that in 1966 the whaling industry slaughtered almost exactly twice as many whales as in 1933 but produced just over half as much oil. Obviously, whale hunters are killing smaller and smaller whales in larger and larger numbers. If this trend continues—and nothing is so far effectively preventing it—then the industry, and incidentally the world, will soon run out of whales.

The whaling industry has interpreted this trend not as a long range problem of resources but as a short range problem of technology. The whaling nations, principally Japan and Russia—but also Australia, Brazil, Canada, Chile, Iceland, Norway, Peru, Portugal, South Africa, Spain, and the United States—are apparently only interested in improving the efficiency of their already overwhelming technology for killing whatever whales remain.

鯨の悲劇

多くの人は、今日捕鯨業について尋ねられたら、恐らくそれは帆船と共に消滅しましたと答えるでしょう。蒸気船が風の中でも走ることが出来るので帆船にとってかわったように、鯨油はケロシンが光源として値安なので放棄されたと説明するかもしれません。そして、こんなふうに古風でいささか野蛮な捕鯨のならわしは、100年前に絶えたと。しかしながらこれは全く違っているのです。そしてこの考えにみられる無知さ加減が、この世界から鯨を失わせることになるかもしれない意味で、悲劇的な誤解といえます。

真相は、捕鯨産業が現在その最高点にあり、今世紀は、その捕鯨量において、これまでのどの世紀よりも、はるかに上まわっているのです。特に1960年代に殺された鯨の数はこれまでのどの10年間の捕鯨量よりも大きいものです。そうして100年前のそれと、今日の殺害は、比較のしようがありません。例えば、今日、キャッチャーボートが、一日平均一頭から二頭の鯨を殺すのに対して、一世紀前は、三年間にわたって捕鯨航海し、一ヶ月平均一頭の割合いで、37頭分の油を持ち帰ったものです。1860年代で最も収穫量の大きかった三年航海で、85頭殺したと記録されています。これに比べて、1967年は、まっこう鯨だけで25,911頭仕止め、日本でとられた20,000匹のいるかを入れないで、この年にとられた各種の鯨の数は52,046頭にもなります。これでわかるように、捕鯨業は100年前に頂点に達し消滅したのではありません。現在、頂点に向いつつあり、このままの殺害量では、あと数年以上続けていく可能性もなくこの10年間にすたれる運命にあるのです。

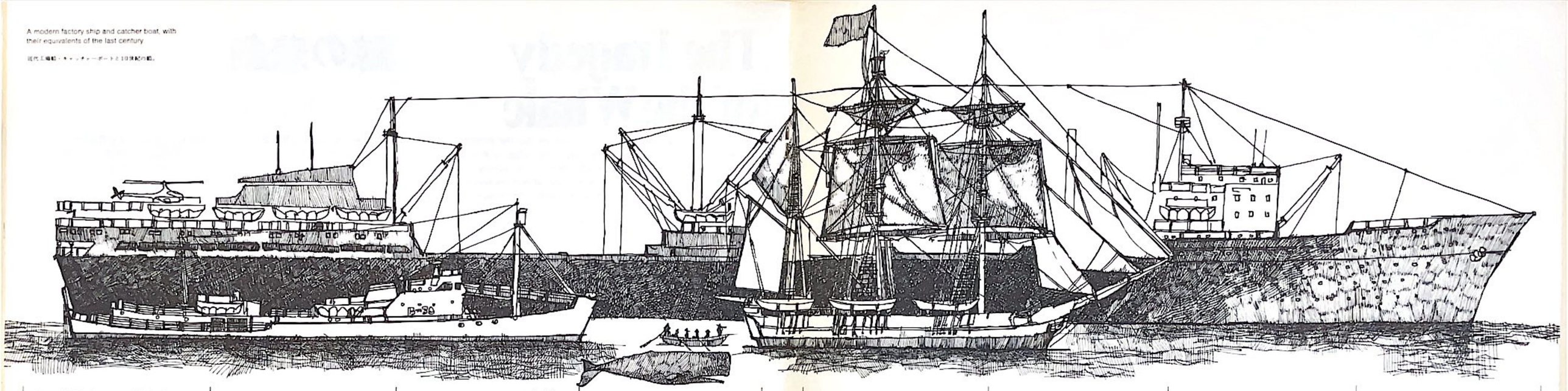
ここで、1933年と1966年の殺害と産出高を比較してみましょう。1933年には、28,907頭から、2,606,201バレルのオイルがとられています。1966年は、これが57,891頭から、1,546,904バレルのオイルがとれています。これでわかる様に、1966年に捕鯨界は、1933年のほぼ2倍にあたる鯨を殺したにもかかわらず、その半分のオイルしか産出していない、つまり年ごとにより小さい鯨をより多く殺しているのです。

現在のところ、どの方法も、この傾向を効果的に止め得ていないのですが、このままゆくと、捕鯨産業から、又世界から、間もなく鯨が居なくなるでしょう。

捕鯨界のこの傾向を、自然源の長期間にわたる問題として解決するかわりに、技術の短期間の問題としてみています。主として、日本、ロシア、その他にオーストラリア、ブラジル、カナダ、チリー、アイスランド、ノールウェイ、ペルー、ポルトガル、南アメリカ、スペイン、アメリカ合衆国の殺害国は、残っているどんな鯨でも殺害しようとして、すでに圧倒的な技術の効能を改善することのみ、関心があるらしいのです。

A modern factory ship and catcher boat, with their equivalents of the last century

近代工場船・キャッチャーボートと19世紀の船。



How Whales are Killed

THE TECHNOLOGY OF whale slaughter has evolved two methods of hunting: shore stations, built on coasts where whales gather, and ocean-going factory fleets, called pelagic expeditions. Shore stations are very effective in wiping out local herds and they have usually done so.

A shore station has a fleet of from one to six small catcher boats that travel out within a radius of about 150 miles of the station to kill what whales they can find and tow the corpses back to the land for processing. Within a few years they invariably succeed in bringing whale herds in the region below utilizable numbers. For this reason, shore stations often waver in and out of business, one year shutting down for lack of whales, the next year or so starting up again. Over the past few years they have accounted for an ever-increasing proportion of the world-wide kill, but this more reflects the failure of pelagic whaling than the increased damage done by shore stations, and it is still fair to say that factory ships do the greatest damage.

Unlike shore stations that must cease to operate when they exhaust a local whale stock, the factory ships, with their fleets of catcher boats, can simply move on after decimating one area to continue the slaughter in another.

On pelagic expeditions, ship-based helicopters are used for spotting whales. When the helicopter discovers a herd, it calls the catcher boats in on them by radio. Each catcher boat is equipped with sonar for two purposes. First, sonar makes it much easier for the boat to intercept a whale when it comes up for air. Second, sonar is used to frighten whales into running at the surface, panting and therefore making themselves more visible and easier to catch and kill.

Harpoons are, of course, no longer hand-thrown. Weighing between 100 and 200 pounds, they are fired from a cannon on the bow of the catcher boat. Once fastened deep within the whale by the harpoon's barbs, the line is not managed, as it was in the nineteenth century, by human hands, and splashed with hatfulls of water to keep it from burning as it smoked around a wooden loggerhead but it is operated by a steam-driven winch with a 750-ton ship to anchor it. And it is not the ¾-inch natural fiber line used in the nineteenth century but an 1¼-inch nylon line with a breaking strength of 36,000 pounds.

To keep the whale's battle for life as short as possible, the head of the harpoon is usually fitted with an exploding grenade, which usually kills the whale in about five seconds. Often, however, the struggle between the catcher boat and a frantic whale lasts much longer. The death throes of one whale on record lasted five hours and required nine harpoons. Another whale, struggling to save itself, pulled a ninety-foot catcher boat, with its engine fully reversed, forward at 5 knots for eight and a half hours. Despite the incredible effort, neither whale survived, of course.

Once dead, the corpse of the whale is inflated with compressed air to keep it from sinking and a radio beacon is anchored to it. This process immediately frees the catcher boat for more killing while the beacon signal guides a tow boat to the bloated carcass. The tow boat is equipped with radios and radar and can find both the carcass and the factory ship in any weather so that not even the thickest fog stops this operation.

The largest factory ships are two Russian vessels built in 1961, solely for the purpose of whaling, when it was already abundantly clear that whales were being badly overhunted. These ships are each 715 feet long and displace 44,000 tons, making them the largest fishing boats on the ocean, larger than all but a few World War II aircraft carriers.

When the dead whale has been towed to the factory ship, it is winched up onto a cutting deck through an inclined slipway in the big ship's stern. There, the entire carcass of an 80-ton Finback whale, for instance, is butchered within thirty minutes to an hour. After the flensed body has been melted down, ground up, and stored, its produce is picked up by refrigerated transport ships that carry the meat quick-frozen in huge plate-freezers back to port. Tankers make regular runs to collect some of the oil. The rest of the oil is carried back by the factory ship after each expedition in the same tanks in which fuel oil was kept during the outward bound voyage.

Thus, whatever else it accomplishes, an entire pelagic whaling operation simply transforms a cargo of one type of oil (petroleum) into a cargo of another type of oil (whale). To accomplish this transformation, the whaling industry has so improved its technology that it has all but destroyed the animal it has tooled up to exploit. No animal population can withstand such a technological onslaught. It remains to be seen whether the human animal can withstand it.

どんなふうに鯨は殺されるのでしょう

鯨の虐殺技術は二つの捕鯨方法を発展させました。その1つは鯨の集る海岸にたてられた沿岸基地とした近海捕鯨で、他の1つは航海上の母船を中心とした母船式捕鯨です。前者はその地域の鯨群を消滅させるのに効力を発します。

沿岸捕鯨は、1台から6台の小さいキャッチャー・ボートの船団を持ち、このボートが工場から約150マイルの海上半径に乗り出しそこで見つけられる限りの鯨を殺し、その死体を加工処理の為に陸上へと引張って来ます。この方法は一様に、数年の間に、その領域鯨群を有効数下に引き下げ、その結果こうした工場は鯨の不足から或る年は工場を閉鎖し、次の年は鯨の数が増加したので再開と云う具合に、捕鯨業を止めたり再開したりをくり返します。過去数年にわたり、この沿岸捕鯨こそ、上昇の一途を辿る世界中の殺害の原因と考えられていますが、これは沿岸捕鯨によって為された損害と云うより、むしろ母船式捕鯨の失敗を反映しているのです。従って、やはり母船式捕鯨が最も大きい害を為すと云って間違いないでしょう。

沿岸捕鯨が、その地域にいる鯨が居なくなると仕事を止めなければならないのに対して母船式捕鯨は領域で多量殺害した後は、たゞ単に、そのキャッチャー・ボート船団と共に、別の新しい領域へと移動し、そこで殺害を続けるのです。

母船式捕鯨では、船を基地とするヘリコプターが鯨を見出すのに使われ、鯨群が発見されるとラジオでキャッチャー・ボートを呼び出します。このキャッチャー・ボートは各々水中音波探知機を備えています。それは第一に探知機で水面に空気を求めて浮き上って来る鯨をとらえやすいこと、第二に、これを用いて鯨をおびやかすと、驚いて水上へと息をつく為に浮び出るので見付けやすく捕まえやすいのです。

銛は勿論、現在では手で投げられるわけでありません。100パンドから200パンドの銛は、キャッチャー・ボートのへさきに取り付けられた大砲から打ち出されます。銛がやじりによって鯨の中に深くつきさると、19世紀のの昔、人間の手で操りボートの先の木の円柱にまかれた綱が鯨のひっぱる力で摩擦し煙が出るのを、燃え上るのを防ぐ為に帽子で水をすくってかけたのとちがって、750トンの船をアンカーとして蒸気で動くウィンチで操作されます。そうしてこの銛についた綱は19世紀の¾インチの自然繊維にかわって36,000ポンドの重さに耐えるナイロン綱です。

鯨の生命への戦いを出来る丈短いものにする為に銛の先には大体手榴弾がついており、これは約五秒内に鯨を殺します。が、しばしばキャッチャー・ボートと狂乱した鯨のたゝかいは、もっと長くつゞきます。記録によると或る鯨の死のひどい苦しみは五時間にもわたって続き、9つの銛を打ちこまなければなりませんでした。又もう一頭の鯨は、のがれようとし90フィートのボートを、そのエンジンが全力逆転の状態で8時間半にわたって五ノットの早さでひっぱったと云うことです。こうした信じ難い様な努力にもかゝわらず、無論そのいづれの鯨も生き長らえることは出来ませんでした。

一旦鯨が死ぬと、その死体は水中に沈まないようにと圧縮された空気でふくらまされ、無線標識が取りつけられます。こうした過程は無線信号が引き船をふくらまされた死体へと導く間、キャッチャー・ボートをたゞちに次の鯨の殺害へと自由にするわけです。引き船は、ラジオとレーダーをそなえつけていますから、どんな気象状況下でも死体と母船をさぐり当てることが出来、従って、最も深い霧の中ですら操作が続けられるのです。

母船の最も大きいものは、もっぱら捕鯨が理由で鯨がとられすぎとの事実がすでに誤りもなく明らかであった、1961年に建造されたロシアの二船です。船体715フィート排水量44000トンもあるこの船は、その大きさにおいて第二次世界大戦中の数隻の航空母艦を除いて、どの船よりも大きい漁船です。

鯨の死体が母船へと引いて来られると船尾の傾斜したスリップウェイから作業甲板上に巻き上げられます。そこで例えば80トンのなが鯨の全死体は30分から1時間の間に屠殺されます。脂肪や皮をはがれた胴体がつぶされ、ひかれ、貯蔵されると、その生産物は、即座冷凍肉を巨大な冷凍装置の中に入れて港へと運ぶ冷凍輸送船によって持ってゆかれます。

定期的にやってくるタンカーによりその油は集められます。こうして集められる以外の油は、各遠洋捕鯨の母船によって、船が海洋に出る為の燃料が貯えられたと同じ燃料タンクに入れて持ち帰えられるのです。つまり、その他にどんな効果を上げているとしても、全捕鯨操作は単に、船荷として1つのタイプの油（石油）をもう1つ他のタイプの油（鯨油）に変えているにすぎないわけです。こうした転換をなしとげるために捕鯨産業は、その技術によって開発しようとした動物そのものを、ほとんど死滅させるまでに技術を進歩させてしまいました。どのような動物群と云えども、こうした技術による殺害にたちむかうことはできません。我々人間自身がこれにたちうちできるかゞ今後残された問題です。

The Business of Killing Whales

THE BUSINESS OF KILLING whales will very probably continue until—within the next five to seven years—it has reduced all whale herds in every region of the world to such small numbers that whaling no longer pays. No force now exists that can prevent this devastation, and this is probably only because relatively few people realize that the slaughter is taking place. Still fewer understand both how unnecessary and how destructive it is. At its present rate, the whaling industry is not only robbing the world of its whales, it is squandering the only major source of human food in one of the most productive regions of the ocean.

The rich nations talk of food from the sea and invite the underdeveloped nations to join with them in tapping this vast source, but the facts are that the existing fishing nations already harvest at least 70 percent of the whole productive potential of those fish species we use for food. And even so, two-thirds of the present human population is still protein undernourished.

All major species of commercially valuable fish are already overexploited wherever their major grounds exist, yet we keep on increasing our own population and improving a food gathering technology that, on the average, reduces to insignificance each year another species we depend on. What if the underdeveloped nations accept the invitation to go fishing? They will find that the nations who made the invitation are already overexploiting the resources.

If there is any First Principle of Ecology, it is the observed fact that complexity of life is necessary for stability of life. Yet all of our efforts are directed at simplifying the environment. This is what we accomplish with agriculture. When we replace a jungle with a field of corn, for instance, we create a simplified condition that is unstable and must periodically fail. The failure may be from many causes: perhaps a flood (which would not have occurred had the original vegetation held back the rainwater), or a plague (which could only exist in high concentrations of the plague's host plant), or depletion of minerals in the soil (which would have remained in balance had the original vegetation persisted). There are, of course, ways to control these things—dams, insecticides, or the addition of minerals—but dams all eventually silt in, and insecticides and minerals consistently employed eventually bring problems that force a change. Over the very long run these measures can only be said to postpone periodic failures: they never prevent them.

This same principle applies to the oceans. When we wipe out whales from large portions of their range, we will be forced to pay the price, and in some regions that price is already clear. Whaling is the only way men have yet used for significantly harvesting the abundant food that grows in the Antarctic Ocean. What is of the utmost importance is the simple fact that whales are not themselves the basic source of food from this area but rather they are the packages in which the abundant polar food comes.

It may sound strange to speak of polar waters as being abundant with food, but in fact it is the polar seas, not the tropic ones, that are highly productive. Because of the lack of nitrogen cycles in most of the ocean, except in upwelling regions, tropic seas are deserts compared with polar ones. In the polar seas life is so abundant that during the short growing seasons the ocean surface is often discolored with plankton blooms for many square miles. Whales harvest this food more efficiently than we could ever hope to do and they store their harvest in neat, easily collected multi-ton packages: themselves. As yet there is no significant fishery for human food in the Antarctic Ocean to replace what was obtained from whales. And now, because of the indifference and folly of the whaling industry, whales have been virtually obliterated from those waters.

If productive areas of the ocean—the world's largest environment—can bear the analogy to a bread basket, then you can understand most clearly what the whaling industry is doing if you realize that it has single-handedly destroyed—in the Aretic in the last century and the Antarctic in this century—our access to two of the greatest bread baskets in all the oceans: the whale herds of the polar seas. Thus, the Arctic and Antarctic oceans are simply not available to us now as a significant resource for food. So the burgeoning populations of the underdeveloped nations—and the expanding populations of rich nations as well—are forced to put even greater stress on the remaining resources. That is what we have to thank the whaling industry for.

Is there any chance at all that the situation can be saved? That is a difficult question to answer. It is even more difficult to pose, for while a few scientists are trying to answer it, the modern whaling industry is trying to avoid it.

What is a viable number of whales? At what point in the diminution of the species does traditional herd structure fail in the rearing of young? How low can the number

殺鯨産業について

殺鯨業は恐らく、この五年から十年の間に、世界各地から全ての鯨群が減少した結果、商売として引き合わなくなるその時まで続けられるにちがいありません。こうした鯨に対する蹂躙を防止する力は現在なくそれは単に比較的少数の人しかこの殺害の為されていることを知らない理由によるのです。さらにこれが何如に不必要で、何如に破壊的であるかと云う点に至っては、ごくごく少数の人の知るところです。現在の割合で捕鯨を行うことは、単にこの世界から鯨を消すだけに止まらず、海の最も生産的な地域の唯一の主なる人間食品源を無駄使いしつつあることになります。

豊かな国は、この海から取れる食物について論じ後進国に手を取り合って、この広い資源を開発しようではないかと呼びかけています。事実は、現在の漁業国がすでに我々の使う魚群の潜在生産力の少くとも70％にあたる量をとり、それでもなお、人間人口の⅔が蛋白質不足と云う状況なのです。

すでに、商業的に価値のある、ほぼ全ての種類の魚は、その主な生存領域で過度なまでにとられています。加えるに人口増加、収穫技術の進歩改善は、我々の依存する魚群を平均して年に1つづつ取るに足らない数に減少させています。

こんな状態のもとで、後進国がさそいのまゝに漁業を始めるとなると一体どう云うことになるでしょう？彼等は招いてくれた国々が、すでにこの資源を行き過ぎまでに開発してしまっていることに気付くのです。

社会生態学に第1原則と云ったものがあるとすると、生命の複雑性がその永続性に必要である、と云うことが観察された事実です。この原則と逆に、我々の全ての努力は、環境の単純化に向けられているのです。例えば、農業ですが、これもこの方向にむかっています。我々がジャングルを開いて穀物畑をつくることは、単化した状況に変えたわけで、これは不安定で周期的に問題を起します。周期的に問題を起すことは多くの原因によるのです：多分洪水（もし本来の植生が雨水を保っていたら起らないでしょう）や伝染病（伝染病菌の宿主植物が高い密度であるところにのみ起ります）また土壌からの無機物の欠乏（もし本来の植生が保たれていたら調和して残っているでしょう）などがその原因でしょう。勿論これらを防ぐ方法はあります。ダム、殺虫剤、無機物添加です。しかしダムと云えども、これはついにはくづれてしまいますし、殺虫ミネラルの常用は問題をひき起こし変化は避けられません。延って長期にわたっては周期的に起る問題の機先を制することは出来ても、防止となると、どの方法も有効でありません。

同じ原理は海についても云えることで、鯨をその生息地域から消滅させたあかつきは、全儀なくその代価を払わせられることでしょう。その代価は、いくつかの領域に於いてすでに明らかです。捕鯨は我々人間が南極海で得つ豊かな食物の収穫に使う唯一つのやり方ですが、ここで最も重要なことは、こうしてとられる鯨自体が食物の基礎源でなく、むしろ多数の極地食物の入ったパッケージ詰みであると云う点です。

南極、北極海が食物にあふれていると云うと不思議にきこえるかもしれませんが、事実熱帯の海にくらべると極海は豊かな多産なところです。熱帯の海は、その一部を除いて大部分に窒素の循環が不足し、その為に南極、北極海にくらべると砂漠のごとき有様です。これに反して極海では海生物は豊かで、短い繁殖シーズンは、海水表面が何平方マイルにもわたってプランクトンで色付くこともしばしばなのです。

このプランクトンを、鯨が我々が競う以上に効果的に収穫します。きれいに容易に何トンものパッケージとして、つまり鯨自身の中にのみこんで貯蔵するのです。今のところでは南極海において鯨から得られるものにとってかわる人間の食物の為の重要な漁業はありません。そうして現在、捕鯨産業の無関心さとおろかさの為に、鯨は実質的に海からまっさつされてしまっているのです。

こゝで生産豊かな海の領域を、世界最大の環境を、パンかごに転換することに耐えられるならば、捕鯨産業が一体何をしているか一番よくわかると思います。捕鯨産業は、全ての海の中で我々にとって最も豊かなパンかごである海、すなわち極海の鯨群を、19世紀では北極海を、今世紀においては南極海のそれを、破壊しているのです。ありのまゝにいって南極海も北極海も今では、我々の重要な食物源とは云えません。残されたいくばくの資源の上にすら、後進国のムクムクふくれ上る人口による、又創造国の拡大する人々からの、さらに強い圧力がかゝっています。これが私共が捕鯨産業に感謝すべきだという点なのです。

こうした状態がすくわれるチャンスはあるのでしょうか？これは大変にむつかしい質問

As wild herds of whales have been destroyed, finding the survivors has become more difficult and requires more effort. As larger whales are killed off, smaller species are exploited to keep the industry alive. However, because in the Antarctic there have never been species limits, Blue whales were, and Fin whales are, always taken whenever and wherever encountered. Thus, small whales have been used to subsidize the significant extinction of large ones.

鯨の野生群が破壊したとき、生き残りの鯨をみつけることは難かしくなり、より多くの努力を必要とします。大きい鯨が殺されると、小さい鯨が鯨産業を存続させるために殺されます。しかし南極海では捕鯨上の種に制限がないため、しろながす鯨とながす鯨はいつでも、どこでもみつけ次第殺されています。かくして小さい鯨が大きい鯨の膨大な消滅部分のうめ合わせにつかわれるようになりました。

of whales be there is no longer enough genetic variability for a species to survive the natural decimation of occasional food failure or disease? No one knows, and while a few scientists are now trying to find out, the whaling industry is slaughtering whales as fast as humanly possible.

Scientists are attempting, against these odds, to determine what a viable whale population might be by studying the rate at which a species can replace itself and thus maintain its population. Under healthy conditions, whale species, like all animals, produce more young than are necessary to maintain the whole population, and under healthy conditions a fairly high percentage of newborn whales presumably die of natural causes during the first year: predators, disease, inadequate food supply, failure to compete, and so on. Scientists know from the study of other animals that under unhealthy conditions, when most of the population of a region is killed back for any reason, a larger proportion of the young survive and surplus animals from other regions move in to take up the habitat left vacant by the reduction. Thus, a whale species that may be widely distributed throughout the ocean should quite rapidly fill in a reduction in numbers as long as the death rate of individuals in a herd does not exceed the rate at which the species can replace those individuals.

From a commercial viewpoint, then, a viable number of whales would be the maximum number of animals that can be taken from a species each year without preventing the species from making up that loss. This number is known as the maximum sustainable yield, and the fate of whales hangs on how scientists determine it and whether the whaling industry abides by it.

In order to calculate the maximum sustainable yield of a whale species, one must know, among other things, the size of the overall population, how many young a female bears each year, how long it takes the young to reach reproductive age, how long an individual's reproductive age lasts, and what the life expectancy of each age group is. In domestic animals these values are easy to determine, but in wild animals, particularly whales for which prolonged observations of individuals are not available, it is a very difficult task.

Thus, it might appear that scientific calculations about safe whale population levels are only educated guesswork. You may think it could reasonably be argued—as it frequently is by innocent optimists as well as guilty opportunists—that scientific predictions of whale herd sizes could be way

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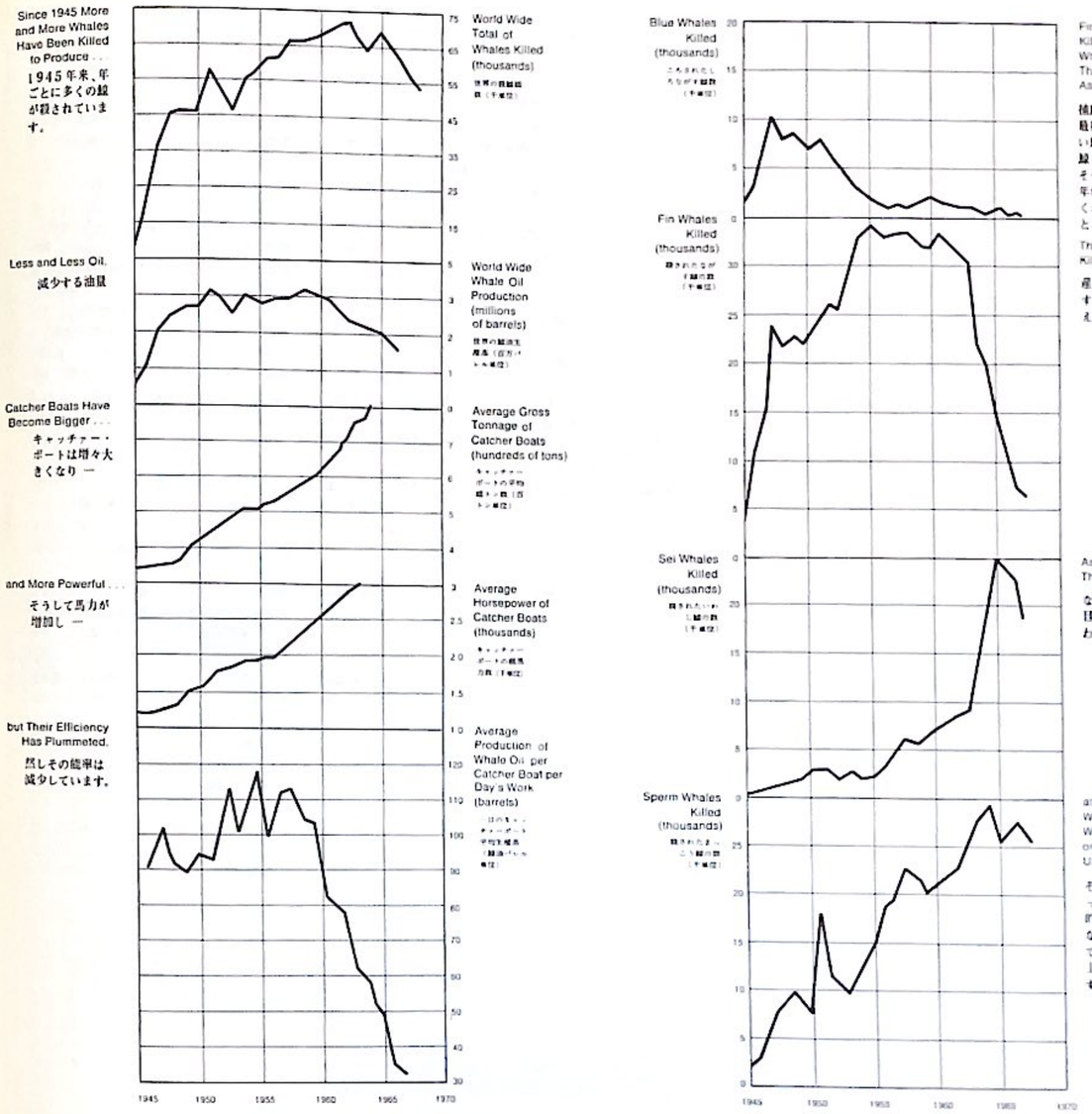
鯨の生存数は何頭なのでしょうか。種の消滅過程のどの点で歴史的背景をもつ集団構造が子孫の養成に失敗するのでしょうか？種が時として起る食物の不足、或いは疾病等の自然に起る多量の死をこえて生き残る為に十分な遺伝的変異性を失うのは一体鯨数がどの位低下した時なのでしょうか？こうした疑問については誰も答えられないのです。そうして少数の科学者が、その解答発見につとめる間、捕鯨産業は人間に可能な最大のスピードで鯨殺害を続けているのです。

これに対して科学者は、種が補充され、その結果総数を一定に保つ速度を研究することにより、鯨の生存数は一体どのくらいか決定しようと試みています。異状のない状態では、他の全ての動物と同じように鯨種も、全鯨数を維持するのに必要以上の子供を産出します。そしてこうした鯨の赤ン坊は、捕食動物、病気、食物の不足、たゝかう力の不足等と云った自然の理由で、かなりのパーセンテージが一年内に死ぬと推定されます。他の動物について為された研究から、異状下でなんらかの理由でもって一定領域内の総数が減少すると、割合としてより多くの子供が生き残り、又、他の領域から余剰動物が侵入し、その動物の減少によって空間となった生息環境をふさぐ事実もわかっています。従って海一様にわたってひろく分布する鯨種も、群の中に於ける個の死亡率が、種がこれらの個体を補充する割合を越えない限り、かなりのスピードで減少した数を埋めるべきです。

商業的見地からすると鯨の生存数とは、種をしてその損失量を補充するのを防げることなく一年に捕獲可能な最大数と云うことになります。この数値は、最大続持性生産量と呼ばれているのです。鯨の運命は、科学者がこの数値を何如に決め、捕鯨業がこれをどこまで守るかにかゝっているわけです。

鯨種の最大持続性生産量を計算する為にはおゝまかな鯨の全個体数、雌は毎年何頭の子供を生むか、これが成長し生殖年令に達するのに何年かゝるか、個体の生殖年令は何年か、そうして各年令グループの寿命は、等について知らなければなりません。家畜ならば、こうした数



off and that, in fact, the situation is not at all as bad as Dr. Payne and others say it is. In fact, however, the statistics available about the Antarctic Ocean—from the whaling industry itself—are deadly accurate. And the Antarctic was, of course, the heart of the whale range.

Pelagic expeditions in the Antarctic Ocean radio their catch summaries every week throughout each season to a central Bureau of Whaling Statistics at Sandefjord, Norway. All other whaling enterprises, with a few reporting late, send the bureau detailed statistics on their kills at the end of each season. It is most unlikely that there could be any sizable whaling operation in recent years going undetected by the Bureau of Whaling Statistics—because it is very expensive to go whaling and no one takes it up on the spur of the moment—so we can believe that the bureau has for several years been recording, in detail, the total whale kill throughout the world. Thus, when coupled with several extensive scientific studies from the Antarctic, these reports make it possible to determine the rate at which each species is being reduced and their rates of replacement.

At the bureau in Sandefjord, information is stored concerning the number of whales of each species taken or lost and the oil aggregate gotten from all species. Statistics are also kept for each individual whale killed: its species, the date it was taken, the latitude and longitude at which it was taken, its length, its sex, and, if it was a female with an unborn foetus, the length and sex of that foetus. It is probable that the statistics kept on whales in the Antarctic are far more detailed and complete than the available information about any other wild animal species being hunted over a comparable area. We probably don't even know as much about the numbers of domestic land animals in areas of comparable size as we know about whales in the Antarctic. There is no such accurate information, for instance, kept on each sheep in Australia or each heifer in the United States.

Because of the whaling statistics, scientists can now estimate with extraordinary accuracy just how many whales are left in the Antarctic.

For example, in 1963 the whaling industry stated that it would take from the Antarctic Ocean a total of 10,000 Blue Whale Units, that is, the equivalent in oil of 10,000 Blue whales. One Blue Whale Unit equals either 1 Blue, 2 Fins, 2½ Humpbacks, or 6 Sei whales. The scientists, however, predicted from their studies of whale populations and replacement rates that the industry would be able to take only 8,500 units. When the 1963 season ended, after an all-out effort to take the full quota, the total kill came to 8,429 units. Besides predicting that the 1963 whale kill would produce not more than 8,500 Blue Whale Units, scientists also predicted that of those units 7,000 would be made up from Fin whales. The total, in fact, was 6,935. This means that the scientists were off by only 0.8 percent in the first case and 0.9 percent in the second. They knew enough about the populations of each whale species to be better than 99 percent correct in their predictions. Thus, when scientists claim that the main herds of whales have been brought to near extinction in the Antarctic there is every reason to believe that they are right.

The question that remains, however, is what "near extinction" means. Some scientists studying whales are quick to point out that there is little danger that any species will become totally extinct. They cite the fact that the Gray whale, considered thirty years ago to be extinct, has made a remarkable comeback. So have some other marine mammals, such as sea otters and some species of seals. But, to quote Dr. Payne, "The assumption here seems to be that if we allow a tiny percent of the original stock of a species to exist, we are to be congratulated for our self-control and can brush aside those who worry about overkilling. Although 'total extinction' means absolutely no more animals—not a single one—and 'commercial extinction' means too few animals to harvest profitably, the difference between the two terms is a silly semantic point that has nothing to do with the significance of a species. Of course it is not correct to say that the Ivory-billed woodpecker is totally extinct; there may be at least a dozen of them left. And that's probably true of the Marsupial wolf; there may be a dozen of them too. But what part do Ivory-billed woodpeckers and Marsupial wolves play in the 1970s? None. How can anyone feel reassured by the idea that a species is not actually extinct when the animals are so utterly reduced that they have no significance? And how can anyone be hopeful about the possibility, merely the possibility, that a species might come back? The Gray whale has come back but the Right whale has not, and the Right whale hasn't been hunted for thirty years either. Are 500 Blue whales in all of the Antarctic Ocean enough when twenty-five years ago there were 100,000 in the same area? Would 100 mountain lions be enough if we killed them down to that point? The idea is absurd. In such small numbers any species becomes insignificant. What I want to ensure is not merely the existence but the significance of whales. They must exist in significant numbers so that they are available forever as a resource, a significant resource, for everything from cat food, if need be, to musical inspiration. The industry, on the other hand, is only concerned with whether it can turn a profit for seven more years as against five more years. They worry only about commercial extinction. Some scientists apparently worry only about total extinction. I am not concerned with either one, because the cause of whales would be lost in either case. What worries me is what I call 'significance extinction,' the point reached when a species no longer has any significance in the scheme of things. It is a point reached long before commercial or total extinction."

What can be done to bring decimated whale species back to significant numbers and to protect the now remaining herds? There is really only one measure that would work: the declaration of a worldwide moratorium on whaling. When subsequent studies indicate which species might be hunted again at a useful sustainable yield, the industry could resume. Scientists have shown that, had the whaling industry established a five-year moratorium in the Antarctic between 1962 and 1967, the industry could have been harvesting the maximum sustainable yield from 1967 onward. That yield would have been roughly six times what the industry must now be content with from the same area because it did not pause for five years but went on killing. To achieve a recovery now and bring back the Antarctic whale stocks to the same size they might have reached between 1962 and 1967 will take, by most guesses, from 50 to 100 years.

At present, however, no such thing as a moratorium on the killing of whales is even being considered. The only instrument of control over the whaling industry is the International Whaling Commission, but this agency has failed almost completely and has, in fact, presided over the demise of whales.

The International Whaling Commission (IWC), created by whaling countries to protect whales from overexploitation, meets once a year and is composed of representatives from Argentina, Australia, Brazil, Canada, Denmark, France, Great Britain, Holland, Japan, New Zealand, Norway, Panama (which at this writing has recently announced its intention to withdraw), South Africa, the United Kingdom, the United States, and the U.S.S.R.: all of them nations that have whaled in the past or that are still whaling. Membership in the IWC changes

値を得ることは容易ですが、野生動物、特に長期にわたる個体の観察が不可能な鯨では、大変にむづかしいことなのです。

こんな風に云うと、確実な鯨個体数についての科学的計算が、なれた見当に基づいたものと、思われるかもしれません。そうして、しばしば、無知な楽観主義者や、やましい便宜主義者のするように、鯨群のサイズについての科学的予見ははづれ、実際には、その状況はベイン博士やその他の人が云う程わるくはないと正当に議論できると考える人があるかもしれません。然しこれはあやまった考えで、南極海についての統計は、捕鯨界そのものから得た数字ですが、正確そのものです。そうして南極は以前、勿論、鯨の生息地の中心でした。

南極海に於る母船式捕鯨は各シーズン中、毎週にわたって捕鯨数をノルウェーのサンドゥフィヨードにある鯨の統計局に電信します。又その他のものは、シーズンのおわりに、明細にその殺害数を局に送ることになっているのです。近年では、かなりの規模の捕鯨操業が、統計局によって、つきとめられずにすむことは、ほとんどありません。なぜなら、捕鯨は、かなり費用のかゝるもので、即座にやろうとして出来るものではないからです。そこで、統計局が数年にわたって、明細に世界中で殺された鯨の合計を所有していると信じれるわけです。この数値と、南極海でのいくつかの大規模な科学的研究を合わせることにより、種がどの割合で減少されているか、その捕充の割合についての証拠等の決定が可能です。

サンドゥフィヨードの統計局には捕獲された各種の鯨の数、或いは損失、又全部から得られたオイルの総量等に関する数字が保存されています。又捕獲された各鯨について、その種類、捕獲月日、捕獲された経度、緯度、その長さ、性、そうして胎児の有無、胎児の長さについて記録されてます。こうした南極海における鯨についての統計は比較可能な領域にわたって詳細された他の野生動物についてのそれよりもうんと詳しく完全だと云えるでしょう。比較可能な領域に於ける陸上の家畜の数すら、南極海の鯨数のようにはわかっていません。例えばオーストラリアの各羊について、或いはアメリカに於ける各牛について、こうした正確な情報は集められていないのです。

こうした統計の故に、科学者は非常に正確に現在南極海に一体どの位の鯨が残されているのか予測できます。

例えば、1963年に捕鯨界は南極海より総計10,000しろながす換算単位をとると言明しました。（これはつまり、これだけの数のしろながす鯨からとれる油に相当するもので、しろながす換算一単位は、しろながす鯨なら一頭、ながす鯨なら二頭、ざとう鯨なら2.5頭、いわし鯨なら六頭にあたります。）これに対して科学者は、その鯨個体数と、その捕充の進度に関する研究に基付いて、8,500単位の収穫が可能であろうと予測したわけです。1963年のシーズンが終ってみると、その割り当て分取ろうと、全力上げての努力の総計は8,429単位になりました。1963年の捕鯨は8,500しろながす換算単位以上の産出高をこさないと予想した他に、科学者は又その中の7,000単位はながす鯨からなると予測しましたが、これについての結果は、6,935単位でした。こゝで明らかな様に、科学者は最初の場合は0.8％、第二の場合は0.9％はづれていたわけです。云いかえると、各種の鯨がいくら残っているかについての予測は99％以上の正確さと云えるのです。従って科学者が、鯨の主群がほゞ消滅に近い状態だと主張する時は、彼らの云っていることが正しいと信じる、十分な理由があるわけです。

ここで"ほゞ消滅した"とは何を意味するかとの質問が残っています。鯨を研究している科学者の中には、すぐさま、どの種にしても完全に消滅する危険はないと指摘する人も居ます。そうして30年前に、消滅すると考えられたこく鯨の見事なカムバックを例として引用し、その他の海の哺乳動物、らっこ、おっとうせいも例として挙げられます。が、ベイン博士は、これに対して次のように云っています。"ここに見られる仮定は、もし我々がその種のもとを少数さえ残せば、コントロールする力があると視えることになり、すぎた殺害について心配する人々を頭から無視出来ると云うわけです。完全な消滅は一頭として残らない状態を意味します。が"商業的消滅"は、収穫に利益をとりにはあまりにも少数すぎることを意味します。この二つの言葉の差はばかばかしい語義学上のことで、種の重大さと何のかゝりもないことです。例えば象牙のくちばしをした木つゝきが完全に消滅したと云うのは正しくありません。少くとも12羽は残っているでしょう。同様なことは貨狼についても云えるようで、これ又12匹前後残っています。しかし、このいづれも1970年代にどんな役割を果すのでしょう？　ゼロです。その動物がひどく減少した結果、何の存在意味をもたないのに、それが完全に消滅したわけでないと云う考えで、どうしてあんかんと出来るでしょう？又、種が再びもどって来るだろうとの可能性、その単なる可能性にすがることが出来るでしょうか？こく鯨はカムバックしましたが、せみ鯨は30年以上とられていないにもかゝわらず回復していません。25年前南極海に100,000頭と居たしろながす鯨が、現在の全部合せて500頭と云うので十分でしょうか？もし我々がアメリカ・ライオンを100頭になるまで、殺してその100頭で十分と云えるでしょうか？馬鹿らしい考えです。こんなに少数では、どんな種と云えども重要でなくなってしまいます。私が保証したいのは鯨の単なる生存でなく、その意味なのです。永遠に資源として、必要ならば猫の食料から音楽のインスピレーションの為の重要な資源として、利用出来るように意味のある数として存在しなければなりません。これに対して捕鯨界は単に、あと五年に対して七年以上利益を出せるかいなかにのみ関心があるのです。つまり商業的消滅をのみ心配しているのです。又、科学者の中には完全消滅をのみ憂いている人も居ます。私は、そのいづれでもありません。何故なら、いづれにおいても、鯨の大義が失われているからです。私が憂いているのは種の数が減少した結果、物事の成立ちの上での意味をもはや持たなくなる点に達する"意味の消滅"で、これは商業的消滅よりも又完全消滅よりも、うんと早く来ます。

では、多量に死滅した鯨を意味のある数へと回復させ、現在残っている群を保護する為に、何が為され得るでしょう。実際に、効力のある方法は1つしかありません。即ち、世界中が捕鯨停止を宣言することです。その後の研究が、その種が有用な持続性産高で狩猟できるだろうと明らかにしたら再開出来るでしょう。科学者は捕鯨界が南極海に於いて1962年から1967年まで捕鯨を中止していたらば、1967年以後その最大持続性生産量を収穫することが出来たことを示しました。この産高は、おゝまかにいって、捕鯨界が五年停止することをせず殺害を続けた後に、それで満足しなければならない量の六倍にあたります。今回復しようとすると、そうして南極海の鯨を、1962年と1967年の間に停止することによって達し得たであろう数にもどす為には、ざっと見積って50年から100年かゝるでしょう。

現状では、それでも鯨殺害の停止と云った様なことな考えられてもいません。捕鯨界を調整する唯一の機構は国際捕鯨を協会（IWC）ですが、これはほぼ完全に失敗で、名前ばかりの存在となり実際には調節される個になっています。

捕鯨業に従事する国によってつくられたこのIWCは、鯨を過度の開発から守る為に、一年に1回会議をひらき、これには過去に於い

as new whaling countries join and others, for various reasons, withdraw. It is important to know that some whaling countries have not signed or ratified the IWC's agreements. Among the nations that have never committed themselves to IWC control are Chile and Peru, two of the chief whaling nations in recent years. Because they never ratified the IWC charter, they are not obliged to adhere to its rules. This allowed Chile and Peru to go right on killing Blue whales, which all signatory nations of the IWC had agreed should no longer be hunted. Chile and Peru temporarily stopped hunting the extremely rare Blue whale only a year ago. This followed efforts to persuade them to do so by the great aviator and conservationist Charles Lindbergh.

In recent years the IWC has had some small successes, causing some of its members to claim that, given enough time, strong controls will be achieved. But time of the sort the IWC has been taking is simply not available. What's more, even the agreements it has recently succeeded in obtaining were only made to cover a region once its herds had been brought to a level that is no longer commercially exciting. For example, there is now an agreement on how many whales may be taken in the Antarctic Ocean, but the Antarctic catch is now at only a small fraction of its original commercial value. Again, the IWC still states its kill limits for the Antarctic in Blue Whale Units, but this is an amount of oil not a quantity of whales and thus of no value as a species limit.

The point here is crucial. The larger a whale is, the more valuable it is as a source of oil. If all whale species grew to the same size as the Blue whale, then all whales would be equally valuable and a law like the Blue Whale Unit would do no damage. But, of course, whales don't all grow to the same size and the Blue Whale Unit is a deadly hoax that keeps the whaling industry alive a few more years by allowing the cost of mounting a factory ship expedition to be borne by the smaller, less valuable whales. Because a whaling expedition is allowed to take its limit with, for instance, the smaller Sei whale in place of the larger Blue whale, in a ratio of six to one, it can make its way slowly and profitably into the last haunts of the remnant stocks of a large species by killing small, less valuable species like Sei whales all along the way. On those infrequent occasions when it comes across a large whale of the rarer species, it can kill them too. This is what Dr. Payne has pointed out in saying: "The Blue Whale Unit method of setting quotas has made it possible

て捕鯨にたづさわった、又現在なおかつ従事している国々、アルゼンチン、オーストラリア、カナダ、デンマーク、フランス、イギリス、オランダ、日本、ニュージィランド、ノールウェイ、パナマ（この国は最近脱たいの意志のあることを声明しています）南アフリカ、イギリス連邦国、アメリカ、U.S.S.R.等からの代表により成り立っています。こうした参加国は、新規に捕鯨を始めた国が参加したり、様々な理由で脱退する国により変ります。が、これらの捕鯨国の中にはIWCの協定にサインしない国や定約に批准しない国のあることを知っておくことが大切です。捕鯨にたずさわる国々の中で、かつて一度もIWCの統制にはいっていないのはチリーとペルーの近年に於ける主なる二つの捕鯨国です。この二ヶ国はIWCの宣言を一度も批准したことがないので、その規則を固守する責任がないのです。これはチリーとペルーに他のIWCの条約加盟国がとらえないと同意しているしろながす鯨を獲手に殺害させておくことになります。チリーとペルーが一時的にこの非常に稀となったしろながす鯨をとるのを止めたのは一年前のことで、これは偉大な飛行家で天然資源の保護管理論者であるチャールス・リンドバーグが、そのように説得した結果でした。

最近はこのIWCも、いくつか小さい点で成功し、その関係国をして、十分な時間さえ与えられれば強いコントロールを達し得ると主張させています。しかしながらIWCが要した様な十分な時間はもうないのです。さらにその獲得に最近成功したその協定は、もはや商業的に存在しないレベルにまで群が減少した領域についてなのです。例えば、現在、南極海に於いて何頭の鯨をとるか協定が結ばれていますが現在の南極海の捕獲高は元の商業価値のごく小部分です。又、IWCは南極海に於ける殺害限度をしろながす換算単位で示していますが、これは油の量であって鯨の数ではない訳です。従って種の制限には何の役にも立ってないと云えるのです。

この点は重要なことです。鯨が大きければ油のもととして、より価値があるわけです。従って、もし全ての鯨種がしろながす鯨のサイズになれば、全鯨の価値は同じと云うことになりその結果しろながす換算単位も害になりません。然しながら勿論、全ての鯨が、同じサイズになることはありません。そうして、しろながす換算単位は上昇する母船式捕鯨の費用を、より小さい、より価値の低い鯨でもって支えることによりあと数年鯨界を保つと云う人をかついだ話し

for the smaller species to subsidize the commercial extinction of the larger ones. For without the small whales to pay for the costs of an expedition, a whaling company could never afford to collect the thinly scattered larger species."

Another trouble with the Blue Whale Unit system is the fact that it allows a whaling company to parcel out its kill according to how the market is fluctuating and with no regard to what species is being overhunted. Generally speaking, Sei whales are of more value for meat than their Blue Whale Unit equivalent in Fin whales; therefore, a company interested in meat may choose to kill six Sei instead of two Fin whales for each of its allotted Blue Whale Units, regardless of how many Sei whales may remain.

The International Whaling Commission has played a role in establishing species quotas for sustainable yield whaling in the North Pacific, but let us examine the situation carefully. The species limit on Fin and Sei whales in the North Pacific was brought about not as part of the IWC agenda but off the floor in private meetings among representatives of Japan, Russia, Canada, and the United States—the four nations that fish for whales in the North Pacific.

Let us look at the Fin whale agreement first. During the first year of this two-year-old agreement the Japanese and Russian pelagic fleets volunteered to take 27 percent less Fin whales than they had caught the previous year. Because that previous year, 1967, had been a bad one, Japan and Russia were acting in good faith. The single United States shore station in Richmond, California, however, took no reduction and was allowed to repeat its previous year's catch. Japanese shore stations were also permitted the full previous year's catch.

The trouble with this North Pacific Fin whale quota is that it was based upon whale age calculations that now appear to be wrong.

To determine the replacement rate of a species, hence its sustainable yield, it is necessary, among other things, to know the average length of an individual's life. From that information it can be told how fast a species reproduces and thus what its replacement rate is. The principal method of calculating whale age is a count of the rings that appear on a plug found in the whale's ear canal. It had previously been thought that two rings equals one year. It is now thought that one ring equals one year. Therefore, the whale grows only half as fast as originally supposed, and thus replaces its population more slowly than was supposed when the North Pacific Fin whale quota was set.

In 1969 the new method of estimating whale age was used in fixing new Blue Whale Unit quotas in the Antarctic, but it has not yet been applied to the North Pacific Fin whale. Now, for the North Pacific Fin whale quota to be effective, it must be adjusted to the new aging data.

A far more serious situation exists with the North Pacific Sei whale quota. Here, none of the countries hunting these waters acted in good faith. At the time the present North Pacific Sei whale quota was set, everyone knew that the Sei whale was being overhunted by almost twice the kill it could sustain, yet the new quota was based on the previous year's total catch, and that was the largest catch, by fully one-third, ever recorded from the North Pacific! This new quota was set by delegates to a Commission whose express function is to restrict and control the take of whales.

The portion of the North Pacific Sei whale quota obtained by the sole American whaling company is especially interesting. The Richmond, California, whaling station had had a poor catch of Seis in 1967, so it somehow managed to obtain a catch limit based on the U.S. catch in 1966, which was a better year. Now it just happens that in that earlier year, the Richmond company had had a competitor that had since gone out of business, so by obtaining 1966 as its base year, the Richmond company got not only the chance to catch the full number of Sei whales that in a better year it had taken itself but also the number of Sei whales that had been killed by its competitor. Apparently, no effort was being made by the Americans to conserve whales and this is a poor position from which to argue when trying to make international agreements based on self-imposed restraints.

Anyone trying to stop the whale slaughter who inquires about realistic quotas is usually told that some hopeful new quota is now in the works or has just been set. But when closely examined, each of these new provisions seems always to reveal a hitch that benefits the industry. Take, for example, the new Sperm whale quota that, with some sense of accomplishment, the IWC announced had been set for the North Pacific in 1970. This new quota of 11,273 Sperm whales is not based on sustainable yields, which is what counts. It is based on a 10 percent reduction in the 1968 Sperm whale catch, and no one knows if the North Pacific Sperm whale population can survive that number of losses. Information on Sperm whales in the North Pacific is not as thorough as the information about baleen whales in the Antarctic, but early indications

なのです。捕鯨船団が、その制限量を大きいしろながす鯨の代りに比較的小さいいわし鯨（これは6対1の割合です）で取ることが許されているので、船団は小さい価値の低いまっこう鯨、いわし鯨等を選びにしつゝゆっくりと利潤の上る残された大きい鯨の生息地域へと入っていくのです。そうして稀な種類の大きい鯨に行きあうと、それらをも殺すことができるのです。この点がペイン博士が指摘して云っている点です。"しろながす換算単位による割当ての設定は、小さい種類が、大きい種の鯨の商業的消滅の助けるのに役立っています。と云うのは、小さい鯨によって船団の費用をまかなわなければ、捕会社は広範囲にわたってそこゝにちらばり存在する大きい種類を取ることは出来ません。"

しろながす換算単位のもう1つの問題点はどの種の鯨が過度に捕えられているかをぬきに市場の高低に従って、捕業者がその殺害を分配できることです。例えば一般的にいって、いわし鯨は、ながす鯨と同様ですが、前者は、しろながす換算単位としてよりも、肉として価値があり、その為に会社は割り当てられたしろながす換算単位として、二頭のながす鯨のかわりに六頭のいわし鯨を、一体いわし鯨が何頭のこっているかを考慮に入れず、殺害することも出来るのです。

IWCは、北太平洋に於ける持続性生産高の種分配を成立させる役割をしました。こゝでその状況を注意深く検討しましょう。ながす鯨といわし鯨の北太平洋に於る種の限定はIWCの協議事項の一部として出て来たものではなく北太平洋で鯨をとる日本、ロシア、カナダ、そうして合衆国の四ヶ国の代表間の私的会合で持ち出されたのです。

最初にながす鯨についての協定を検討してみましょう。二年前につくられたこの協定の最初一年間にロシアと日本の母船々団は、前年不漁の年でしたから日本、ロシア共に誠意をもって行動していたのです。しかしながら、カリの捕獲量の27％にあたる数だけ少く取ろうと云って出ました。その前年にあたる1967年はフォニア・リッチモンドの唯一の沿海捕鯨は減少せず前年と同じ捕獲を繰返すことが許可されましたし、日本の母船式捕鯨も同様に前年の捕獲量を許可されました。

この北太平洋ながす鯨割り当ての問題点は、現在では間違ってみえる鯨年令の計算に基づいてきめられている点です。

種の補充速度、従って持続性生産高の決定の為に必要な、いろいろな事の中で、1個体の平均年令を知ることが必要です。これから種が何如なる早さで繁殖するか、つまりその補充速度がわかります。鯨の年令の主な計算法は、鯨の耳の穴管の中にあるせんの上に現われる輪を数えるのです。以前は2つの輪が1年に当るものと思われていたのですが、現在では1つの輪が1年に等しい、つまり、鯨の成長は、はじめに考えられたより半分のスピードにあたります。そう云うわけで、北太平洋ながす鯨割合の設定された当時に推定されたより、より長い時間がその総数の補充にかゝるわけです。

1969年南極海に於る新しいしろながす鯨単位を設定するさいに、鯨年令をきめる新しい方法が使われましたが、北太平洋のながす鯨にはまだ使われていません。現在の北太平洋鯨割当が効力を持つ為には、新しい年令のデーターで調整されなければなりません。

北太平洋のいわし鯨に関しては、さらにゆゝしい状況です。こゝでは最適にたづさわる国のどの1つも誠意をもって行動しなかったのです。現在の北太平洋いわし鯨割当が設定された時、いわし鯨が過度に捕獲され耐えうる二倍もの殺害が行われていることは誰もが知っていました。それでいてなおかつ新しい割当は前年の総量（これは最大の収穫で北太平洋からかつて記録されたもの、為にもある最大の捕獲です！）に基けいたものでした。この驚くべき割当では捕鯨を制限調節することを特別任務とする委員会への代表によりきめられたのでした。

唯一のアメリカ捕鯨会社が得たいわし鯨の割当は特に興味あるものです。カルフォニア・リッチモンドでは1967年のいわし鯨の捕獲高は低く、そこでどう云うふうにしたかわかりませんが、捕獲高の大きい1966年にもとづいた捕鯨割当量の獲得に成功しています。たまたまこの年に、リッチモンド会社の競争相手が倒産し、その結果1966年を基礎とすることにより、リッチモンド会社はよい年における、いわし鯨の最大捕獲量にあたる鯨をとらえるチャンスをつかんだのみならず、この競争会社によってころされたいわし鯨をも得たのです。明らかに鯨を保存しようとするアメリカ人の努力は見られません。こうした自己中心性は、自らが課した所の制限に基けいて国際的協定をつくろうと試みる時に問題となる点です。

鯨の殺害を止めようとしているものは誰でも、リアリスティクな割り当てについてたづねるわけですが、新しい希望の持てる割り当てについて研究中であるとか、それが制定されたばかりとかの返答をうけます。然しこれらを念入りにしらべてみると、こうした新しい時期はそれぞれ常に業界が利するからまりがみえるのです。例として、IWCが設定した1970年度の北太平洋へのまっこう鯨の新しい割当てをみてみましょう。この新しい割当て11,273頭のま

—for instance, the high incidence of young whales and the relative absence of mature whales in recent catches—are that the Sperm whale population in the North Pacific is already badly overhunted and cannot stand a loss of 11,273 whales in 1970.

The use of a previous year's catch instead of a sustainable yield figure is only part of the hitch in this new North Pacific quota for Sperm whales. The other part is that the quota applies only to the North Pacific and because the Sperm whale is now being hunted in its equatorial breeding grounds, all a whaling fleet needs to do, if it isn't finding enough whales to fill its North Pacific quota, is steam a few miles south, cross the equator, and kill as many Sperm whales as it likes, because there is no quota whatever on Sperm whales in the South Pacific.

If we look at the new agreements on quotas for the Antarctic Ocean, where for the past three years there have been sustainable yield quotas, we find the same shaky structure. Though everyone originally acted in good faith, the recent revision of aging data now indicates that the Antarctic quotas were too high for the first two of those years. Even now, they have not been adequately reduced, because all members of the IWC's scientific committee—with the Japanese scientists dissenting—feel that the sustainable yield for the Antarctic should be 2,500 Blue Whale Units and not the 2,700 units agreed upon. It is also true that even if the quota is reduced in 1970 to a point truly below the sustainable yield, it is still given in Blue Whale Units and will therefore be ineffective unless the relative proportions of Fin and Sei whales in the catch remain the same. The recent increase in the value of Sei whales as a meat source suggests that there is not much hope that the composition of the kill in the Antarctic will stay the same. Thus, unless a species quota can be established in the Antarctic, Sei whales will probably be decimated there.

To sum up this complicated business, it is fair to say that as of March 1970, there is no whale quota—neither a species quota nor a Blue Whale Unit quota—applied anywhere in the world that falls within the sustainable yield of the world's whale populations.

The whaling industry, which the International Whaling Commission was created expressly to control, is still having its way.

What are the prospects for true progress within the International Whaling Commission? There are two major goals being sought by some members of the IWC, and they have been before the Commission for years, but there is still no progress to report. One goal is abolishment of the Blue Whale Unit completely and its replacement with species limits alone. The other goal is an international observer system. Such a system would involve observers who are not nationals of the country that runs the factory expedition. This system would help prevent "accidents," such as the two Blue whales a Canadian company allegedly took in 1969 and entered "by mistake" as Fin whales in their records. An international observer system might also considerably reduce the number of Sperm whales that are reported at lengths just at or barely above the minimum legal length. It is hard for most scientists to believe that a whale population could consist of so abnormally high a proportion of animals at just that legal length or slightly over. Undoubtedly, whales are being taken below the legal length and falsely reported just at or over it. Perhaps disinterested observers, reporting to a concerned world press, could at least stimulate the world's disapprobation, a policing function that the IWC has been powerless to apply. Not one of its offenders has ever received any punishment for any offense.

There is now before the IWC another matter that could undo any reform it is now considering: the vigorous effort of the Japanese representatives to amend Paragraph 11 of the schedule of the convention. This paragraph prohibits any factory ship used in the Antarctic from being used in any other sea in the same year. As it stands, this provision effectively forces whaling companies to maintain two separate fleets if they wish to whale both in the Antarctic and elsewhere. It is one of the few agreements that has controlled the rate of baleen whaling outside the Antarctic. If Paragraph 11 of the schedule did not exist, whaling companies could do the same amount of damage with only half of their present factory ships. As it now stands, if they are whaling in the Antarctic and elsewhere, they must operate two fleets at different times of the year. Without the restriction of Paragraph 11, one fleet could do the job in both areas. If Paragraph 11 is amended as Japan proposes, the whaling industry could operate twice as efficiently as before and sell off half its factory fleet besides, perhaps to other countries wanting to get in on the last few years of the whaling business. Or the surplus ships might be used by the original companies to extend their own operations elsewhere. The proposed amendment of Paragraph 11 would merely increase the already overwhelming odds against the whale's survival. Paragraph 11 must be maintained.

Another crucial agreement voted by most IWC nations, and just as important as Paragraph 11, was broken before it ever went into effect. It is the restriction against factory ship whaling in the breeding grounds of Sperm whales, the area between the latitudes 40° North and 40° South. Russia broke the agreement first and was immediately followed by Norway and Japan. The importance of this restriction is obvious, for it is axiomatic that the fastest way to kill off a species is to hunt it on its breeding grounds. That was how the United States brought passenger pigeons—once the most numerous game bird in North America—to total extinction in the last century. In the Sperm whale breeding grounds, mature bulls are present only as harem masters. Thus, whaling ships hunting in these grounds will take almost nothing but females and young and thus vastly reduce the species' reproductive ability.

These two points—Paragraph 11 of the IWC's schedule and the convention's restriction against hunting in the Sperm whale's breeding grounds—have an interesting relationship. The Japanese, who suffer from Paragraph 11, want to amend it. The Russians, who compete with Japan and are not bothered by Paragraph 11, want to retain it. The Japanese, who are concerned about the whale stock, have indicated that they want to stop hunting in the Sperm whale's breeding grounds if their competitors, the Russians, will also stop. Perhaps the Russians would leave the Sperm whale's breeding grounds alone if the Japanese dropped their attempt to amend Paragraph 11.

Such are the problems that the IWC seems unable to solve, but perhaps we should be grateful that it exists at all. It has at least managed to get species protected after they have been hunted to commercial extinction. Let us hope that the good sense expressed in its almost realistic Fin whale quota for the North Pacific will continue. But let us also realize what a slim hope this is. All of these new IWC agreements were achieved at a time when whale oil prices were at an unprecedented low due to competition from herring and anchovy oil.

The herring industry in the North Atlantic has now been overexploited and the Peruvian anchovy industry has leveled off. As a result, the price of whale oil has doubled in recent months and by all predictions will double again before the year is out. When the value of whale oil has quadrupled from that prevailing at the time the new agreements were reached, restraint may not prevail.

The fact is that the business of killing whales—though it is on the brink of collapse—is at this moment sufficiently profitable to encourage irresponsible companies in the whaling nations to go on evading control until the last dollar has been made and the last species has been slaughtered to the near oblivion of commercial extinction.

What are these marvelous profits for which the world is giving up its whales? There is no public source of information about the whaling industry's profits, and the companies themselves guard this information jealously. But an optimistic estimate based on known prices of the raw materials on the world market would put the whole industry's gross revenues at about $150,000,000 a year. That sum, for which men are virtually eliminating the world's greatest animal, is less than the Hilton chain grosses annually from only four of its hotels; less than is spent in a single year to remove garbage from one large American city; less than Hollywood has grossed on a few successful movies; far less than the Ford Motor Company lost on one unsuccessful model. If the whaling industry were to fold tomorrow, and its estimated 15,000 employees were freed for other jobs, that would add to the world labor forces fewer people than the net increase of the world's population in less than two hours.

No one would wish, of course, to see any man lose his job, but the industry *will* fold, like it or not, if it continues to harvest the whale stock at its present rate. Pelagic whaling has already completely collapsed in Norway, which at one time dominated the industry, and it has collapsed in several other countries as well. But the remaining countries are seeking to develop new consumer interest in whale products in order to prolong the present rate of profitable slaughter. In self-defense they justify their greed by the consumer demand they themselves create. As this profiteering continues for a few more years, one of the most important protein supplies in all the ocean—a magnificent animal with so much to teach us about the sea—is utterly disappearing from any significance in the world. What outrageous absurdity. The whaling industry, bent on committing suicide through unstoppable overproduction is, in this decade of ecological awakening, the perfect metaphor for all mankind.

っこう鯨は（こゝが重要なところですが）持続性生産高に基付いたわけでなく1968年のまっこう鯨獲穫高から10％ひいたにすぎないのです。そうして、この北太平洋鯨総数が、それ丈の減少に耐え得るかどうか誰もしりません。北太平洋のまっこう鯨に関しては南極海におけるひげ鯨について程完全に知られているわけではありませんが、捕鯨中にしばしば若い鯨が見られること、最近の獲物の中に成人した鯨の比較的少いこと、等から北太平洋に於いて、まっこう鯨が、すでにひどく過度に捕鯨されていることは明らかで1970年の11,273頭に耐え得られない状況です。

持続性生産高のかわりに前年度の捕鯨高を使用することは、まっこう鯨に関する新しい北太平洋割り当ての障害の一部にすぎません。もう1つの障害は、これが北太平洋にのみ適用されることです。つまり、まっこう鯨は現在赤道下の繁殖地で捕鯨されているわけですが、北太平洋割り当て分の鯨が見付からない時は、赤道線をこえて南に数マイル船を走らせ、南太平洋でのまっこう鯨については何の規定もないことからそこで好きなだけまっこう鯨を殺せるわけです。

同様に、過去三年にわたって持続性生産高割り当てのつかわれていた南極海についての新しい協定を見てみると、これ又、あぶなかしいものです。はじめは誰もが誠意をこめて行動したにもかゝわらず、最近の改正されたデーターをみると、その最初の二年の南極海割り当てが高すぎたことが明らかです。それでも現在量は十分に減少されてはいず、それに異議をとなえる日本の科学者もふくむIWCの科学委員会は南極海持続性生産高は2,500しろながす換算単位であって協定した2,700ではないと云う立場をとっているのです。又たとえ1970年の割り当てが本当に持続産高以下に減少されたとしても、しろながす鯨単位を用いていることに変りなく、従って、ながす鯨といわし鯨の捕鯨量での割合が同じに止まるならば、何の効果もないことになります。最近、肉資源として、いわし鯨の価値が上昇しつゝあることは、南極海での殺害構成が同じ状態で止まることは、あまり望めないことを暗示しています。このように南極海での種の割り当てが成立されない限り、いわし鯨の大量の死はまぬがれないでしょう。

複雑なこの問題を要約すると1970年3月の時点において、鯨の割り当ては、種の割り当てにしろ、しろながす換算単位の割り当てにしろ、世界中どこにも適用されてないと云ってよいでしょう。特にその調節の為にIWCを設立した捕鯨業自体は、何らの統制をうけることなく思うまゝに鯨をとっているのです。

IWC内の本当の向上の可能性はあるでしょうか。これについての解答は次の例に見出せましょう。IWCのメンバーによって追求されてた二つの主な目的がありますが、委員会に数年にわたり提出されているもゝ進歩は全然ありません。その1つは、しろながす換算単位を完全に止め、種の制限をかわりに用いようとするこゝろみです。もう1つは国際オブザーバー組織の設立で、これには沿海捕鯨も母船式捕鯨も経営してない国の人にもオブザーバーとして参加してもらうようになっています。こうした組織は1969年にカナダの会社が二頭のしろながす鯨をとったと宣言し、記録には"間違って"ながす鯨と書き込んだと云った事故をふせぐことが出来ます。又、とられたまっこう鯨から、規定の長さに違っているか違っさないか、その境界線に属する数（かなりの数にのぼっていますが）をへらすことが出来るものと思われます。記録に見られる程、異常に沢山に、その長さが、法定のそれより、ほんの少し長いとか短い鯨が居るとは、多くの科学者にとって信じがたいことです。疑いもなく、法定の長さに違しない鯨がとられ、いつわってそれより幾分上か、あるいは丁度その長さに達するとして報告されているのです。或いは、関心の少いオブザーバーが、関心をもつ世界の報道界に報告することにより少くとも世界の非難を弱体し得るかもしれません。これはIWCの使うことが出来ない政治的力です。これまでは、反則者の誰1人としてその違反行為の罰をうけたものはありません。

IWCの前には、この委員会が現在考慮している改善を一挙に取り消す他の事件があります。これは、会議の目録の第二項を改正しようとする日本代表の猛烈な努力です。この項目は南極海で使われた母鯨が同じ年に、他の海で使われることを禁止しています。現状では、この規定条件は鯨会社が、もし南極海とその他の海の両方にゆきたければ、二つの独立した船団を維持しなければならない点を効果的に強要しているわけで、南極海外のひげ鯨捕鯨を統制している数少い協定の1つです。もしこの第二項目が存在しなかったとすると、鯨業者は、現在の半分の母船団でもって現在と同じ害を為し得ることになります。現状では、南極とその他の海で捕鯨する場合は二船団を一年の中独立して操作しなければなりません。が、第二項目による制限がなければ、1船団でもって両領域やれるわけです。もしこれが日本の提案通り改正されるならば、今までよりも二倍効果的に捕鯨界は操作されるわけで、又その船隊の半分を、捕鯨業の最後の数年に参加したいと思っている他の国に売り払うことが出来るのです。あるいはこの金剛鯨は同じ会社内で他の領域での操作を拡大するのに使われ得るかもしれません。このように第二項目の改正提案は、すでにこの上もなく希望のもてない、鯨の生残りのチャンスをへらすことになります。第二項目は保持されなければなりません。

IWC参加国の多くによって投票されたもう1つの重要な協定は第二項目と同様に重要ですが、効果を発する前に破約されました。これは、まっこう鯨の繁殖地北緯40°から南緯40°間での母船式捕鯨を制限するものです。ロシアがまず最初に協定を破り、次でノールウェイと日本が、これに従いました。この制限の重要性は説明するまでもないでしょう。種の繁殖地で捕獲することが、種を断絶する一番すばやい方法です。合衆国がかつて北アメリカで一番数の多い鳥であったところの伝書鳩を前世紀に於いて完全に消滅させたのは、まさにこの方法によってでした。このまっこう鯨繁殖地で、成熟した雄は、単にハーレムの主人としてのみ存在し、従って、この地で鯨がとらえるのは雌と子供の鯨なのです。と云うことは、その種の再生産能力をいちじるしく減少させることになります。

これまで述べてきたIWCの目録第二項と会議のまっこう鯨繁殖地における捕鯨禁止は興味ある関係をもっています。第二項目で苦しめられている日本人は、これを改正したいのですが、その競争相手で、これから苦しめられていないロシアは改正を防止したいのです。鯨のストックに関心を持つ日本人は、もしその競争相手ロシアさえ止めれば、まっこう鯨繁殖地での捕鯨をやめたい旨明らかにしています。ロシアは恐らく日本が第二項目の改正を思い止まれば、まっこう鯨の繁殖地をそうっとしておくことでしょう。

これらがIWCが解決し得そうにない問題です。然しながら、少くともIWCの存在することに感謝すべきかもしれません。これによって商業的消滅にまで達した種の保護がされているのですから。北太平洋のながす鯨割り当てに表現された良識が続くことを期待しましょう。が同時に又、こうした期待がいかに甘りにならないかを認識しなければなりません。と云うのは、IWCの新しい協定は、にしんとアンチョヴィからの油との競争がせいで鯨油の値段が低い時につくられたものなのですから。

北大西洋に於けるにしん工業は過度に開発され、ペルーのアンチョヴィ工業は積ばいの状態をつゞけた結果、この数ヶ月の間に鯨油は二倍に値上りし、さらにこの年が終わるまえに再び倍になるとの予測です。従って鯨油が協定がつくられた当時の四倍の値段になった時、この協定が守られるかどうかみものです。

事実は捕鯨が崩壊に近いにもかゝわらず現在段階国の責任感のない会社をして規制を犯してまでも全になる最後の鯨まで全にかま、最後の種を殺害し、商業的消滅をもたらすまで捕鯨をつゞけることを奨励する程に、十分に利益のある商売なのです。

世界をして、その鯨を失わせる素晴らしい利益とはなんでしょう？公には鯨産業の利益について知る情報はなんにもありません。そうして会社自身はこれを絶対なく守っています。然し、世界市場の資源の値段に基付いて業態的な評価をしてみると、全工業界の総粗益は一年に150,000,000ドルになります。この利益の為に世界から最も偉大な動物である鯨を消し去ろうとしているこの総額は、一体どのくらいなのでしょうか。これはヒルトンホテルがもつ多くの中のたった四つのホテルの年収を合わせた額以下なのです。又、アメリカ大都市の1つが、ごみくずを除く為に一年に使う費用以下です。成功した数少い映画でハリウッドがあげる総利益以下です。或いはフォード自動車会社が不成功なモデルによって損をする額よりうんと低いものです。かに捕鯨業が今日閉鎖されるとすると、そうしてその推定15,000人の雇傭者が職を離れ世界の労働人口に加えるとしても、これは二時間ごとの世界人口増加数以下です。勿論、誰一人として人が失職するのを目撃したくありませんが、鯨産業は現在の速度で鯨のストックをとっていたのでは、好むと好まざるにかゝわらず閉鎖しなければならない時が来ることは明らかです。ノールウェイでは母船式捕鯨はかつて強力な産業でしたが現在では完全に崩壊しています。同様な崩壊はノルウェイ以外にいくつかの国で起りました。それにもかゝわらず、他の国は現在の利益の上に報害を長引かせる為に鯨製品への消費者の新しい関心を発達させようとやっきになり、自らつくり出した消費者の要求でもって彼らのどん欲さを正当化しようとしています。こうした暴利獲得がさらに数年続く間に海に於ける最も重要な蛋白源の1つが、我々がそれから海について沢山のことを知ることが出来る素晴らしい動物が、意味をもった存在としては、この世界から消え去りつつあるのです。なんと云う法外な不条理でしょう！　捕鯨界が、停止することの出来ない過剰生産から自殺行為へ傾いていることは、社会生態学が目ざめつゝあるこの十年にあって、全ての人類に対する申し分のない侮辱と云えましょう。

This map shows the areas where Sperm whales have been frequently captured. Females and calves accompanied by bulls are found between 40°N and 40°S latitude. Only males—the so-called bachelor herds—are found in polar waters. Although many Sperm whales still exist in the oceans today, the whaling industry (unless its tactics change) will bring this species to commercial extinction within about one decade.

この地図は、まっこう鯨がしばしば捕獲された海域を示したものです。雌と仔および雄と子供は、北緯40°から、南緯40°の間に見つけられます。独身群と呼ばれるところの雄だけが極地で捕えられるのです。現在、海にはまっこう鯨は多数存在しますが捕鯨業界の方法を変えない限り、この10年以内に、経済商業的絶滅をすることでしょう。

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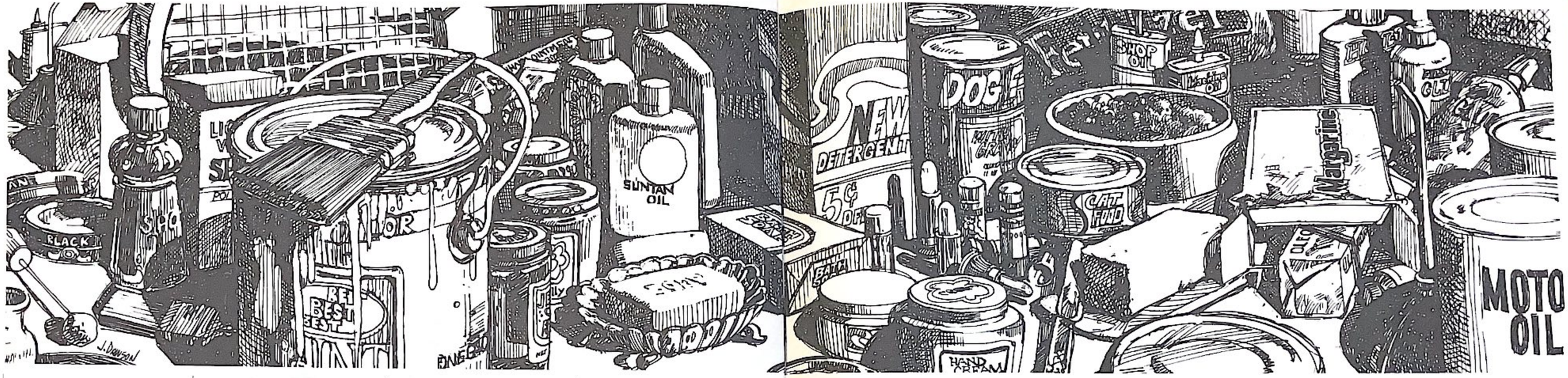


Why Whales are Killed

THE VARIOUS PRODUCTS made from the whale slaughter are remarkable for only one thing: not one of them needs to come from whales. Every product for which whales are now being hunted to significant extinction is readily available from other, more abundant sources.

First, there is whale oil, which, properly defined, is the fatty oil rendered from the blubber of baleen whales and can be used for edible or inedible products. Sperm oil, which is not edible, is a combination of Sperm whale oil and spermaceti, the waxy substance in the Sperm whale's head.

The best grades of baleen oil are used in making drying agents for paints and in making margarine and soap. Lesser grades of the oil are used for tanning, especially chamois leather. Sperm oil, on the other hand, is used primarily in cosmetics wherever an oil easily absorbed by the skin is needed, as in hand creams, face creams, suntan oil and lipstick. It is also used as a lubricant and a base for waxes.

Next, there is the flesh, which until recently was simply thrown overboard. Now it is the chief product sought on many expeditions. Some of the meat is eaten by people—primarily in Japan, Germany, Britain, and Norway—but by far the greatest amount of whale meat is fed to dogs and cats in Europe and the United States and to ranch fox and ranch mink in the United States, Canada, and Norway. The bones, skeletal tissue, tendons, and vital organs are put to various other uses.

There is nothing made from the oil and flesh of whales—not a single product—that is not much more abundantly available from a whole spectrum of synthetic or naturally occurring alternatives. Even ambergris, that exotic substance sometimes found in the intestines of Sperm whales and once worth its weight in gold, has long since been replaced by synthetic alternatives that the perfume industry developed to ensure a more predictable consistency and thus better quality control.

There are no properties in any sort of whale oil that make it indispensable for the uses to which it is put. Each use could easily be replaced with oil from a more abundant source. Indeed, the whaling industry is the least productive source of oil of any industry listed by the Food and Agriculture Organization of the United Nations. The total whale oil yield of 1968 equals only one-seventh of the oil produced that year by the world's sunflower seed industry, and only one-fourth of the oil produced that year by the world's rape seed industry. Anchovies, herring, tallow, corn, soya beans, and palm nuts each produce far more oil than the whaling industry and all of them can easily replace whale oil.

If all whale products were taken off the market today, the users likely to suffer the greatest financial loss would be companies selling whale meat to pet owners and fur ranchers. And here, in the enormity of turning the world's whales into fur pelts and house pets, we have the perfect profile of human excess.

Man has overpopulated the world, and with his population explosion has come a proportionate increase in the number of his pets and in his demand for goods. Whales are disappearing from the world today so that the luxury of a mink coat and the pleasures of a lap dog may be enjoyed in excessive numbers by a human population that has grown to an excessive size. The whale's cause —all causes—will be lost eventually if the human population is not controlled. Should we succeed in saving the whale now, without also turning back human numbers by safe and constructive means, then we will find that, while the whale may temporarily be spared, other wild animals will be slaughtered in its place to make pet food and fur pelts. There is no way out—none—except to control the quantity of people.

鯨は何故殺されているのでしょう

鯨の殺害によってつくられる産物について驚くべき1つの点は、これらの生産物はいづれも鯨からつくられる必要がないと云うことです。全ての産物、その為に消滅に近いまで捕鯨がなされた産物のどれとして、鯨からでなければ得られないと云うものでなく、他のより豊かな資源から簡単に得られうるのです。

まず鯨油ですが、正確に定義すると、ひげ鯨の脂肪から精製された脂肪油で、食品用、非食品用製品に用いられています。まっこう油は非食品用で、これはまっこう鯨油と鯨蝋、まっこう鯨の脳の蝋状物質のまぜ合わさったものです。

最も良質のバリーン油は、ペンキの乾燥剤とし、又マーガリン、石けんの製造に使われています。これより質のわるい油は、セーム皮、シャミ皮の製革に使われます。一方、まっこう油は、主として化粧品、油が皮膚に容易に吸収されるところ、例えば手のクリーム、顔クリーム、日焼クリーム、そうして口べに等に使われています。又、滑剤として蝋のベースとしても用いられます。

次に鯨肉ですが、これは最近まで単にすてられていたものです。が、現在では母船式捕鯨の目的とする主産物で、特に日本、ドイツ、イギリス、ノルウェーでは人間用の肉として食べられています。これを上まわってヨーロッパ、アメリカでは犬猫用の肉として使われているのです。骨、骨格組織、腱、重要器官は、その他の様々なものに使われています。

鯨の油と肉からの製品は、そのいづれもより豊かにある合成物あるいは自然範囲から採る方法があるのです。鯨鬚、これは、まっこう鯨の脳の中から取り出される珍らしい物質で、一時は金に等しい価値をもったものでした。これすら今では香水工業が発達させたより予測可能な濃度の、従ってよりよい品質統制の出来る合成物にとってかわられています。

鯨油は、どんな目的の為に使われる場合でも、それでなくてはならないと云う属性はありません。いづれも、より豊かな源からとれる油で容易に代用出来るわけです。全くの所、国連の食糧農業機構の油源リストの中で、鯨産業はその生産量において最少で1968年の全鯨油産高は単にひまわりの種からとれる油の1/7に当り、なたね油と比較するとたったの1/4の生産量なのです。アンチョビー、にしん、獣脂、とうもろこし、大豆、やし等は、それぞれ鯨油より多量の油をつくり、いづれも鯨油の代用として使われ得るのです。

今日マーケットから鯨製品の全てを取りのぞくことで最大の商業的被害をかんじるのは、鯨肉をペットの持主や毛皮牧場主に売っている会社だけでしょう。ここに、世界の鯨を毛皮の為に家庭のペットの為に変換しているこの無法さに見事な人間の不謹慎さが現われているのです。

人間がこの世界の人口を増やしすぎています。そうしてさらにこの人口増加と共に、彼らの持つペットの数が増え、物への要求が増えました。ふえすぎた人間が毛皮を身につけ、愛玩用の子犬をもつ楽しみの為に、ミンクコートのぜいたくさの為に、この世界から鯨をけしつつあります。人間の数を安全な建設的方法によって減少方向へと方向を変えること抜きで、今鯨を助けられるでしょうか？　そうすることにより一時的に鯨を助命出来るかもしれません。が、これに取って代ってペットの食物として毛皮用として他の野生物が殺害されることでしょう。即ち、人間の質そのものをコントロールする方法以外では、こうした状況から逃れる手はないのです。

Turn Back

What the Whale Song Says

NO ONE HAS ANY CLEAR IDEA YET of what the whale song may mean to other whales, but it has at least one clear meaning for man.

For some time now the Bulletin of Atomic Scientists has shown on its official letterhead the face of a clock with its hands pointing to eleven fifty-five. The implication is that there is very little time left for us to do what we must if we are to escape the cataclysmic disaster that is sure to come when humans armed with nuclear weapons and running out of food covet a neighbor's reserves.

What we must do is not hard to understand: we must control the size of the human herd, for we cannot continue to feed more and more people with less and less food.

Few scientists argue that point, and many feel vehemently that we have now reached the moment in human evolution at which we must flatly reverse the methods by which we have previously made progress. We must stop taking everything we can get and squandering it in the expectation that there will always be more. Soon there will not be more. We must reduce our demand for raw materials, or we will blight the earth and finally perish.

One of the most striking facts of our perilous condition—ours and the Humpback whale's—is that there is really no trouble explaining it. We do not need more accurate information about it, nor further proof. There is an abundance of quite accurate information and convincing proof. And we do not need more exposure to the meaning of what we know. Public communication throughout the world is full of statements like the paragraphs above.

What appears to be needed is something harder to acquire: the simple conviction that our information is correct—and the realization that all individuals, regardless of ability, must now act on it. In that act is our future—and the future of whales. It is a future that cannot now be protected by nations nor defended by armies, for it is now in far less obvious, far more powerful hands. It is in the hands of the individual human who may or may not seek sensibly to survive. It is in your hands.

There is a story, important to remember now, about a pilot who earned the

ひき返えしましょう

鯨の歌は何を云っているのでしょう

この鯨の歌が、他の鯨にとって何を意味するものか、明らかな見解を述べた人は1人としていないのです。然しながらこれは、我々人間に対して少くとも1つのはっきりした意味を持っています。

原子科学者会報はこのところしばらくその公式便箋上部に11時45分を指している時計を印刷しています。それはつまり核兵器で武装し、自然資源を使い果したあかつきに当然来るべき、激しい災害を避ける為に、なすべき事をするために残された時間は非常に少いと云う意味です。

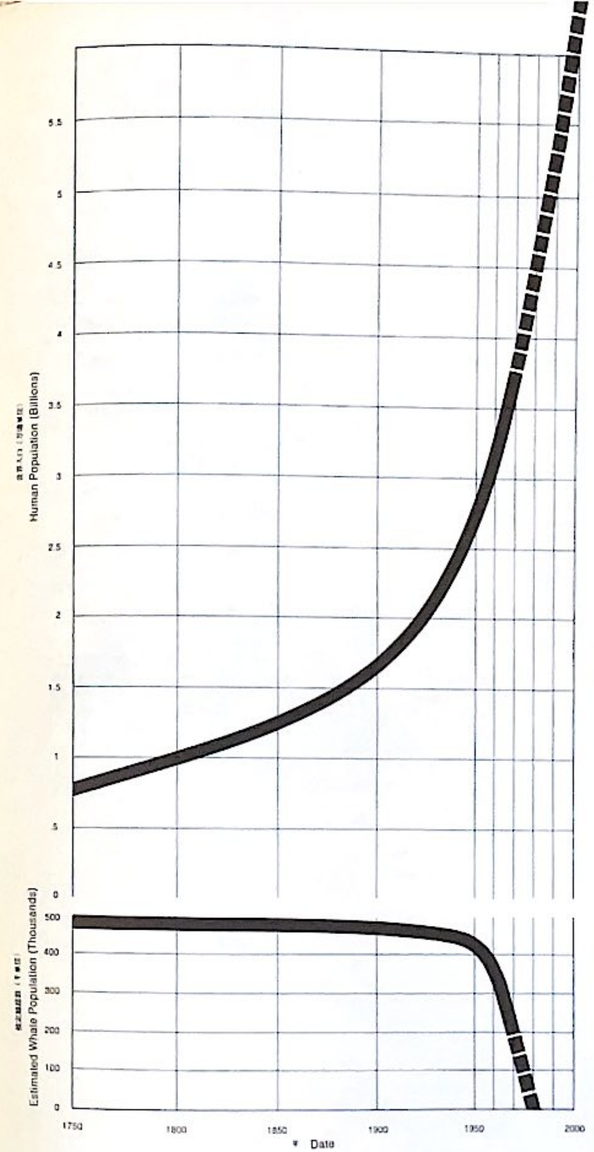
我々の為すべき事は理解に難くありません。まず我々人間集団のサイズを調節しなければなりません。何故なら、年々増加する人口を年々減少していく食物でやしなっていくことは出来ませんから。この点について反論を唱る科学者は居ないでしょう。何故なら、人間の進化過程の中で、我々のこれまでの進歩を可能にした方法そのものを、きっぱりと逆転させなければならない時点に達していることを疑う人はもはやいないのですから。

我々はえられるもの全てを入手し消費することを止めなければなりません。間もなく、これ以上ないと云う時が来るのですから。そうして又、我々の自然資材に対する要求を減少しなければなりません。そうしなければこの地球を枯らし、ついには滅ぼすことになるのですから。

我々人間の、そうしてざとう鯨のおかれた危険な状態について、最もきわだつ事実の1つは、こうした状況の説明に困らないと云う点です。つまり危険さは明らかで、これを示す正確な情報や納得のゆく証拠は山とあり、これ以上の事実も証拠も必要でないのです。さらに又、こうした事実や証拠が一体何を意味するものかと云うことについて明細に誤く必要もありません。そうして世界中の新聞、テレビ、ラジオには、こうした声明であふれているのです。

こゝで要求されるのは、獲得することのむづかしいことですが、我々の手にあるこうした情報が正しいと云う確心と、全ての個人が、その能力のいかんにかゝわらず、この情報に基づいて今行動しなければならないのだ、と云う認識なのです。

こうした行動の中にこそ我々の未来があります。そうして鯨のそれが。これはもはや国によって守られるわけでなく、又軍隊でもって防衛出来るものでないのです。何故と云えば、



Two species in trouble. (Note the differing scales for the two curves.)

問題に直面している二つの種族（二つの曲線のスケールの違いに注目して下さい。）

admiration of his countrymen. The event occurred on a flight far out over the Pacific. The pilot was flying one of four planes in a fighter squadron on routine maneuvers. The squadron had accomplished its final maneuver and the wing commander, setting a course for return to the aircraft carrier, instructed the pilot and the other members of the squadron to follow. The direction seemed wrong to the pilot, however, and he checked the course with his own navigational equipment. He discovered that the wing commander had made an error: the carrier was in fact in a different direction. On the commander's course there was only open sea, much more of it than the four fighter planes had fuel to cross. If they continued in the direction given by the commander, they would run out of fuel and crash in the ocean.

The pilot radioed his commander and asked him to check his figures. The commander went over his calculations again and replied that the original directions were accurate. But the pilot checked his instruments once more, noticing as he studied each figure that in ten minutes the

未来はこうした国や軍隊よりはうんと目立たない、それでいながらこのいづれよりも力強い手の中にあります。つまりそれは、生き残ることを賢明に求めるいかんにかゝわらず、1人1人の人間の手にかゝっているのです。そうです、未来は貴方の手の中にあるのです。

こゝで特記に価するあるパイロット――この人は事件発生後、皆から賞讃をうけたと云うことです――の話があります。このパイロットは演習中の戦闘飛行中隊四機のうちの一機を操縦していました。飛行中隊はその最終の演習を完了し、指揮官は航空母艦に帰着すべくコースをきめ、このパイロットを他の各パイロットに指示をしました。所がその方向がどうも違っているように思ったこのパイロットは、自分の航空装置でもって調べた所、矢張り指揮官が間違っていることに気付きました。航空母艦は指示のコースの逆方向にあり、このコースに従えば戦闘機のもつ燃料では飛び切ることの不可能な海があるのみで、燃料は燃えつき果て海につっこむことになります。そこでパイロットは指令官に電信連絡し、計算結果の再検討を依頼しました。が再び数字をしらべた指揮官は、はじめのコースに間違いのない旨返答しました。そこでパイロットは、10分後に

planes would no longer have enough fuel to get back to the ship. Again his calculations clearly indicated that safety lay in the opposite direction and that the four pilots were hurtling to certain death at sea.

This time the pilot insisted to his commander that his own calculations were correct: it was vital that they turn back immediately while fuel still remained. The commander replied that the squadron was to maintain the original course and that the pilot was to obey orders. At that moment, with less than ten minutes remaining before the planes would reach the point of no return, the pilot, a career officer, refused to obey his orders. He told his commander that he was turning back. The commander warned the pilot that if he were foolish enough to try it and lucky enough to survive, he would be court-martialed. Trusting his own calculations and realizing what they meant, the pilot nevertheless turned back. He reached the carrier with a few minutes of fuel left in his tank. The other three planes were never heard from again.

In that single man's experience is the answer for each of us and for the whale: the decision to turn back. It is now not a few men but all mankind that is hurtling toward destruction. We are still on the course of a fatal miscalculation. We are killing many forms of life faster than they can replenish themselves. Reduced to insignificance, they cannot fill their place in the food chains that connect all forms of life to life itself. If we, in our miscalculation, break the chain, then we ourselves will be unlinked. Thus, the whale—the most enormous animal that has ever existed—being slaughtered without thought for the future, is the perfect symbol for the most enormous mistake we could ever make.

There is still time to turn back. There is time for us to turn back, and there is time for whales to turn back with us.

The whale—immense, magnificent, gentle, serene, amazing mammoth, singer of awesome, captivating songs.

Listen to him singing far below the turmoil and ceaseless motion of the surface, down where there are no waves, only slow, drifting currents. From that profoundly peaceful place a voice calls us to Turn Back.

は航空母艦に帰りつく為の燃料がなくなることを知りつつ、再び航空装置を調べました。結果は、明らかに安全さはコースと逆方向にあり、このままでは四人のパイロットは海での死に突進しつつあることを示しています。こんどは、パイロットは指揮官に自分の計算の正しいことを主張しました。母艦するのに十分な燃料のある間に、ただちに引き返えすことが、絶対に必要だったのです。指令官は飛行中隊が最初のコースを保持すること、そうしてパイロットがこの指示に従うべきであると返答しました。その時、飛行機がひき返えすことが不可能な時点に10分たらずで達するその時に、職業士官のパイロットは上司に従うことを拒否したのです。パイロットは引き返えす旨答えます。指揮官は愚かにもパイロットがそのコースをかえ、運よく生きのびたとしても、そのあかつきは、軍法会議にかけられると警告しました。自分自身の計算を信じつつ、そうしてそれが何を意味しているか知りつつ、やはりひき返えしたのです。こうして、数分間分の燃料をタンクに残して彼は母艦に辿りつきました。他の三機からは、その後再びきくことはなかったのです。このパイロットの1人の人間経験の中に、我々自身の為のそうして鯨の為の回答があるのです。つまり引き返えすという決定が、少数の人間だけでなく人類全てが破滅に向って突進している現在です。今だに致命的な計算違いのコースを辿っているのです。我々は様々なかたちの生物を、新たに補充されるよりも早く殺しつゝあるのです。こんなふうにして取るに足らない数に減らされては、その為に、この生物と他のそれを結びつける食物の鎖の中を位置をしめることが出来なくなるのです。もし我々が計算ちがいの結果、この鎖を破壊すると我々自身がこの階段からはづされることになるのです。こう考えて来ると、生存した中で最も大きい鯨、未来への思惑抜きで惨殺されている鯨こそ、我々の犯し得る最大の問題を象徴しているのです。

まだ遅くありません。我々の引き返す為の時間が残されています。そうして鯨が、我々と共に引き返えす時間が。

鯨 —— 巨大で、偉大な、やさしく穏やかな、驚くべき哺乳動物、そうして威厳ある心をとらえる歌のうたいて、鯨。

絶えまなく働く海のざわめきの、はるか下からうたい来る鯨の声に、さあ耳をかたむけましょう。そこには波はなく、古いゆったりとした漂う潮流があるのです。この深い静かな場所から、さあひき返えしましょうと我々を呼ぶ声がきこえます。

The Whale Campaign

DEEP CONCERN, unless accompanied by action, is not of much use. Many people must become involved now if whales are still to have significance twenty years hence. The Whale Fund of the New York Zoological Society exists to achieve that purpose. The society is a nonprofit corporation with a long history of sponsoring research, education, and conservation activities. The society's Whale Fund is devoted solely to the conservation and study of whales and is not used to defray other fund-raising or operating expenses. The Whale Campaign was created to bring wider awareness of the plight of whales, to spread information about the Whale Fund, and to help concerned persons to act more effectively. Profits from the sale of Whale Campaign materials will go to the Whale Fund.

To join the Whale Campaign, send in $10 and one of the attached cards. You will receive the current edition of the *Whale Campaign Manual*, a mimeographed source of information on the Whale Fund and Whale Campaign activities. The manual also includes reports of quotas and restrictions, numbers of whales killed, the outcome of International Whaling Commission meetings, companies entering or leaving the whaling business, companies that are still using or have stopped using whale materials, and so on.

You can help the Whale Campaign simply by keeping informed. However, the *Whale Campaign Manual* also suggests various ways you can become more deeply involved, depending on the amount of time you have to give. For example:

1. You can help contact companies using whale materials in their products. The *Whale Campaign Manual* lists companies using whale materials. Suggestions are made as to how to contact persons in those companies, urging them to employ alternative sources of materials.

2. You can help obtain greater exposure for the Whale Campaign in the media. The manual describes magazines, newspapers, and radio and television programs that have already discussed whaling or played the whale songs. Suggestions are given for ways to encourage more exposure of the Whale Campaign through local and nationwide media.

3. You may find it possible to relate the Whale Campaign to other ecological groups and movements. The manual lists ecological organizations in the United States and elsewhere and suggests ways that you can help involve these groups in the Whale Campaign.

4. You can help distribute Whale Campaign materials. The manual illustrates buttons, bumper stickers, and several posters that can be sold to raise money for the Whale Campaign.

5. You can help get organizations and interest groups involved in the Whale Campaign. The manual describes student, social, and business groups that have already participated in the Whale Campaign. Several approaches are suggested by which you can get other groups involved through meetings, discussions, and other activities.

6. You can send a record and book to someone who has the power or the opportunity to affect the fate of whales. Help make sure that these songs reach the appropriate ears. The manual lists industries involved in whaling as well as others who might be influenced by the whale songs to turn their efforts toward the survival of whales. You can have a record and book sent in your name to any person. The manual gives the cost and tells how you can indicate a person to whom you would like a record sent.

These are just a few examples of the activities discussed in the *Whale Campaign Manual*. We hope, among other things, that the Whale Campaign will become a model to encourage a sane approach to the cause of saving an animal species. More ideas for active involvement will come from you and others. The Whale Campaign looks forward to receiving your suggestions.

Use these cards to enroll in the Whale Campaign and to order additional books and records. Give the extra cards to friends.

All that is needed for whales to lose their place in the world is for enough good people to do nothing.

Whale Campaign.

I am enclosing $10.00. Enroll me in the Whale Campaign and send me a copy of the mimeographed *Whale Campaign Manual*.

Name _____

Address _____

City _____ State _____ Zip _____

☐ I would like to make an additional contribution to the Whale Fund. Please send information.

Checks should be made payable to "The Whale Campaign."

Whales

I would like to purchase _____ additional copies of the whale book and record.

☐ I am enclosing $9.95 per copy.* You pay postage and handling.

☐ Bill me $9.95 per copy for the book and record, plus postage and handling.

I understand that the majority of the profits from the sale of these books and records goes to The New York Zoological Society Whale Fund, which is devoted solely to the study and preservation of whales.

Name _____

Address _____

City _____ State _____ Zip _____

*New York and California residents please add sales tax.

SWR/RC

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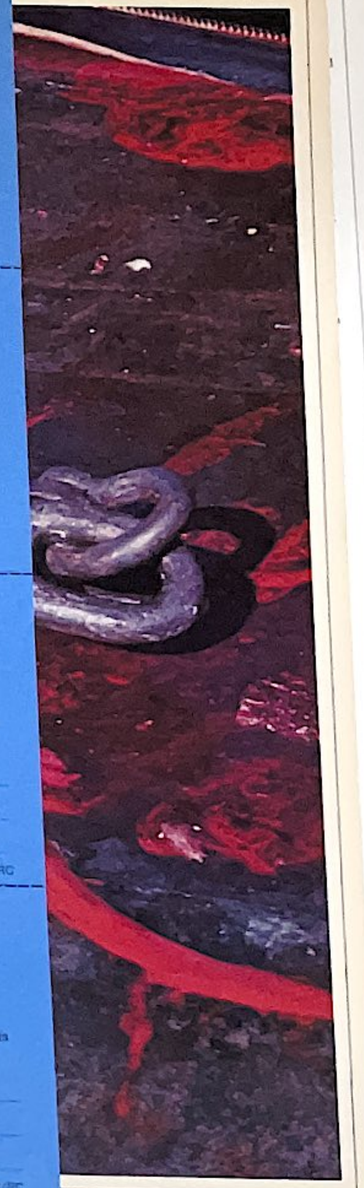

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New York City, New York 10460

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New York City, New York 10460

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The publishers wish to thank Sumi Adachi Rovner and Dr. Yasuo Hotta for their preparation of the Japanese version.

Band 2 — Slowed-Down Solo Whale

This band consists of two short sections of very high notes from the songs of the previous band. They are the notes shown to the left in brackets. They have been slowed to one-quarter of the original speed. This drops the pitch two octaves and spreads the sounds out over a period four times as long as the natural sounds took. The intermediate loud, low sounds have been deleted from this version. When slowed down this much, the low sounds would be too low for most loudspeakers to reproduce.

The echoes are very noticeable in this slowed-down version, because the echoes of the earliest sounds overlap the later sounds in a very intricate and beautiful way. This band has been included to demonstrate the fantastic complexity of the highest tones in the Humpback songs.

Band 3 — Tower Whales

These songs are from recordings at normal speed of the whales that Dr. Payne and his wife heard on many occasions in 1969. They were often heard during the day near a "Texas Tower" standing on one of two shallow-water banks (underwater mountaintops) about twenty-five miles from Bermuda. Because the water is shallow, echoes return rapidly and are not heard distinctly.

The songs heard here are typical of those the Paynes recorded in 1969, and are noticeably different from the songs on many of Watlington's tapes. The Paynes are beginning to suspect that different herds or family groups of Humpback whales may have different song patterns or dialects. When one group is moving through an area, its songs would then be most frequently heard. The Paynes hope to gather further evidence to test this hypothesis on future trips.

The first whale you hear on this band makes some very low sounds. They follow directly after two high squeals. The basic notes of this low sound are actually complex pulses of sound. The low rate at which the pulses follow one another creates the effect of a very low-frequency tone.

Various creaks, groans, and sounds of ropes rubbing are heard, particularly near the end of this band. These noises are from the *Twilight*, the sailboat towing the hydrophones. They must be typical of the sounds that a whale hears as a sailboat passes nearby.

In fact, the *Twilight* is an unusually quiet sailboat. The Paynes found that their early recordings were cluttered with bangs and bumps that synchronized with the rolling of the ship. They found that even the tiniest item free to roll slightly in its place on the ship could create noises that carried through the sea to the hydrophones. Even ropes slapping against the mast produced distinct noises on the recordings.

"We spent hours hunting down various bumping noises," says Dr. Payne. "We wedged small items—batteries, cans of oil, and so on—into place until finally only one loud bang could still be heard. It occurred only in rough weather and was clearly synchronized with the roll of the boat. We searched from stem to stern, but could find nothing that was not secured. At last, one day we discovered that the rudder stock was slightly loose in its housing. As each wave rolled beneath us and tipped the boat, the stock swung from one side to the other of its housing like the clapper of a bell, causing the bang. We had to learn to live with this sound. You will hear the bang of the loose rudder stock on this recording, because the day on which the recording was made was very rough."

Band 4 — Distant Whale

These lovely, mysterious sounds are probably from a very distant whale. There is also an interesting, high-pitched tone that comes from the "singing" of a far-away ship's propeller. Acoustic engineers use the term "singing" to describe a constant loud note produced by the resonant vibration of some propellers. Other propellers, of only slightly different design, do not "sing." Propeller making is a subtle art, and the phenomenon of "singing" is one of its more obscure aspects. Trial and error remains the best method of building a quiet propeller, though we are beginning to understand some of the conditions that cause the noise.

Side II — Three Whale Trip

There are three Humpback whales singing at various times on this recording. There is also a lot of ocean noise. The winds had been strong the day before this recording was made and during the recording day the sea was still running high. Both of the *Twilight*'s hydrophones were located near the ocean surface, where wave noise is loudest. After a few moments of listening, however, you will learn to hear much as a whale probably does, ignoring the background noises and focusing on the whale songs.

Dr. Payne made this recording from a sailboat near Bermuda during his studies of the Humpbacks there. "We found one spot," says Dr. Payne, "where the sounds of whales blended in a very lovely way. We occasionally stopped there to listen while on our way to make recordings at other locations. The Three Whale Trip was recorded at that favorite listening spot on an occasion when the whales sang all day and all night. We have deleted some repetitive sections. The material on the record is actually made up of four separate sections of our original recording spliced together. You will gain some idea from this side of the variety of whale sounds.

"As you listen to this record, I wish only that it could convey to you the pleasant circumstances under which we made it. Through the whole night we listened to the whales, taking turns at the headphones in the cockpit, lulled by the smooth rolling of the boat. Far from land, with a faint breeze and a full moon, we heard these lovely sounds pouring out of the sea."

Although there is no way to bring you the sensations of that Bermuda night on a sailboat, we have found that the use of stereo headphones comes the closest to creating the beautiful, mystical mood that Dr. Payne describes.

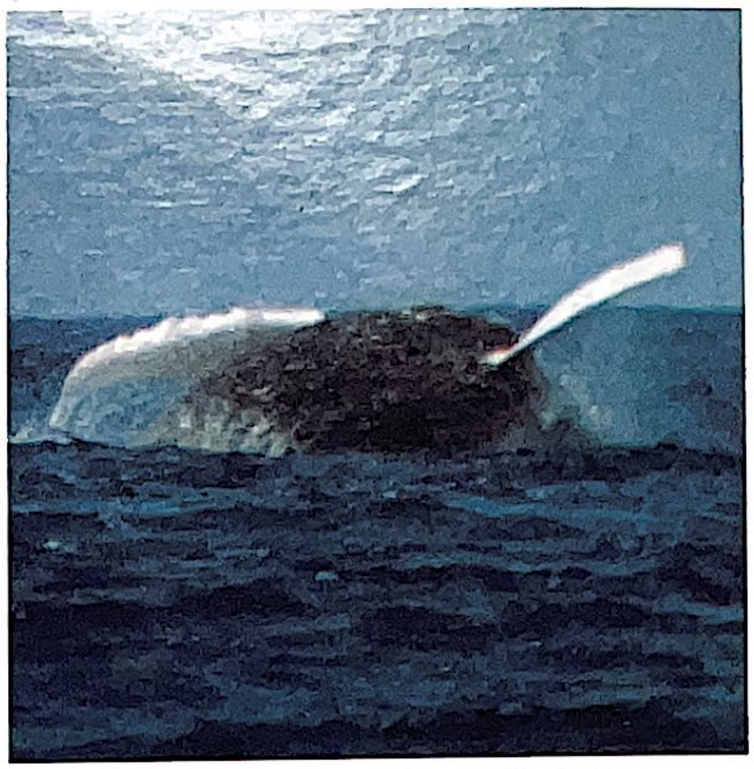
The spacing between grooves has been widened at two points on this side of the record. Although the sound remains continuous, these grooves will help you to locate two interesting points in the recording. The first indicates a place where you can hear a whale exhale. Such recordings are rare. This breathing sound was made by a whale passing very close to the boat. This whale apparently did not take part in the singing.

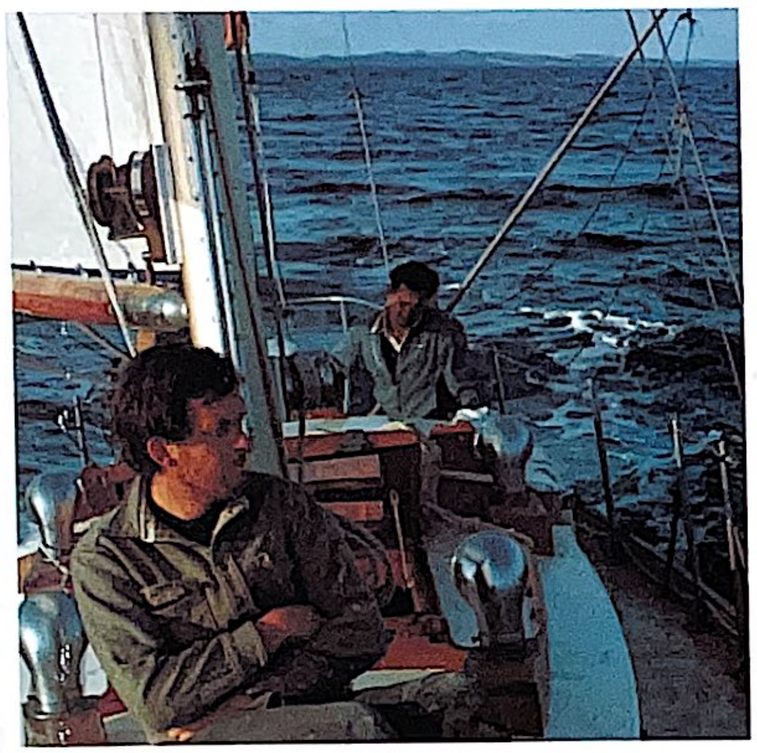
The second wide groove indicates a moment where a lovely flutelike sound is produced by a distant whale. Another whale is making louder cries nearby, but listen more particularly to the distant one. "We seldom heard its call," says Dr. Payne, "but it is perhaps the loveliest whale sound I have yet encountered."

As you listen, you may notice a strange effect, particularly on the higher notes. A cry is heard softly at first; a moment later exactly the same sound repeats itself much louder. The first cry is probably traveling directly to the boat. The sound ray moves just beneath the surface and is soft because much of the sound energy has been deflected downward through the water. The second repetition is probably caused by sound rays reflected from the bottom and traveling directly to the shallow hydrophones on their first bounce. Because of the peculiar acoustics of this location, we have the unusual situation of an echo that is louder than the original sound.

The title of side two refers to more than the day's trip on which the recording was made or the voyage of the three whales who paused off Bermuda to sing that day. By playing on the slang meaning of the word "trip" as a mental voyage, this title also acknowledges what has been discovered time and again by people who have listened to the whales sing: the songs produce an extraordinary inner experience for anyone who lets them into his mind.

The songs seem to have a universal appeal. Dr. Payne has played whale songs for many thousands of people in a wide variety of circumstances—at lectures throughout the United States and elsewhere, at the home of influential statesmen with guests invited to hear the songs; in the living rooms of performing artists; at colleges; in concerts; in a dozen other situations—and always, whatever the occasion, the people who listened have been affected, often profoundly moved, by the songs. Folk singers have begun to sing about whales. Works of orchestral music have been composed with whale songs. Finally, through art forms and through television, radio, newspapers, magazines, lectures, and meetings of all kinds, people have begun to tell each other that the magnificent whale, now in peril of virtual extinction, must be saved. The world is "turning on" to whales.





DR. ROGER S. PAYNE, whose work produced this record and forms the basis of the accompanying booklet, has spent the last fifteen years doing research in biological acoustics and is currently at The Institute for Research in Animal Behavior operated jointly by the New York Zoological Society and The Rockefeller University. His studies began with work on the directional sensitivity of the ears of bats, which he did while still an undergraduate at Harvard University. He later received his doctorate in biology from Cornell University for brilliant work on the ability of owls to find their prey in complete darkness by hearing. He then did equally important work on moths, discovering their ability to judge the direction of bat sonar and thus evade capture. When asked how he reached the decision to do research on whales Dr. Payne replied, "The decision reached itself really. It was something I had wanted to do for a long while. Certainly, I wasn't first led to it through any particularly inspiring encounter with whales. I've had any number of wonderful days among wild whales since, but at the time I decided to study whales I hadn't even seen one. In fact, the first whale I did see was a dead one and the encounter was anything but inspiring.

"I was working in a laboratory at Tufts University one March night during a sleet storm when I heard through the local radio news that a dead whale had washed ashore on Revere Beach. I wanted to see it so I drove out there. The sleet had turned to rain when I reached the place. Many people had come to see the whale earlier but there were only a few on the beach when I arrived and by the time I reached the tidal wrack where the whale lay, the beach was deserted.

"It was a small whale, a Porpoise about 8 feet long with lovely subtle curves glistening in the cold rain. It had been mutilated. Someone had hacked off its flukes for a souvenir. Two other people had carved their initials deeply into its side, and someone else had stuck a cigar butt in its blowhole. I removed the cigar and stood there for a long time with feelings I cannot describe. Everybody has some such experience that affects him for life, probably several. That night was one of mine.

"At some point my flashlight went out, but as the tide came in I could periodically see the graceful outline of the whale against the white foam cast up by the waves. Although it is more typical than not of what happens to whales when they encounter man, that experience was somehow the last straw, and I decided to use the first possible opportunity to learn enough about whales so I might have some effect on their fate."

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