

## **Guest Editorial: Monachus in Memoria**

by Keith Ronald. Reflections on a quarter century of monk seal conservation.

## **International News**

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## **Cover Story: When Fishermen Save Seals**

by William M. Johnson & Alexandros A. Karamanlidis. Why the artisanal fishers of the Mediterranean are beginning to save monk seals in order to save their own fragile livelihoods.

## **In Focus: Final Millennium for the Caribbean monk seal**

by Gail Swanson. A Florida Keys historian reflects on the Caribbean monk seal's lethal encounters with European explorers and native Indians.

## **Perspectives: Surf's Up, Live! Maui on less than \$500 a day**

by William M. Johnson. Snapshots and outtakes from the 13th Biennial Conference on the Biology of Marine Mammals, Maui, Hawaii.

## **Monachus Science:**

**Kompanje, E.J.O., H. Güçlüsoy & P.J.H. van Bree.** Insufficient calcium intake as a possible cause of osteoporosis in an adult female monk seal *Monachus monachus* from Çesme, Turkey.

**van Bree, P.J.H. & A. Panou.** Do monk seals eat aborted fetuses?

**Baird, R.W.** High levels of human interaction with a Hawaiian monk seal on the island of Maui.

**Karamanlidis, A.A.** Monitoring human and Mediterranean monk seal activity in the National Marine Park of Alonnisos and Northern Sporades, Greece.

## **Letters to the Editor**

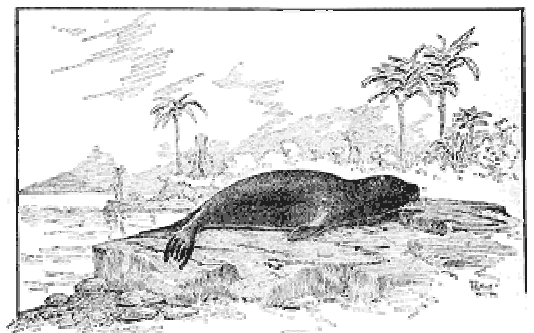
including Monk Seals in the Main Hawaiian Islands by Thea Johanos.

## **Recent Publications**

## **Publishing Info**



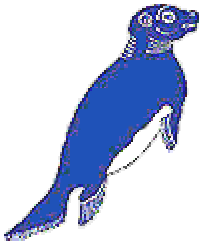
Cover Story: A young monk seal in the Aegean experiences the perils of entanglement in the nets of its traditional enemy.



In Focus: An early victim of European arrivals to the New World, the Caribbean monk seal has probably lived its final millennium



Monachus Science & Letters to the Editor: Why monk seals on the main Hawaiian Islands are posing a serious dilemma for researchers and conservationists



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## Guest Editorial

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### MONACHUS IN MEMORIA

Keith Ronald

The helicopter did its dragonfly-like approach to the ancient wharf, probably a wharf that had seen Phoenician, Italian, Turkish, German, Lydian, and British ships disembark their armies, but never a dust-spinning-siesta-disturbing improbable machine of this da Vinci design. The one advantage in sending several hundred years' dust into the previously blue sky was that the villagers presented themselves and commented on the "trellos" or "crazy" that emerged.

The questions we asked did not relieve their suspicions that the world must really be mad to come in such a machine and in the peak of heat (as high as 140° F in the sun), but the die was cast and curiosity brought them to the "trellos" and his diminutive pilot. This was Leros, this was 1971, and the hunt was on for *Monachus* using modern weapons of discovery.

Eight years before a subarctic biologist, "trellos" had walked on water delving into the then secrets of pagophilic seals... he was now in Greece on the island of Rhodes. A rusty Volkswagen cabriolet had dragged itself and us through the Valley of Butterflies (now better called the Valley of the Tourists — and thereby hangs the theme of extinction), over the top of the mountain. Here we took coffee with a solitary monk in an isolated monastery, who upon learning what I did for a living suddenly became inspired not with John the Divine and his Revelations experienced on nearby Patmos, but rather with his description of the water dog with whiskers, that lived on the beach at nearby Monolithos.

The scent became hot. This was real life, not like the stuffed monk seal and seal trap in the museum in Monaco and the rather dreadful harbour seal that gazed plaintively out of its 3rd floor prison, or the last captive monk seals, one in Lisbon, one in the old and crumbling Rhodes aquarium.



Monolithos was not to be visited for another two years, but the three days in Lindos led to an ever-expanding search for this monk-like seal. This initiated an attempt to help it overcome the human invasion of its lands — the beaches and coasts of first the Dodecanese and then later the wider

Mediterranean, the Black Sea, and the NW coast of Africa (a coast that soon took its toll of friends of *Monachus* by killing the investigators with a land mine).

The long 25 years of talking to fishermen, harbour masters, government officials, operators of isolated diesel electric plants on almost one hundred islands, and NGOs went by in a blur. Few were memorable, although the names of Yeroulanos, Morianos, Boutos, Zagorianos, Johnson, Lavigne, Duguy, Sevel in Istanbul, the deputy minister of environment in Ankara, the Turkish born Canadian Berkes and many, many others still bring back memories of frustrated cooperation on both sides. The French wife of the *Nomarchis* [regional governor] of the Dodecanese, jabbing the leader of the Junta with her handbag to remind him that the monk seal needed help — yes, there were some great moments.

Our odyssey moved from badly bent VW's to International Conferences filled with great hope and extreme platitudes. Even archbishops pledged their allegiance to the cause, but nature and human development and greed moved on.

Newsletters became the new vehicle of communication, with at least 15 countries sending us reports (sadly almost all of decreasing or no longer viable populations).

Some, like the former Yugoslavia, generated enough interest for a flying visit and showed without doubt that the whole coastline was one for the seal. Unfortunately, the tourist destruction had preceded us. Later, of course, inhumanity moved from seal to human, and continues still.

We returned every year to Greece and Turkey. Over 17 years, using helicopters and a Samos-built caique, we visited every beach, cave, and high cliff offering isolation to the seal. These were plotted on charts that hopefully still exist in the map collections of universities and under old blankets in storerooms. This survey, which even included the work of two honeymooning research assistants who drove around the Mediterranean, led to a statement that in the Sporades, Cyclades, and Dodecanese and the nearby Turkish coasts there existed endangered birds (reported to the Smithsonian) and enough room for many thousand seals.

Why weren't they there? The beaches were impregnable from land and the caves were usually unused. The answer can be clearly seen in Lindos where, after The National Geographic declared it one of the most beautiful places in the world, 10-15 busloads of tourists then arrived daily, proving they were right.

On the beaches where the seals once bred, people do.

The film *Mediterraneo* is a classic and shows the Greek passively overcoming the Italian invader. This is a very interesting visual document filmed on Kastellorizo, the easternmost island in the Aegean archipelago. In 1968 we landed a helicopter on the wavering dock of the island, and the occupants were so isolated and so poor we had to siphon jet fuel to take a boat to the cave of "Foca". This cave has a very low entrance which can only be entered when the sea is calm, and expands internally to make the Blue Grotto of Capri look like a small hovel. This was an important annual breeding site for *Monachus*.

Three years ago a return visit to Kastellorizo and a simple enquiry as to the cave's status, immediately produced a large Grand Raid Mark III Zodiac, with an overpowered motor. In 20 minutes we had entered the grotto, now effectively rendered lifeless by the sign above its previously very well hidden entrance: **"DO NOT ENTER. SEAL CAVE"**!

We found no trace of *Monachus* and later, during a few hours of conversation, we heard of the daily income now derived from taking "visitors" to see the seal cave. Sadly, we also heard that no one had seen a seal there for 5 years.

Kastellorizo lies within 1.5 kilometres of Turkey and its once unpopulated coastline. In the last decade Kas and Kalkan and similar nearby small ports have become massive marinas, providing all those luxuries that boaters expect, including diesel-laden waters, roads cut where no roads could possibly exist, and income generating throngs of Turkish and foreign visitors. Turkey has risen as the new Tourist Colossus.

The home of Saint Nicholas [near Finike in the Turkish Mediterranean] is no longer isolated but swamped by boats and beach dwellers. The "Death Sea" where we once anchored with only one other

boat to watch two seals haul out, now has cafés, tea houses, tourist huts and all of this without National Geographic saying it was the prettiest place in Turkey! The mountain *Baba Dag* and Strabo's burning phoenix look down on summer chaos. Where once the seal hauled out we have another example of the bludgeoning effect of the human species, a geometric breeder in a linear natural resource world.

What else do we have to remember? Madeira — which will perhaps become like the circles in a pond from a thrown stone, radiating seals to Flores and other islands.

The discrete western Saharan colonies might also spread out and survive — to the Cape Verdes, for example, although coral reef specialists diving there have seen nothing so far. The problem is we know almost nothing about the species' needs, either nutritionally, or its minimum interactive population size. Will the breeding behaviour be activated by a colony of 10 animals, 50 animals or will we need 100s to establish a surviving species? If the group size is inadequate, the species is lost. In 25 years of searching for this animal I have seen 7 free swimming individuals, and two of those at one time — surprisingly enough in the boat-choked harbour of Rhodes, and small boys were throwing broken Hellenistic stones at those.

Perhaps seeing the breeding herds of hundreds of thousands of harp seals on the ice floes has spoiled me. Can I still expect reproductive returns from a few *Monachus*?

This leads me to Antibes, and the proposal that called for monk seals to be live-captured in Mauritania/western Sahara and transported to an aquarium in southern France. This was blocked by hard-nosed science — and for good reason. We have no way of knowing if it would have produced a single pup. We do know that disturbing the largest remaining colony in the world could well have broken the bond that holds them in those wave washed caves, and broken the breeding cycle of one of our last hopes. Captive breeding has never been a substitute for proper protection of a natural colony and we saw no indication that France wanted to help the Islamic Republic of Mauritania develop a strong support program for the almost mythical *Monachus*.



Let us return to the present — what do we actually know from the work of French, Turkish, British, Greek, Spanish, German and Canadian research workers? Scientifically little. Politically, the Blue Plan, together with other efforts associated with UNEP's Mediterranean Action Plan, has just degenerated into a somewhat off-colour joke. Research is sporadic, and what does exist has been mainly driven in recent years by the personal conservation interests of people like Hoffman, Mursaloglu, Harwood, Johnson, Lavigne, IMMA, IFAW and Sadruddin Aga Khan. Apart from some wall papering by the Council of Europe, IUCN and WWF — whose fingers seem to enter into every pie — and a few lay individuals who have great drive, intense interest but lack funding or coordination, there is very little else. Any thought that say, Syria, Lebanon and Israel might pull together to establish a survival and recolonisation plan for *Monachus* verges on the absurd.

If we look at the Hawaiian Islands chain, we can at least say that monk seals still survive there. Despite recent clashes between conservation and economic interests, the one thing that may save that species is that the USA is not at war with itself (or only in pre-election times, or over handguns).

The seal is therefore in the territory of one country. Whether the U.S. will capitalise on this obvious advantage remains to be seen.

Finally, the example we all look to as being an indication of life after death — the Caribbean monk seal, officially declared extinct in 1996. Recent visits to its historical habitat in Cuba have not produced a single sighting since a vague one 16 years ago. Belize is scuba dived like a Swiss cheese, the Turks and Caicos face a similar tourist invasion, and the Virgin Islands have all lost their maidenheads to the casual boater.

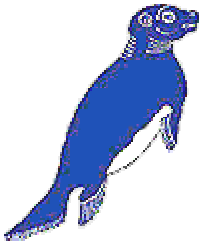
It is almost impossible to escape the conclusion that we are now at the terminal point. There are no hidden populations of *Monachus*. What we see is what we've got — and frankly, it is not much. In twenty-five years of casual to intense investigations, I believe I can state one thing we have with absolute certainty: "Not one more Mediterranean or Caribbean monk seal than we had when I first met that monk in the monastery on Rhodes."

As for his Monolithos, from above it still presents a picture of sheer beauty, with a Süleyman-battered but spectacular crusader castle. The breeding islets of the highly endangered birds are still there, still unrecognized. Looking down to the beach several hundred metres below, we see the antennae of a tourist village built by a German group.

But not one living *Monachus*.

**Professor Keith ("trellos") Ronald, March 30<sup>th</sup> 2000**

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## International News

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### Tourism continues to hound Mediterranean monk seals

Statistics released by the World Tourism Organization (WTO) in Madrid suggest that mass tourism will continue to harass and deprive the Mediterranean monk seal of habitat — while paying only lip service to the plight of Europe's most endangered marine mammal.

According to the WTO's champagne-popping report, *Tourism Highlights 2000*, international tourism grew by 3.2% last year, generating \$455 billion.

Countries in the western Mediterranean fared particularly well, with international arrivals to Spain and Morocco growing by 9% and 22% respectively. In the eastern Mediterranean, tourism in Greece grew by an impressive 5%. Greece attracted almost 11.5 million tourists (up from 10 million in 1997), while Turkey's influx fell from 9 million in 1997 to 6.8 million in 1999, largely due to earthquake scares.

The mass tourism industry has been implicated in the extinction of *Monachus monachus* in several geographic regions, including Spain, France, Corsica, Italy, Sardinia and Croatia. It continues to be a clear and present danger to the survival of the species in Cyprus, Greece and Turkey.



Monk Seal habitat on Sardinia

While the champagne may be flowing at WTO headquarters over the current tourist boom, there is also a growing sense of indignation that grassroots conservation organizations, understaffed and under-funded, are actually subsidising this powerful, money-spinning industry by setting up protected areas, guarding monk seal refuges and distributing information to the public. Although international conferences and intergovernmental institutions such as the United Nations have consistently urged the tourism industry to meet its obligations towards the Mediterranean monk seal, it has so far conspicuously failed to do so.

Despite projecting a green image and scrupulous environmental credentials, the London-based [World Travel and Tourism Council](#) (WTTC) — the industry's business leaders forum — has declined to comment on the issue, despite several requests.

Meanwhile, the World Tourism Organisation has released a Global Code of Ethics for Tourism, which implicitly recognises the industry's impact on biodiversity. The Code states:

"Tourism infrastructure should be designed and tourism activities programmed in such a way as to protect the natural heritage composed of ecosystems and biodiversity and to preserve endangered species of wildlife..."

To put the financial issue into some perspective, Greece saw its receipts from international tourist arrivals swell to \$5.4 billion last year, while Turkey generated \$5 billion. These figures, of course, do not touch upon profits generated by international corporations, nor on domestic receipts. Regardless, it

is perhaps a measure of the industry's attitude towards the species that it is so relentlessly driving into extinction, that funds cannot be found for guards and boats to patrol monk seal refuges.

As reflected in this issue's [Letters to the Editor](#), increasing numbers of readers are voicing their indignation over this state of affairs.

The Monachus Guardian will continue to explore tourism's threat to the Mediterranean monk seal in future issues.

In the meantime, for further information and in-depth analysis, please turn to:

[Aga Khan, Sadruddin](#). 1999. Guest Editorial: A little imagination. Why the billion dollar mass tourism industry should do something to save the Mediterranean monk seal. The Monachus Guardian 2(2) November 1999.

[Johnson, William M. & David M. Lavigne](#). 1999. Mass tourism and the Mediterranean monk seal. The role of mass tourism in the decline and possible future extinction of Europe's most endangered marine mammal, *Monachus monachus*. Monachus Science. The Monachus Guardian 2(2) November 1999.

[Johnson, William M.](#) 1998. Monk seal myths in Sardinia. The Monachus Guardian 1(1): May 1998.

[Savas, Yalcin](#). 1999. The Monachus Guardian 2(2): November 1999. How tourism has ruined the coastal habitats of the monk seal on the Bodrum Peninsula, Turkey.

**Tip:** For other tourism-related articles and news items, try The Monachus Guardian's automated [Search](#) function.

### Hot off the presses



Highlighting mass tourism's clear and present danger to the Mediterranean monk seal, Volume 2 of The Monachus Guardian is now hot off the presses. The hard copy version, intended primarily for decision makers, libraries and those unable to access the Internet, incorporates the May and November 1999 issues. The publication is made possible by the generous financial support of the [Humane Society of Canada](#) and the [Ark Angel Foundation](#).

Those wishing to be added to the mailing list should write to [IMMA Inc.](#) or contact the Librarian: [librarian@monachus.org](mailto:librarian@monachus.org).

### Blushes all Round



In January 2000, Monachus.org received an Internet Guide Award from Britannica.com, the Internet branch of Britain's prestigious Encyclopaedia Britannica. Britannica editors cited the Monachus.org site as "one of the best on the Internet when reviewed for quality, accuracy of content, presentation and usability." Congratulations to our many contributors who have made this possible.

### Readership Soars

Meanwhile, Monachus Guardian readership online has reached over 1000 people a week, with a peak of 1500 observed during the November publication period.

### One Last Chance

In a January 2000 press release issued in Brussels, the World Wide Fund for Nature (WWF) named the Mediterranean monk seal as among 10 species most in danger of extinction within Europe. The monk seal was joined by the Iberian lynx, the brown bear, the harbour porpoise, the loggerhead turtle, the freshwater mussel, the Atlantic salmon, the marsh fritillary butterfly, the lady's slipper orchid and the Corncrake.



In issuing the press release, the WWF was seeking to pressure EU member states into more effective enforcement of the languishing EU Habitats Directive.

"Every endangered species in Europe is supposed to be protected under an excellent European nature conservation law agreed in 1992," Tony Long, Director of WWF's European Policy Office was quoted as saying. "But the nations of the European Union have broken every deadline for putting the law, the Habitats Directive, into practice."

The full text of the WWF press release is available in the [Monachus Library](#): WWF. 2000. Last chance for Europe's endangered species.

### Few monk seals in Cork

Contrary to expectations, the 14<sup>th</sup> annual conference of the European Cetacean Society (ECS), which convened in Cork, Ireland in early April, saw only one paper on Mediterranean monk seals. Following a rather more substantial showing a year earlier in Valencia, where monk seals were discussed as part of a workshop on seal movements, it was hoped that *Monachus* might become a regular fixture in ECS proceedings. This time, however, monk seals were represented only by Rosa Pires and Henrique Costa Neves in the Critical Habitat session, with a report on sightings on open beaches in the Desertas Islands reserve of Madeira (see [Recent Publications](#)).

### Searching? Click here



A powerful new search engine built by Excite has been added to Monachus.org, giving an extra helping hand to students and researchers. Choosing **Local Search** will find keywords in documents throughout Monachus.org, while **Internet Search** will take advantage of Excite's capabilities throughout the World Wide Web.

Entering keywords into the Search dialogue box will now generate a far more comprehensive list of articles, reports and news items than previously. Results are hotlinked, allowing instantaneous access, and are prioritised according to relevance.

Advanced, customised searches are also provided for. Check out **Help on searching** for tips.

### Be careful what you wish for

The idea of launching a dedicated monk seal discussion forum has been raised in these pages before, and has been regarded as everything from a stroke of genius (furthering international information exchange) to a white elephant (a techno gimmick that everyone is too busy to use).

While IMMA Inc. cannot claim to have launched an Internet forum exclusively for Monachus, it has recently started-up **Coda @ Marinemammal.net**. As the name implies, this moderated discussion forum focuses on all matters relating to marine mammal science and conservation — including issues concerning monk seals. If you have a question to ask, a statement or observation to make, check out [www.marinemammal.net](http://www.marinemammal.net).

### The numbers game

Thousands of islands, inaccessible coastlines, and a species that shies away from human contact have all conspired to make population estimates for the Mediterranean monk seal an extraordinarily inexact science. Partly because of their own tendency to err on the side of caution, historically, biologists have consistently underestimated the numbers of monk seals populating the Mediterranean. Conversely, errors can also creep into population estimates when biologists rely on old data. On more occasions than the authors would probably care to remember, this has resulted in monk seal colonies being placed in areas where they have been extinct for many years. The only thing that can be said with any degree of certainty is that the Mediterranean monk seal remains critically endangered, and that its range has shrunk dramatically over the last 50 years.



At the risk of continuing the tradition of pulling numbers out of a hat, we present the following updated population estimates, based on various sources. It should be remembered that question marks hang over monk seal abundance in most of these regions and countries. As such, these figures should be treated with caution.

| <b>Mediterranean monk seal population estimates</b> |                   |                  |
|---|-------------------|------------------|
| area  | regional subtotal | area total       |
| <b>Black Sea</b>                                    |                   | <b>0 – 5</b>     |
| Bulgaria  | 0                 |                  |
| Georgia   | 0                 |                  |
| Romania   | 0                 |                  |
| Russia  | 0                 |                  |
| Turkey  | 0 – 5             |                  |
| Ukraine   | 0                 |                  |
| <b>Eastern Mediterranean</b>                        |                   | <b>260 – 320</b> |
| Albania   | 0                 |                  |
| Croatia   | 0 – 5             |                  |
| Cyprus  | 5                 |                  |
| Egypt   | 0                 |                  |
| Greece  | 200 – 250         |                  |
| Israel  | 0                 |                  |
| Lebanon   | 0                 |                  |
| Libya   | 5 – 10            |                  |
| Slovenia  | 0                 |                  |
| Syria   | 0                 |                  |
| Turkey  | 50                |                  |
| Yugoslavia  | 0                 |                  |
| <b>Western Mediterranean</b>                        |                   | <b>15 – 30</b>   |
| Algeria   | 10 – 20           |                  |
| France & Corsica                                    | 0                 |                  |
| Italy & Sardinia                                    | 0                 |                  |
| Malta   | 0                 |                  |
| Morocco   | 5 – 10            |                  |
| Spain   | 0                 |                  |
| Tunisia   | 0                 |                  |
| <b>Atlantic</b>                                     |                   | <b>104 – 175</b> |
| Azores (Portugal)                                   | 0                 |                  |
| Canary Islands (Spain)                              | 0                 |                  |
| Cape Verde Islands                                  | 0                 |                  |
| Gambia  | 4                 |                  |
| Madeira (Portugal)                                  | 21                |                  |
| Mauritania  | 2                 |                  |
| Morocco   | 0                 |                  |
| Senegal   | 0                 |                  |
| western Sahara                                      | 77 – 148*         |                  |
| <b>TOTAL</b>  |                   | <b>379 – 530</b> |

\* Mean estimate: 103 (95% CI: 77 - 148) (Forcada, Hammond & Aguilar 1999).

#### Sources

**Aguilar, A.** 1998. Current status of Mediterranean monk seal (*Monachus monachus*) populations. Meeting of experts on the implementation of the action plans for marine mammals (monk seal and cetaceans) adopted within MAP. Arta, Greece, 29-31 October 1998. UNEP, Athens: 1-34.

**Forcada, J., Hammond, P.S. and Aguilar, A.** 1999. Status of the Mediterranean monk seal *Monachus monachus* in the western Sahara and the implications of a mass mortality event. Marine Ecology Progress Series 188: 249-261.

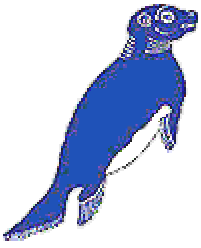
**González, L. M.** 1999. Update on the situation of the Mediterranean monk seal (English translation). *In*: Convention on the Conservation of Migratory Species of Wild Animals. Scientific Council of the Convention on the Conservation of Migratory Species of Wild Animals. 9th Meeting, Cape Town, 4-6 November 1999: 1-16 + 6 maps.

**Johnson, W. M. (ed).** The Monachus Guardian. [www.monachus.org](http://www.monachus.org).

### **Sayings of 3000 Years**

Due to space limitations in the hardcopy version of The Monachus Guardian, our previously-announced article, reproducing the most memorable quotations on Mediterranean, Hawaiian and Caribbean monk seals, has been postponed until our Millennium issue in November. We thank all those contributors who have submitted their favourite lines from the past, and apologise for any inconvenience. On the plus side, our postponement allows more time for additional contributions. Nominations, from classical antiquity to the present day, may cover any subject relating to monk seals, their study or conservation. Quotations may be profound or insightful, sad, amusing or even absurd. Please contact the [editor@monachus.org](mailto:editor@monachus.org). Unless otherwise stipulated, the names of contributors will be credited at the end of the article.

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## Hawaiian News

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### Maui Conclave

For our report on the Society for Marine Mammalogy's 13th Biennial Conference on the Biology of Marine Mammals, turn to Perspectives: [Surf's up, Live! Maui on less than \\$500 a day.](#)

### NMFS policy on trial

Acting on behalf of the Greenpeace Foundation, the Center for Biological Diversity, and the Turtle Island Restoration Network, the Earthjustice Legal Defense Fund filed a lawsuit in federal district court in Honolulu on 26 January against two government agencies. The action was prompted by growing concern over overfishing pressures in the Hawaiian Islands National Wildlife Refuge, and starving monk seals on French Frigate Shoals (see [The Old Woman Who Swallowed the Fly](#) and [Native Hawaiians Speak Out](#)).

The three conservation groups are suing representatives of the National Marine Fisheries Service (NMFS) and the Department of Commerce for violating the Endangered Species Act and the National Environmental Policy Act. The lawsuit alleges that, in failing to properly manage Hawaii's lobster and bottomfish fishery, the agencies are jeopardising the survival of the monk seal.

The US Marine Mammal Commission has repeatedly urged NMFS to ban lobster fishing around the monk seal's breeding colonies.

On 24 February Earthjustice lawyers introduced a motion to court seeking a preliminary injunction preventing the commercial lobster fishery in the Northwestern Hawaiian Islands from opening this year. The motion cited new scientific evidence linking the lobster fishery to the monk seals' decline. The plaintiff's case has been bolstered recently by the Hawaiian Monk Seal Recovery Team — a group of scientists selected by NMFS to further the study and conservation of *Monachus schauinslandi* — which in January also called for the fishery to be closed.

'At the beginning of the 1994 season, NMFS announced a quota of 200,000 lobsters for the Crustacean Fishery. After the season was underway, NMFS concluded that its quota had been far too high, that a properly protective quota was only 20,900, and that the season should therefore immediately be aborted. The fishery had already harvested 131,000 lobsters, however...'

'As NMFS acknowledged in its 1999 Program Review: "Recent studies have also identified a different potential interaction between the commercial bottomfish fisheries in the NWHI and the monk seal... [M]onk seals commonly dive to depths of 10-200m and forage on commercially valuable fish. It is possible that bottomfish (snapper, grouper, and jacks) are more important in the monk seal's diet than originally thought..."

**Extracts from:** Complaint for declaratory and injunctive relief; summons. Greenpeace Foundation, Center for Biological Diversity and Turtle Island Restoration Network (Plaintiffs) versus William M. Daley, Secretary of the United States Department of Commerce and Penelope D. Dalton, Assistant Administrator of the National Marine Fisheries Service. The full text of the legal complaint is available in the [Monachus Library](#): Earthjustice. 2000b.

Contacted by The Monachus Guardian, NMFS declined to comment on the lawsuit until such time that it can fully determine its strategy towards the legal offensive.

The full text of the Earthjustice legal complaint, and press releases, can be accessed in the [Monachus Library](#): [Earthjustice 2000a](#) / [Earthjustice 2000b](#) / [Earthjustice 2000c](#).

### **Marine Mammal Commission sees overfishing as culprit**

The Marine Mammal Commission's recently-released Annual Report to Congress for the year 1999 supports the contention that the monk seal colony at French Frigate Shoals has been plummeting due to overfishing pressures. Over the past decade, the Commission states, almost no pups have survived to breeding age at French Frigate Shoals. Evidence to implicate decreased prey availability includes starving and emaciated pups, nursing females smaller and thinner than at other colonies, and a delay in the average age of first reproduction to 11-12 years of age.

"The monk seal decline at French Frigate Shoals," the report declares, "started shortly after commercial lobster fishing began in the Northwestern Hawaiian Islands early in the 1980s. Most fishing was concentrated at three banks in the eastern end of the chain (Necker Island, Maro Reef, and Gardner Pinnacles) east and west of French Frigate Shoals. Based on analyses of monk seal scat and spew samples, monk seals are known to eat lobsters as well as small reef fish, octopuses, and crabs. The relative importance of different prey items is difficult to assess from scat samples and, although lobsters were a small proportion of prey items identified in scats, the Commission became concerned that lobsters could be important prey items, especially for young seals. Studies of other pinnipeds have found that, as young seals mature, their diets shift from crustaceans to fish, and it seemed possible that young monk seals learning to feed could depend more on lobsters for food than adult seals (*e.g.*, slow-moving lobsters may be somewhat easier to catch than fish for young seals with poorly developed foraging skills)."

An added cause of concern is that octopuses, crabs and small reef fish are taken as a bycatch of the lobster fishery, reducing food supply still further.

As in previous years, the Commission reiterates its view that the NMFS should impose an immediate moratorium on commercial lobster fishing at all major atolls supporting monk seal colonies, including French Frigate Shoals (see [The Old Woman Who Swallowed the Fly](#), TMG 2:1). It points out that NMFS was first advised to close the fishery in 1994, pending further research on the dietary needs of monk seals, but that no steps were ever taken to implement its recommendations.

In rejecting the Commission's repeated appeals, NMFS continues to assert that there is insufficient evidence to implicate the lobster fishery in the monk seal's decline.

This is in spite of new findings on the diet of the species, based on analysis of prey fatty acid signatures in monk seal blubber samples. Preliminary results (presented at the 7-8 December 1999 Hawaiian Monk Seal Recovery Team meeting) have "revealed that lobsters probably constitute a significant percentage of the diet of most juvenile and adult female monk seals at French Frigate Shoals, but only a small proportion of the diet of adult male monk seals."



Sharks patrolling the shoreline along Trig Island, a Hawaiian monk seal pupping beach at French Frigate Shoals

On other issues, the Commission continues to express concern over entanglement in lost and discarded fishing gear, particularly ghost nets. Since the 1980s, the report reveals, NMFS field crews have observed more than 150 entangled monk seals. During 1999, 25 entangled monk seals were seen during expeditions to breeding sites. A limited NMFS diver survey during the winter of 1996-1997 estimated the presence of 94 net fragments per square kilometer, and more than 29,000 net

fragments in waters less than 10 meters deep at French Frigate Shoals alone. During 1999, about 25 tons of debris were removed from Lisianski Island and Pearl and Hermes Reef. Through the Department of State, the MMC and NMFS are attempting to kickstart international cooperation among Pacific Rim nations to counter the growing threat of marine debris.

In a development intended to reduce juvenile monk seal mortality, both the MMC and the NMFS appear to be supporting a controversial plan to selectively cull Galapagos sharks patrolling waters off pupping beaches at French Frigate Shoals. The MMC believes that shark predation on monk seals could be significantly reduced by eliminating the few sharks responsible, and without inflicting any discernible damage upon the atoll's ecosystem.

The MMC report is available in the [Monachus Library](#): **Marine Mammal Commission**. 2000. Hawaiian monk seal (*Monachus schauinslandi*). Pages 44-55 in Chapter III, Species of Special Concern, Annual Report to Congress, 1999. Marine Mammal Commission, Bethesda, Maryland.

#### **Fourth of July pup probably killed by boat**

Illustrating the perils of being a monk seal pup on the main Hawaiian Islands, a seal born on 4 July 1999 was found dead two months later by a kayaking couple on Kauai. They reported that they had discovered the jet-black pup floating dead in the surf. Closer examination of the animal revealed bleeding from the nose and mouth, and a badly damaged eye.

According to the Honolulu Star-Bulletin, the kayakers also reported seeing an inflatable speed boat circling nearby, as though the people aboard it were searching for something in the water. They later expressed their suspicion that the boat may have hit the seal.

Of late, monk seal pups have not fared well on Kauai. According to marine biologist Don Heacock of the State Aquatics Division, three out of four monk seals born on the island since 1989 have been found dead.

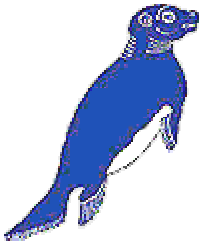
"Young seals have to learn survival skills," Heacock was quoted as saying. "An adult monk seal can outswim and outfight any tiger shark in the ocean but a young seal will just stop and look at it. Same thing with a boat. They don't know what it is."

The full Honolulu Star-Bulletin report can be found in the [Monachus Library](#): **Honolulu Star-Bulletin**. 2000a.

#### **EndQuote**

"SeaWorld San Antonio guests can observe the [Hawaiian monk] seals in their new home at SeaWorld's Seal and Sea Lion Community, adjacent to the Sea Lion, Walrus and Otter Stadium."

**SeaWorld San Antonio**. 2000. Highly endangered Hawaiian monk seals thriving at SeaWorld. SeaWorld San Antonio Press Release, January 10, 2000. [Available in the [Monachus Library](#)]



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## Mediterranean News

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[Albania](#) / [Bulgaria](#) / [Croatia](#) / [Greece](#) / [Madeira](#) / [Mauritania & Western Sahara](#) / [Turkey](#)

### Albania & Croatia

As reported in our last issue, the Mediterranean Monk Seal Group in Zagreb, and Aquarius in Tirana, have joined forces to produce sightings postcards, information pamphlets and educational colouring books for children. The Albanian-Croatian venture is being sponsored by The Regional Environmental Center for Central and Eastern Europe.

Now, thanks to these organizations, monachus.org is able to publish the English-language version of the educational book *Adriana and her family in the Mediterranean sea*. The book has been added to the [Monachus Library](#) (MMSG/Aquarius 1999), and is available as an Acrobat PDF file.



### Bulgaria

The Bulgarian Ministry of Environment and Waters is discussing the possibility of preparing a National Action Plan for the Mediterranean monk seal, reports Stefan Avramov of the Bulgarian Society for the Protection of Birds. Although the species is thought to be extinct in Bulgaria, conference resolutions and international agreements encourage governments to protect former monk seal habitat in the hope that the species might eventually recolonise such areas. In a parallel development, Avramov hopes to propose the region of Ropotamo and Maslen nos – once a favourite haunt of the monk seal – as a Ramsar site.

### Greece

#### Weak pup succumbs after rescue

Shortly before our last issue went to press, MOm announced that an orphaned monk seal pup had been reported to its Rescue and Rehabilitation Network from the Aegean island of Ikaria ([Stop Press](#), TMG 2:2). The alert reached MOm on 1 November, and the organisation wasted no time in dispatching a rescue team to the island ([Breaking News](#) 07/11/99).

The Ikarian resident who found the animal washed up on a beach near the village of Aghios Kirikos reported that he had seen the pup being battered about in heavy waves for about an hour beforehand.



Approximately three weeks old and still nursing, the male pup bore no signs of external injury. However, it was dehydrated and severely exhausted, having been without food for at least two days, following separation from its mother. It weighed in at just 11kg (the normal weight for an animal of its age is thought to be about 20 kg).

After administering first aid on site, the pup was taken to MOM's rehabilitation unit at Steni Vala on the Northern Sporades island of Alonissos. MOM's rehabilitation efforts have traditionally drawn on expertise from various sources, including the Seal Rehabilitation and Research Centre of Pieterburen, the Netherlands, Erasmus University in Rotterdam, and the Veterinary School of the University of Thessalonika.

Named 'Akritas' by MOM in honour of the remote island where it was found, the pup showed some initial signs of recovery. The animal, however, was found to be suffering from severe parasitism and anaemia.

On 9 November Akritas' health deteriorated, with the seal exhibiting respiratory problems and central nervous dysfunction. Despite intensive veterinary care, the pup died the following day.

The subsequent necropsy and analysis of collected samples (histological, virological, bacteriological, parasitological), performed in collaboration with Erasmus University in the Netherlands, provided evidence that the animal had suffered from an acute parasitic infection in the respiratory and gastrointestinal tract. A more prominent finding, however, was the animal's severe emaciation, characterised by skeletal muscle atrophy and complete absence of fat. – Eugenia Androukaki, MOM.

### **New research initiatives**

Two new research initiatives have recently been announced by MOM. Taking advantage of the organisation's monk seal sample bank, a collaborative effort with the University of Barcelona has been launched in order to study the genetic variability of the Greek monk seal population and to determine whether it is differentiated from the Atlantic population. The second cooperative effort involves the University of Bangor, North Wales, where a toxicological study will be performed in order to determine the level of heavy metals in monk seal blubber tissues.

### **Virus identified**

The recent identification of a virus that caused the death of an adult monk seal on the island of Psara in the Eastern Aegean in 1996, is regarded as having a potentially great significance for the Greek monk seal population.

Laboratory analysis has found that the virus belongs to the morbilli virus category. Viruses of the same category have caused mass mortality in other seal populations (*Phoca vitulina*) in the North Sea in 1988, in dolphins (*Stenella coeruleoalba*) in the Mediterranean in 1990 and 1992, and possibly in the



Mauritanian monk seal population in 1997. The specific virus identified in the Psara seal was similar to one that was detected in a harbour porpoise (*Phocoena phocoena*). Based on that evidence, it has been concluded that there is a possibility of viral transmission from cetaceans to monk seals, a fact unknown in the past. This may be an important factor to consider when planning and implementing conservation strategies for these species. The samples were analysed in the Laboratory of Virology of Erasmus University in Rotterdam. The results were published in the journals *Vaccine* (Osterhaus et al. 1998) and *Veterinary Microbiology* (Van der Bildt et al. 1999). – Vrassidas Zavras, MOm.

### Seals found dead

MOm's Rescue Team has already performed three necropsies in the current year, following alerts received from members of the organisation's Information Network:

1. On the island of Kefalonia (Ionian Sea), on 21 February. The dead animal was a juvenile male, 3 years old, and had died from natural causes.
2. On the island of Skiathos, on 20 April. The dead animal was a juvenile male, 2-3 years old. The cause of death could not be determined due to advanced decomposition of the carcass.
3. On the island of Samos on 24 April. The dead animal was a juvenile female, 1.5 years old. Death was due to entanglement in fishing nets. Entanglement appears to be a rare cause of death for seals in Greek waters and has been reported only for young animals (**Editor's note:** see [When Fishermen Save Seals](#), this issue). – Vrassidas Zavras, MOm.

### Guarding continues despite funding crisis

MOm is still awaiting a response to its international "call for help" that was issued after last year's EU decision not to fund monk seal conservation projects in Greece ([TMG 2:2 November 1999](#)).

Several efforts to secure funding for the current year have not borne significant results, leaving MOm facing project disruption and a severe budgetary shortfall.

Despite these upheavals, MOm's Board of Directors recently decided to continue guarding activities in the National Marine Park of Alonnisos & Northern Sporades. The project is implemented by a number of trained local guards, using the high speed boat *Alonnisos*, donated in part by the International Fund for Animal Welfare (IFAW) in 1991. On the alert for illegal fishing practices, tourism-related infringements and other prohibited activities, the *Alonnisos* is responsible for patrolling the Park's 2,200 km<sup>2</sup>, but pays particular attention to the core zone island of Piperi, regarded as one of the most important breeding habitats of the monk seal in the Mediterranean.



The *Alonnisos* on patrol in the Northern Sporades Marine Park

### LIFE-Nature: the end... or the beginning?

The final day of 1999 marked the completion of MOm's LIFE-Nature project: *The Mediterranean Monk Seal in Greece – Conservation in Action* (Monachus Guardian, passim).

The 3-year project chalked up some notable achievements:

- More than 120 Mediterranean monk seal shelters were located and mapped in all four project areas.
- Monk seal populations were monitored, allowing basic population estimates.
- Project sites were found to include important breeding habitats, in which 34 newborn pups were recorded.
- Marine and terrestrial environments were surveyed, allowing the status of habitats and species to be evaluated for possible designation as Natura 2000 protected areas.
- Human activities and development trends were recorded in each project area.
- Public awareness material was published and widely distributed to local inhabitants and visitors.
- A large scale Environmental Education programme was implemented in the schools of the project areas, which more than 5500 pupils attended.
- Four Information Centers and eight mobile exhibits functioned in the project areas.
- Integrated management plans for each area, including zoning and protection measures, and Specific Environmental Studies for the areas of Kimolos, N. Karpathos and NW. Zakynthos, were drawn-up and submitted to local, regional, national and European authorities.

These advances have set the stage for establishing the first Natura 2000 monk seal reserves. – Vrassidas Zavras, MOm.

### **Natura 2000 areas continue to attract support**

Despite its current financial handicap, MOm's long-term project to establish monk seal reserves under the Natura 2000 network continues to draw official support.

A case in point was the unanimous decision of the Municipality of Olympos, on the Eastern Aegean island of Karpathos, to endorse the establishment of a protected area. An extract of the council declaration reads:

"In Olympos today on the 24/11/1999... the Municipal Council unanimously...

- Emphasises the immediate need to conserve the natural environment as well as the cultural heritage of the area of Northern Karpathos...
- Considers that the most appropriate tool to achieve this goal is the declaration of the area as protected, with the designation *Olympos Eco-development Area*, based on the Law 1650/86 for the Protection of the Environment in Greece...
- Decides unanimously to support the proposals, conservation measures and the blueprint of the Presidential Decree that are included in the Special Environmental Study elaborated by MOm/Hellenic Society for the Study and Protection of the Monk Seal..."

Meanwhile, the Specific Environmental Studies (SES) have been positively received by the Ministry of Environment, leading MOm and other observers to believe that government action can be expected on the new protected areas with a minimum of delay. The recent appointment of the former Director of Greenpeace Greece as the acting Deputy Minister of Environment, is raising expectations of an expeditious process. – Vrassidas Zavras, MOm.

### **National Marine Park and Eco-development Area proposed**

As a consequence of the LIFE-Nature project, detailed proposals for the environmental protection and sustainable development of the four target areas were submitted to the authorities. Following the passing of relevant legislation, a Network of Special Conservation Areas will have been established in Greece, affording protection to some of the world's most important surviving monk seal colonies.

### Milos-Kimolos-Polyaigos-Antimilos

The establishment of a **National Marine Park** is proposed for the area of Kimolos-Polyaigos, where a significant number of monk seal breeding caves are located. These two islands hold all of the important natural characteristics that define the project area as a whole, while being less affected by human activities.

The **Kimolos National Marine Park** will include the islands of Kimolos and Polyaigos with the surrounding marine protection zone extending one nautical mile from the coasts of the two islands. Proposed conservation measures aim to regulate land uses and human activities, such as professional and amateur fisheries, boat traffic and construction works. Within the park area, marine and terrestrial zones with varying degrees of regulation have been designed (and are described in detail in the respective SES). It is proposed that these zones be declared "**Nature Protection Areas**", "**Areas of Special Fishing Regulations**", and "**Areas of Low Impact Tourism Development**".

In the same island complex, in the area of Kleftiko on the SW coast of the island of Milos, an additional "**Nature Protection Area**" is proposed, in order to secure the protection of this coast of great aesthetic value, where several monk seal shelters have been recorded. The respective proposals, included in the SES for the conservation of the endemic viper of Milos (*Macrovipera sweizerii*), primarily aim to control organized tour boats and coastal construction works.

### Karpathos-Kasos-Kasonisia

In this island complex, Northern Karpathos and the uninhabited island of Saria were identified as being most important for the monk seal. The area hosts many other rare and endemic species, and is also notable for its archaeological, historical and cultural features, thus offering considerable scope for the development of ecotourism.



Saria (under cloud), as seen from neighbouring Karpathos

It is here that the "**Olympos Eco-development Area**" is envisaged. Within this area, a number of marine and terrestrial conservation zones are proposed, including "**Nature Protection Areas**", "**Areas of Low Impact Development**", "**Protected Landscapes**" and "**Coastal Protected Areas**". Within these zones, varying degrees of regulation would be applied, aiming to control land use and human activities, such as construction works, opening of roads and visitor access.

### Samos-Ikaria-Fourni

In this island complex, two sites were considered as a priority for the Mediterranean monk seal: the area of Seitani and the Fourni islands. In the case of **Seitani**, since the area was already designated as "**Strictly Protected**", MOm's specific proposals for the conservation of the species were included in the ongoing SES that is being implemented by the Prefecture of Samos. Within the final proposals, two marine zones (200m and 500m wide) with regulations on fishing activities and boat traffic, are proposed.

Based on fieldwork conducted during the project, it was concluded that the Fourni islands lie in abundant fishing grounds that also represent significant feeding grounds for the monk seal. It is therefore proposed that the surrounding marine area be declared an "**Area of Specific Fishing Regulations**". The proposed measures are aimed at the protection of the Posidonia sea grass meadows that are abundant in the area, and at the conservation of fish stocks that are considered of primary importance to the local economy. These goals will be achieved through the exclusion of

trawlers within a distance of 3 nautical miles from the coast. Upon evaluation of the data collected, it is considered that the proposed measures will best be enacted through a Ministerial Decision or a Port Police Regulation.

## Zakynthos

The zoning plan that is proposed in the SES for Zakynthos, implemented by WWF Greece, focuses on the conservation of the monk seal and its habitat, while promoting sustainable development. The plan also aims to minimise accidental and deliberate killing of the animals.

According to the proposals, marine and terrestrial areas on the western and northern coasts of Zakynthos, that fall within the Municipalities of Elatia, Artemisiou and Lagana, would be declared "**Nature Protection Areas**", individually named "**Protected Mediterranean monk seal habitat...**" (...of Schinari, Ag. Andrea, Kabi, Korakonisi and Marathia respectively). Three of these sites include core areas that are proposed as "**Areas of Strict Protection**". A considerable marine area is also proposed as a buffer zone, where specific fishing regulations would be enforced.

Apart from zoning and regulation in the various protected areas, specific proposals aimed at achieving integrated management of the sites were also submitted. These mainly relate to **enforcement and guarding, surveillance and monitoring, training and education** (of local inhabitants, visitors and staff) and **sustainable development** (the ecologically sound activities that are compatible with the status of each site, such as organic agriculture and ecotourism). – Vrassidas Zavras, MOm.

## Network report issued

As indicated in our last issue ([European Network for Monachus monachus](#)) MOm has been leading EU-sponsored efforts to encourage coordination and teamwork between the various independent organisations involved in the *in situ* conservation and study of Mediterranean monk seals. MOm's recently released report on the initiative is available in the [Monachus Library](#).

**MOm.** 2000. Establishment and pilot operation of a network between the Mediterranean monk seal conservation projects. Final report, January 2000: 1-28.

## World music honours monk seals



As part of its Planet Music series, leading Greek record producer Chart Records has released a 2-CD compilation of international "ethnic" music. The cover features a photograph of a Mediterranean monk seal, while sleeve material provides brief information on the species and on MOm's conservation activities. The CD was launched in Greece with significant media fanfare in April. A fraction of the proceeds will benefit MOm's conservation efforts.

## Monk seal births on Zakynthos

Research activities implemented by WWF Greece on the monk seal population around the Ionian island of Zakynthos have documented the presence of at least three pups, born in autumn 1998. Two of these individuals were sighted again by the research team in December last year. One newly born pup was also recorded during the same period. – Demetres Karavellas, WWF Greece.

## Madeira

### Far-reaching implications seen as seals return to beaches

As a result of non-invasive observation studies, researchers have learned how monk seals on the Desertas Islands of Madeira may be changing their behaviour in reaction to a reduction in human persecution and harassment.

The findings were presented at the 14th annual conference of the European Cetacean Society (ECS) which convened in Cork, Ireland, in early April.

During the 1970s, as a result of intensive fishing activity around the islands, observations indicated that seals were exclusively using beaches in sea caves to rest and rear their young. However, during 1997, after 9 years of protection and monitoring using non-intrusive methods, seals were observed on open beaches on the Desertas Islands. Two females used Tabaqueiro beach to rest and suckle their pups. Similar observations were made in 1999 on the same beach, and other seals were also observed resting on another open shore.

The observations have potentially far-reaching consequences for the conservation and survival of the monk seal.

Historically, Mediterranean monk seals used to haul out and pup on open sandy or pebble beaches throughout their range. There is compelling evidence to suggest that deterioration in habitat driven by human persecution – in which open beaches were traded for the relative security of sea caves – has been a leading factor in the decline of the species (Johnson & Lavigne 1999). – Rosa Pires, Parque Natural da Madeira.

#### Sources

**Pires, R.M. Neves, H.C.** 2000. Monk seal sightings on open beaches in Desertas Islands, Madeira Archipelago. In press.

**Johnson, W. M., & D. M. Lavigne.** 1999. Monk seals in antiquity. The Mediterranean monk seal (*Monachus monachus*) in ancient history and literature. *Mededelingen* 35: 1-101. The Netherlands Commission for International Nature Protection. [Online abstract: <http://www.monachus.org/mguard03/03scien1.htm>].

## Mauritania & Western Sahara

### Regional Recovery Plan heads for signing ceremony Science will be undermined, say critics

Conservation of the monk seal's Atlantic colonies along the disputed Côte des Phoques in the western Sahara continues to make headway – and to make waves.

As indicated in our November 1999 issue, international efforts to establish a Regional Recovery Plan for the species are being channelled through the Convention on the Conservation of Migratory Species of Wild Animals (the CMS, or Bonn Convention). Luis Mariano González, of Spain's Ministry of Environment, has been the leading force behind these moves, which seek to implement scientific study and conservation within an agreed international framework. While this approach may originally have been intended to avert the internecine squabbling that has long plagued conservation efforts in the region, ironically, efforts to streamline or limit the decision-making process appear to be raising the same spectres yet again.

Critics of the Plan believe that it is being pushed through to completion and signing without adequate consultation or review by the wider scientific and conservation community. Similar criticisms were heard repeatedly during previous initiatives in the region, particularly those involving controversial translocation and captive breeding schemes.



Following exploratory talks between designated representatives of the range states, the Recovery Plan became a focus of discussion at the November 1999 Cape Town meeting of the CMS's Scientific Council. A report compiled by Dr. González was presented at the meeting (see [Recent Publications](#)), providing status updates on the monk seal and a brief assessment of conservation initiatives supported by the European Union and UNEP's Mediterranean Action Plan. The report then goes on to rationalise the Bonn Convention's involvement in efforts to conserve *Monachus monachus*, largely on the basis that range states have a legal obligation to safeguard the monk seal from illegal killing, capture and harassment, and its habitat from degradation that might impede movements or migration.

A draft summary of the Recovery Plan proposes five primary goals:

1. Continuous monitoring of population numbers.
2. Reducing factors having an injurious impact on individual survival and the productivity of populations.
3. Adequate protection of habitat.
4. Increasing genetic variability.
5. Providing the necessary conservation mechanisms and tools to accomplish these aims.

The report then provides a point-by-point breakdown of the various conservation measures envisaged. Aside from its more predictable and mundane components, the conservation wish-list marks a startling departure from priorities pursued during previous efforts in the region. They include plans to:

- Coordinate and regulate research activities.
- Avoid intrusive research in breeding caves.
- Establish a rescue, rehabilitation and reintroduction programme.

Within a broad-ranging conservation plan that also addresses everything from fishery problems to education, these three points in particular have become a cause of dispute. Some controversy, of course, might be considered inevitable given the chasm-wide divisions in opinion that climaxed during the 1997 mass die-off. Under these circumstances, an ambitious plan seeking to bridge diverse viewpoints might be considered an accomplishment in its own right.



Victims of the 1997 mass die-off

Critics, however, most notably those involved in monk seal scientific research, charge that a consensus of opinion has only been made possible by castrating the review process and ignoring scientific opinions.

A second version of the Recovery Plan, released in February 2000 to a limited circle, incorporated some fine-tuning to proposed conservation measures. According to information received by The Monachus Guardian, it was at this time that even some of the Plan's closest supporters began to voice concern that key monk seal experts were being sidelined in the review process. In response to this criticism, the review distribution list was apparently expanded. A third draft appeared in April, following a meeting in Las Palmas of the appointed representatives (or "Working Group") of the range states.

Despite these various versions, the Plan's components appear to have remained largely intact. Whether this is a testament to the Plan's broad acceptance among the range state representatives or to its truncated review process appears to be a matter of increasingly contentious opinion.

Political considerations, particularly foreign policy, may also have played an unseen hand. If so, then the allegedly abbreviated review process may reflect the diplomatic tip-toeing required in order to move the Plan through its regional minefield. Despite Morocco's claim to have established a National Park at the Bay of Dakhla (an intention first raised during UNEP's Rabat meeting in 1994), this decreed protected status is clouded by the area's disputed political status and its inaccessibility to researchers and conservationists.

Fisheries also remain a potentially thorny issue both for Mauritania and Morocco, the maritime controlling power of the western Sahara. Industrial overfishing by foreign fleets – including the deployment of new Dutch "Super Trawlers" – the frequency of seal entanglement in nets, and the plight of traditional Mauritanian fishers whose export markets are being undercut by a heavily-subsidised EU fleet, are matters which increasingly demand international study, negotiation and settlement. (**Editor's Note:** For further detailed information on the developing fisheries crisis in Mauritania / western Sahara, check out the following publications in the [Monachus Library](#): **CFFA** 1999a and **CFFA** 1999b). Irrespective of its willingness to do so, the Bonn Convention is empowered to intervene in this fisheries problem where it concerns the monk seal and ships flying the flags of range states. As the Cape Town report states: "It is important to point out that the Convention applies the term 'Range States' to States whose flag[ed] ships are engaged in taking migratory species on the seas, outside national jurisdictional limits."

It is the other contentious elements of the Plan, however, that are now fuelling the most heated debate.

Rehabilitation, an issue that caused such bitter recriminations in 1997, continues to be a focus of dissension according to knowledgeable sources in the region. While some participants in the Recovery Plan have always regarded the rescue, rehabilitation and release of orphaned or injured seals as a legitimate conservation and public awareness tool, other parties have voiced concern that an over-zealous rehabilitation effort may end up losing more lives than it saves.



Monk seal pups under SRRC/CNROP rehabilitation in Mauritania

A particularly controversial aspect of the Plan is the apparent intention to combat the relatively high incidence of pup mortality on the Côte des Phoques, caused by storm surges into caves, by preemptively removing pups from their mothers as storm forecasts are received.

"These are healthy individuals," says one anonymous critic, "not sick or wounded animals. And yet in the Plan they are listed as 'requiring intervention'. Rehabilitation can be a difficult process, and the probability of survival in the caves, even during storms, is statistically higher than in rehabilitation."

Some critics of rehabilitation also believe that the reintroduction of individuals that are genetically weak or predisposed to certain diseases (individuals that might otherwise have died) might have longer-term repercussions for the entire colony.

Rehabilitation is seen by some observers as playing a key role in the Recovery Plan, but that is disputed by Luis Mariano González. Indeed, in a message to The Monachus Guardian, he states categorically that "rehabilitation will not play a key role in the Plan."

Regardless, The Monachus Guardian has recently learnt that the Plan's associate members are seeking a partnership with the Seal Rehabilitation and Research Centre (SRRC) of Pieterburen, the Netherlands. The SRRC has long-standing experience in the rehabilitation of Mediterranean monk seals and has been a partner in rehabilitation and training programmes in Mauritania, Madeira, Greece



and Turkey. SRRC methodology, coupled with an alleged absence of agreed international protocols governing rehabilitation and post release monitoring, caused friction during the 1997 die-off. This prompted the EU-funded project in Mauritania to subcontract the RSPCA's Norfolk Wildlife Hospital for its rehabilitation needs, despite the latter's inexperience with monk seals. As a direct consequence of that decision, and of the mistakes it engendered, the rehabilitation of the pup known as Juanito took 11.5 months rather than the 4 months that is customary. Doubts have also been cast on the decision of the Canary Islands contingent of the project to remove the pup from the cave in the first place. In a reflection of current concerns, critics also suggest that the pup was taken as a pre-emptive measure, rather than out of imminent concern for its welfare.

According to one government participant, a final round of meetings in the Canary Islands in April has now settled remaining differences between the parties to the accord. "Spain, Portugal, Morocco and Mauritania have now reached unanimous agreement on the plan," our source told us. "It will be a good plan with a firm emphasis on recovery and protection rather than pure academic study. Academics will oppose the plan, but our first priority is conservation."

All types of invasive research have now been stricken from the Plan, presumably obliging researchers who gather their data in the Côtés des Phoques caves to either cancel their programmes or to find new, non-invasive methods of gathering information.

Some critics, however, insist that the invasive research that is implemented in the Côte des Phoques, rather than being of idle academic curiosity, is actually fulfilling conservation objectives internationally mandated by the scientific community. They point, for example, to the taking of blood samples which are analysed for the presence of the morbillivirus. This course of action was approved by the international Workshop that was convened in Amsterdam following the 1997 mass die-off.

Illustrating the polarisation of opinions on the issue, critics of recent research on the Côte des Phoques accuse scientists of causing unnecessary stress and disturbance to seals for information of dubious conservation value.

While some believe that a lack of consultation and review has "dug a trench between science and conservation", others believe that a "hands off" approach – exemplified by the success of Madeira, where invasive scientific research is prohibited in seal caves – is now warranted. Indeed, one of our sources suggests that the conservation management plan that has served Madeira and the Desertas Islands so well in recent years will be the model used for the Côte des Phoques.

According to one government member of the working group, parties are expected to sign the final version of the accord in Nouadhibou, Mauritania, in late May.

That, however, is disputed by the coordinator of the Regional Recovery Plan, Luis Mariano González, who insists that there will be no imminent signing. Dr. González also expressed "surprise that... [there] seems to be controversy and debate about the Plan. I [have] heard nothing about this inside the working group."

Critics caution against any undue haste in signing the agreement, insisting that an international action plan of this kind should only be endorsed following open and transparent review by the wider scientific and conservation community. According to these critics, an international workshop should be convened to review the Regional Recovery Plan at the earliest opportunity.

Only time will tell whether yet another promising conservation initiative for the region falls victim to internecine warfare. Positions seem to be hardening on both sides, despite the fact that there appears to have been little effort expended in reaching a compromise. Perhaps that effort should be considered before it is too late. If not, it may be just another case of the good-intentioned snatching defeat from the jaws of victory.

**Editor's note:** The Monachus Guardian, which has received, from official sources, a copy of the third draft of the Regional Recovery Plan for review and comment, has endeavoured to represent the views of all sides as accurately and as impartially as possible. It has provided drafts of this news item to several key parties, and has revised the contents according to the responses received.

### Further reading:

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**CFFA.** 1999b Coalition for Fair Fisheries Agreements (CFFA). Newsletter N° 8, September 1999: 1-4. [Available in the [Monachus Library](#)]

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**González, L. M.** 1999. Update on the situation of the Mediterranean monk seal (English translation). In: Convention on the Conservation of Migratory Species of Wild Animals. Scientific Council of the Convention on the Conservation of Migratory Species of Wild Animals. 9th Meeting, Cape Town, 4-6 November 1999: 1-16 + 6 maps.

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**Acknowledgement:** Our sincere thanks are extended to the Coalition for Fair Fisheries Agreements (CFFA) in Brussels, who have agreed to make their above-cited publications available in the [Monachus Library](#). The CFFA can be contacted at the following address: ICSF Brussels Office / CFFA, Rue du Midi 165, B-1000 Brussels, Belgium. Tel: 02 513 15 65. Fax: 02 513 73 43. Email: [gilletp@skypro.be](mailto:gilletp@skypro.be).

### New pups identified

University of Barcelona researchers have been holding planning and logistics meetings in Mauritania, preparing their next campaign on the Côte des Phoques, scheduled to start in July.

Visits to the study area also allowed a brief assessment of monk seals occupying the caves, which lie at the foot of steep cliffs, north of the Mauritanian border in disputed territory.

A group of 15 seals were observed surrounding Cave-3, including one juvenile female born in June 1999, several other previously-identified individuals, and at least four new pups born this year. Two, born in January, had already moulted entirely. Having shed their dark pelage, they had taken on the greyish colour typical of juveniles. The third young pup, which was observed to be finishing her moult, is thought to have been born at the beginning of February.

The fourth pup sighted was lying close to its mother. Its small size and black pelage led the researchers to believe that it may have been born at the end of March or during the first days of April.  
– Manel Gazo, University of Barcelona.

### SRRC publishes report on 1997 die-off



An SRRC veterinarian and her Mauritanian counterpart attend to a dead pup during the 1997 mass die-off

The Seal Rehabilitation and Research Centre (SRRC) of Pieterburen, the Netherlands, is publishing a report on the controversial 1997 mass die-off of monk seals in Mauritania / western Sahara. The report, originally compiled from field notes and observations gathered by the National Centre for

Oceanographic Research and Fishing (CNROP) and SRRC-affiliated veterinarians, will be made available in French and English. The die-off, which claimed two thirds of the world's largest surviving monk seal colony, proved particularly contentious as scientists sought to isolate its cause. Divided scientific opinion at the time blamed both toxic algae and a morbillivirus outbreak. Although never satisfactorily resolved because of uncertain data, the forthcoming CNROP/SRRC report speculates that both viral and algal agents may have been to blame for the lethal outbreak.

The report may be obtained directly from the SRRC. A download version will be made available in the Monachus Library in due course.

A 25-minute video film of SRRC and CNROP activities during the 1997 die-off is also available from Pieterburen. To obtain a copy, please write to the [SRRC](#) specifying the format and language you require. The video is available in PAL and NTSC, in English, Dutch or French.

## Turkey

### Funding injection

As predicted in the November issue of The Monachus Guardian ([Winners and losers in LIFE](#)), European Union SMAP funding has been granted to the WWF's Mediterranean Programme Office in Rome (WWF MedPO), SAD-AFAG's long-term financial lifeline and conservation partner. The decision effectively ensures the financial viability of Turkey's leading monk seal efforts for a further two years.

Entitled *Conservation and Management of Biodiversity Hotspots: Developing a Mediterranean Network*, the 4-project initiative is to focus on endangered species and habitats in Lebanon, Morocco, and Turkey. The effort will be co-ordinated by WWF MedPO in partnership with local NGOs.

A key objective of the project is to demonstrate how sustainable environmental practices can achieve conservation aims while providing tangible socio-economic benefits to local stakeholders.

In recognition of SAD-AFAG's long-term efforts, the monk seal initiative will continue to focus on the species' habitat in the areas of Foça, Karaburun and the Cilician Basin. Specifically, the projects seek to:

- Extend the existing marine protected area in Foça north and south of its present limits, and to include adjacent monk seal habitats on the Karaburun Peninsula.
- Establish a core "No Fishing Zone" for fish stock recovery in Aydıncık (Cilician Basin) and prevent illegal trawling within the 3 mile limit.
- Increase public awareness for monk seal conservation through communication and environmental education.

In collaboration with the Middle East Technical University – Institute of Marine Sciences (METU-IMS), SAD-AFAG has already accomplished one of these objectives – the "No Fishing Zone" in the Cilician Basin (see [Ban on trawlers preserved in protection zone](#), below). Team members in the area are now working hard to ensure that its legal status is respected. – Cem O. Kiraç & Ali C. Gücü, SAD-AFAG.

### Pup drownings on Karaburun

A pup born in November last year in a known breeding cave on the Karaburun Peninsula was found dead by SAD-AFAG researchers two weeks later. A necropsy revealed that the animal had drowned, and researchers have concluded that the seal was a victim of entanglement in fishing nets. According to information received, a fisherman had set his nets very close to the cave on the day of the pup's death. With seals believed to cross regularly between Karaburun and the adjacent Foça SPA, SAD-AFAG is campaigning to have parts of the Peninsula set aside as a sanctuary. The pup's death underscores the perils of incidental entrapment to the monk seal (see [When Fishermen Save Seals](#), this issue). SAD-AFAG researchers believe that in the Central Aegean region of Turkey, entanglement

might represent one of the most severe threats to the survival of recently weaned pups. – Harun Güçlüsoy, SAD-AFAG.

### **Legal battle attracts reinforcements**

Artisanal fishing cooperatives continue to join legal moves against the Ministry of Agriculture, challenging the legality of the Annual Aqua Products Circular 33/1 in Turkey's high court for administrative and constitutional cases. The disputed Aqua Products Circular seeks to regulate commercial fisheries during the 2000 season (see [Court action follows artisanal fisheries symposium](#), TMG 2:2). Fishing cooperatives from Cesmealti, Balikliova, Foça, Dikili and Karaburun have now joined several other artisanal fishing groups and conservation organizations (including SAD-AFAG) as plaintiffs in the case. The court complaint views the Aqua Products Circular as biased towards industrial-scale seining and trawling, activities which are exhausting coastal fishing grounds and are having a severe impact on the livelihoods of traditional fishers and on the survival of the monk seal.

### **Five sites set to become Monk Seal Conservation Areas**

Of 17 sites in Turkey classified as important for *Monachus monachus* by SAD-AFAG, METU-IMS and TUDAV (Turkish Marine Research Foundation), five are likely to become "Monk Seal Conservation Areas" (MSPAs). That appeared to be the consensus of opinion to emerge from the 14th National Monk Seal Committee meeting, held in Ankara on 27 December 1999.

Of the original 17, the 5 accepted areas are:

1. Area 5 (covering Gökçeada and Bozcaada Islands, Baba br., and the mainland vicinity near Çanakkale).
2. Area 6 & 7 (no. 6 between Izmir and Aliaga, incorporating the Foça SPA, and no.7, the Karaburun Peninsula).
3. Area 8 (covering the coastal zone between Çesme and Kusadasi).
4. Area 10 (Bodrum Peninsula, between Güvercinlik and Bodrum).
5. Area 16 (incorporating the 5 recently-announced SIT (Ministry of Culture) protected zones in the Cilician basin, between Gazipasa and Tasucu).

SAD-AFAG proposed that Areas 6 and 7 be considered a single entity because of their close proximity to each other, and the likelihood that monk seals move between both areas.

As indicated in last year's May and November issues of The Monachus Guardian, National Committee members representing tourism, yachting and transport interests lodged objections to the proposed protected areas, particularly Area 10 on the Bodrum Peninsula, a major tourist centre. At the urging of the Ministry of Environment, however, it appears that critics have been persuaded that the protected areas will not impede growth and development. In what is being called an encouraging sign, Turkey's powerful Ministry of Development has indicated that it will now add the protected areas to its development strategy plans, provided that Conservation Planning Codes are well defined for each area to guide local government, municipalities and investors.

A draft version, prepared by SAD-AFAG, TUDAV and Ministry of Environment staff, divides the Codes into two: General Codes to be implemented in all areas, and Special Codes designed according to the specific needs of each area.

The draft General Code includes the following restrictions:

1. Entering monk seal caves by any means is prohibited. Only researchers may enter the caves, solely for conservation purposes, provided that necessary permits are obtained from the relevant government authorities.
2. All types of construction, such as secondary summer housing (single units or groups), road building (rough or asphalt), all tourist facilities (regardless of whether they are permanent or temporary), and forest cutting are prohibited within 1000 meters from the coast in Monk Seal Protection Areas.

3. An as yet undefined speed limit will be imposed on vessels entering MSPAs.
4. The regulation of fishing within the MSPAs will be defined by the Ministry of Agriculture with the advice of the NMSC.
5. No fish farms may be added to the development plans of areas incorporating MSPAs, and existing fish farms will be obliged to install outer protection nets in order to avoid conflict between seals and fish farmers.

Special Codes to be applied to individual MSPAs are currently being evaluated by a Technical Sub-Committee of the NMSC. – Cem O. Kiraç & Ali C. Gücü, SAD-AFAG.

### Philatelic honour



The Turkish PTT issued a monk seal stamp on 1 February 2000 to "commemorate the millennium". Like many Telecom and IT ventures that purport to see a corollary between the "information revolution," developments in communication, and awareness of global development and environmental problems, the Turkish Postal Service took the opportunity of reminding the nation that 2000 had been declared the Year of Protecting Biological Diversity. First day covers provided basic information on the monk seal's biology and rarity, compiled by the WWF affiliate in Turkey, DHKD (the Society for the Protection of Nature), and SAD-AFAG. A limited issue, 602,000 monk seal stamps (each with a face value of TL 300,000) were printed, and they will be on sale only for 6 months. – Yesim A. Öztürk, SAD-AFAG.

### When the cat's away...

A chronic bureaucratic tangle continues to frustrate effective guarding of Turkey's flagship monk seal reserve, the Foça Specially Protected Area (SPA). Foça's unfortunate patrol boat, the *Cevre*, has been sidelined for months on end because of mechanical damage, funding shortages, disagreements over official responsibility (Monachus Guardians, *passim*), and now, to top it all, rivalry between various state and local government agencies appointed to operate the craft. As already reported on numerous occasions, ineffective guarding in the past, particularly during the summer months, has compromised the integrity of the SPA. Tour boats have been observed sailing within a few meters of sensitive monk seal caves, and artisanal fishers have complained bitterly about an increase in illegal fishing activities. For all its faults, a protocol designed to share responsibility for the patrol boat's operation between multiple agencies has been drawn-up and endorsed, the boat is mechanically sound, and funding for its operation has been guaranteed. What remains inexplicable to the international conservation community is why the *Cevre* is still languishing in port.

### Ban on trawlers preserved in protection zone

Following both domestic and international appeals (see [Breaking News](#) index), the Turkish government has preserved a ban on industrial trawling along 16 miles of protected coastline in the Cilician Basin. Trawlermen had exerted heavy pressure on the Ministry of Agriculture and Rural Affairs to lift the ban, jeopardising a 5-year monk seal conservation programme by the Middle East Technical University's Institute of Marine Sciences and SAD-AFAG. As in most of the eastern Mediterranean, the welfare of local, subsistence fishermen in the Cilician Basin is inextricably tied to overfishing pressures by industrial fleets, and to the survival of the last Mediterranean monk seals.

## Monk seal behaviour under surveillance

A TV monitoring system is being installed in one of the caves frequented by monk seals in SAD-AFAG's Mediterranean Project area, on the south coast of Turkey.

Inside the cave, the surveillance system is composed of three monochrome TV cameras sensitive to infrared (IR) illumination, two IR illumination sources and a microphone. Sound and images captured in the cave will be transmitted to a monitoring station about 2 km away via a broadcast link system. Here, seal activities in the cave will be observable on a switcher-equipped monitor, and can be recorded on VHS video tapes.

The cave units and transmitter are fed by 12 and 24 volt batteries, recharged by solar panels, while the observation station equipment and the receiver will run on mains power (220 V).

The first test run of the system is planned for the second week of May. If it performs as anticipated, the system will allow SAD-AFAG researchers to monitor four monk seal individuals that are expected to frequent the cave until the end of August. The system will then be moved to a known breeding cave.

SAD-AFAG hope that the surveillance equipment will allow researchers to gather valuable information on the in-cave behaviour of the monk seal, including little-studied aspects of mother-pup relations and relationships between other "family members". The broadcast seal images may also turn into a powerful public awareness tool. SAD-AFAG plans to release real-time images of the seal cave via a special web page, allowing an international audience to share a unique moment: observing one of the world's shyest and most endangered species in its own environment.

The monitoring system has been made possible thanks to the financial support of WWF Belgium and Turkish battery producer MUTLU. – Yalçın Savas, SAD-AFAG.

## Live long ladies and prosper

An ability to produce healthy offspring is crucial for the survival of any species. The number of healthy pups produced each year therefore becomes an important benchmark for those involved in the conservation and study of Mediterranean monk seals. The fate of the species depends almost entirely upon those recruited to the population. At the same time, the seal's breeding success is also dependent on the overall health of the ecosystem in which it lives. Any detrimental influence on any component part of an ecosystem can limit the number of offspring produced, thereby reducing the probability of survival. Urbanisation and overfishing pressures compromise the monk seal population's ability to successfully reproduce. Breeding success may therefore be considered an indicator of the health of the surrounding ecosystem, and in turn, of the effectiveness of any conservation measures that may be applied.

Since conservation efforts were launched in the beginning in 1994, 8 monk seal pups have been born in the Cilician Basin. Only one, Umit, failed to survive (dying when she was 3 days old). During October last year, two more pups joined the Cilician Basin monk seal family – a promising sign for the fate of the species in the region and a motivating force for the SAD-AFAG team working for their protection.

### Pups found in the Cilician Basin since 1994

| Name of the pup | Sex    | Date of birth  | Date of first encounter | Place of birth |
|-----------------|--------|----------------|-------------------------|----------------|
| Ceren           | ?      | End of 1994    | 23 July 1995            | Ovacik         |
| Arap            | Male   | Aug - Nov 1995 | 19 November 1995        | Kizilliman     |
| Ümit            | Female | August 1996    | 20 August 1996          | Kizilliman     |
| Ferit           | Male   | Aug - Nov 1996 | 2 December 1996         | Kizilliman     |
| Askim           | Male   | November 1997  | 9 November 1997         | Kizilliman     |
| Ney             | Female | August 1998    | 20 August 1998          | Melleç         |
| Sedef           | Female | October 1999   | 23 October 1999         | Melleç         |
| Sanda           | Female | October 1999   | 24 October 1999         | Kizilliman     |



With the new births of the winter season, the number of identified members of the Cilician Seal family has now reached 21. – Ali C. Gücü, METU-IMS & SAD-AFAG.

### **Tourism threat seen in Dalaman**

DHKD and SAD-AFAG researchers travelled to Dalaman in the southern Aegean in November, to investigate plans to build a tourist marina.

Dalaman beach is one of 17 major nesting sites for the endangered marine turtle *Caretta caretta*. The eastern end of the beach – the location of the planned marina – is characterised by complex and fragile ecosystems, including lake, river, wetland and marshland, as well as beach ecosystems. The area also incorporates a rocky shoreline with caves both above and under water, that has been identified as monk seal habitat.

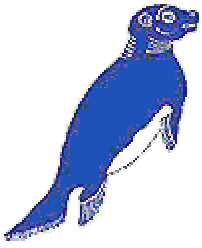
Beach studies have shown that the minimum sea turtle nesting density is 10 nests per kilometre, despite an Ege University report that claims "no nests" can be found in the area. Even during the November survey, remains of a predated nest and pieces of eggs were discovered. The river and lake ecosystem also hosts the Soft Shell Nile Turtle *Trionyx triunguis*, which is also endangered.

As a result of their investigations, DHKD and SAD-AFAG has recommended to the government that:

- The eastern section of the beach be incorporated into the Fethiye-Göcek Specially Protected Area.
- A nature reserve be established to preserve the Kocagol lake ecosystem
- Marina construction plans be halted immediately, and the project moved to the western end of the beach where a tourism infrastructure already exists. – Atila Uras, DHKD.

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## Cover Story

### WHEN FISHERMEN SAVE SEALS

**William M. Johnson**  
**Alexandros A. Karamanlidis**

A young monk seal rescued from a Greek fisherman's net in the Aegean has recently highlighted the risks that this endangered species faces from entanglement.

On the face of it, it was a familiar tale. A hungry seal raids a fishing net but suddenly finds itself ensnared. In its desperation, it bites and tears and struggles until the net is reduced to shreds. The harder it struggles to escape, the tighter the surviving rope and mesh entwines it. In the end it lies at the water's surface, gasping, exhausted, the remnants of the net wound tight around its throat.

The following morning, the unfortunate owner of the tattered nets set out from the little fishing village of Komi on Chios to bring in his night's catch, only to discover the seal still struggling to liberate itself. He tried to free the animal himself, but without luck.

Towing the seal behind his boat, he headed back to harbour, where the loud shrieks of the bewildered animal attracted the attention of other fishermen, locals and members of the port police authority.

The rescue effort that followed was documented by television film crews from various stations and became an absorbing news item on virtually every channel that evening (13 November 1999). The loud human voices and the hands reaching out to help must have terrified the young seal, which in its own defense tried to attack the boats surrounding it.

At last set free, the seal proceeded to express its gratitude in a rather "seal-like" way – by trying to turn over the boat of the fisherman that had just saved it... After throwing a few last, hurt glances at the strange creatures living above water, our seal disappeared into a blue horizon.

Those searching for a moral to this story may find several. First, the seal can count itself lucky to have escaped with a fright and few bruises to its dignity. Next time, it may not be so fortunate. Second, not all fishermen hate the seal enough to kill it. Third, monk seals may find themselves trapped in fishing nets more often than is generally assumed. And fourth, traditional fishermen and monk seals both find themselves caught in a vicious circle of industrial overfishing, net damage and dwindling catches.

#### Entanglement – an extinction factor

Entrapment of marine mammals, turtles and sea birds in fishing gear remains a global problem of staggering proportions (Johnson 1987 & 1988, Woodley & Lavigne 1991, Walker et al. 1997, Morizur et al. 1999). Millions of animals representing non-target species fall victim of drift nets and other types of fishing gear, many suffering an agonizing death



in the process. Marine mammal species may be particularly susceptible to serious population depletion because of their innate biological characteristics – being slow growing, long-lived animals, with low fecundity.

The Mediterranean monk seal (*Monachus monachus*) is no exception, with incidental entanglement in fishing gear considered a major threat contributing to the overall decline of the species (UNEP 1988, Reijnders 1991, Johnson & Lavigne 1998).

Monk seals can become ensnared in all kinds of fishing gear, but unlike pelagic species appear to be most vulnerable to entanglement in static gear and discarded nets in coastal areas (Harwood 1987, Panou et al. 1987, Israëls 1992). It has also been suggested that young monk seals may be attracted to lampara fisheries (*gri-gri* boats) and may fall victim to entanglement in these purse seines (Panou et al. 1987). There is no evidence to suggest that any age or sex category is particularly vulnerable (Texel 1990).

Rather more ominously, entanglement involving different types of gear appears to have been widespread throughout the species' former range. Monk seals have been accidentally ensnared on baited hooks in the Danube Delta (Schnapp et al. 1962), on tuna nets in France in the 1930s-1940s (Cheylan 1974), in a trammel gill net in the bay of Tunis (Ben Othman et al. 1971) and in unspecified nets on the coast of the Spanish Sahara in 1913 (Boettger 1951). In the Balearic Islands, it was reported that most losses occurred in tuna nets and that entanglement was second only to shooting as a source of mortality. Of 26 seals in which the cause of death was known, 9 had perished in nets (Sergeant et al. 1978).

A similar picture emerges from the species' current range. In **Algeria**, eight drownings were recorded between 1987 and 1990 on the west central coast (Boutiba 1996). Research conducted in the Ionian islands of **Greece** has shown that accidental entanglement accounted for 23% of all recorded monk seal deaths (Panou et al. 1993). Prior to the establishment of a protected area, the extensive use of gill nets constituted a major threat to the survival of the small surviving monk seal colony in the Desertas Islands of **Madeira**. Animals had been dying frequently by entanglement in abandoned 'ghost' nets (Anselin & van der Elst 1988). A major clean-up operation, coupled with an initiative to have fishers convert from net gear to long lines effectively solved the problem (Neves 1991). Up until 1987, monk seal colonies inhabiting the Côte des Phoques in **Mauritania** and the **Western Sahara** were largely shielded from the effects of incidental entanglement because of warfare. With the resumption of both industrial and artisanal fishing, however, the risk of entrapment returned in force, together with a possible reduction in food availability for the colony. Although no deaths have been directly linked to fishery interactions, there is concern that some seals – most notably weaned pups or juveniles – may fall victim to entanglement (Texel 1990, Francour et al. 1990, Manel Gazo pers. comm. 2000). In **Morocco**, 27 out of 40 dead seals reported to Avella between 1980 and 1990 had died entangled in nets (Texel 1990). Research along the southern Aegean and western Mediterranean coasts of **Turkey** in the mid-1970s found that entanglement could almost rival shooting as a cause of mortality. Out of 7 known seal deaths, 4 could be attributed to direct killing, and three to drowning by entanglement (Berkes et al. 1979). More recently, entrapment in fishing nets has been implicated in the death of a monk seal pup in the Foça Specially Protected Area (SPA) in February 1997 and a seal found at Kas in 1999 (Johnson 1999, Harun Güçlüsoy pers. comm. 2000).

### Entanglement – a risk assessment

While available data illustrates the severity of entanglement for the survival of the monk seal, it is likely that such research paints a distorted picture of the phenomenon, for several reasons. First, scientific enquiry of this type is hampered by the inherent difficulty of studying a rare, elusive marine mammal along thousands of kilometres of remote coastline. Second, fishers, seafarers or pleasure boaters may be reluctant to report the finding of a dead monk seal. In fact, evidence suggests that the discovery of a monk seal trapped in a fishing net may often be the all too literal trigger for fishers to take their revenge and finally rid themselves of a net-destroying, fish-stealing pest. Given the illegality of that act, many fishers may be reluctant to admit that seals have drowned in their nets. Reported deaths by entanglement may thus represent only the tip of the iceberg. By the same token, however, seals recorded killed by fishers while trapped in fishing nets will normally be assigned statistically to the category of "deliberate kills" rather than "incidental entrapment", casting further doubt on the accuracy of such surveys.

## Why do monk seals get entangled in fishing nets?

Ask any self-respecting monk seal why it raids fishers' nets and the inevitable answer will be "because I'm hungry". Given the high casualty rate associated with this behaviour, however, it may also be necessary to ask why the species is prepared to risk its life and liberty in this way.

Over the years, two separate explanations have found their way into the knowledge base of the species. One sees this behaviour as a form of compulsion driven by external influences, while the other views it as being driven by the nature of the species itself.

First, overfishing. Industrial seining and trawling have resulted in dwindling fish stocks throughout the Mediterranean and have exacerbated the conflict between traditional coastal fishers and the monk seal. As some coastal fishing grounds verge on collapse, research suggests that seals may become dependent on fishermen for food and will seek out fishing boats, stealing fish and damaging nets (Ronald & Yeroulanos 1984, Johnson 1988, Karavellas 1994). Monk seals have been observed following fishing boats for up to 20 nautical miles (Duguy 1975) and to wait until the fishermen have laid their nets to feed (Johnson 1988, Neves 1986). Fishermen at Zakynthos even swear that monk seals know their fishing routes and "lie in wait" for their fishing boats to appear (Mascha Konstapel pers. comm. 1999).

To what extent such behaviour is driven by overfishing is uncertain. However, exhausted fishing grounds have been implicated in the decline in monk seal numbers in Algeria (Boudouresque & Lefevre 1988), and have also been linked to an apparent increase in the frequency of attacks by seals on fishing nets in Greece (Jacobs & Panou 1988, Texel 1990). According to Jacobs and Panou (1990), fishers on Kefallonia "reported that illegal fishing (including dynamiting by locals) and overfishing have reduced the marine resources, forcing the monk seals to take fish from their nets." Faced with the same scarcity, other marine species such as dolphins, dogfishes and marine turtles may also attack fishers' nets with increased frequency.

The second explanation suggests that in raiding nets, the monk seal may simply be fulfilling some of its deepest biological instincts. In this, there may be a grain of truth in the fishers' long held view of the seal as too lazy to catch its own dinner (Johnson 1988). All mammals – seals included – tend to expend as little energy as possible in living their daily lives since food-derived energy is a finite resource. In other words, fishers laying their nets in the vicinity of monk seal caves may be providing hungry seals with an irresistible target.

Research in the Ionian Sea underscores this contention. During one particular experiment, a new trammel net was placed in front of a cave occupied by a large male monk seal for seven nights. In two of the seven nights when the seal was encountered in the cave, the net was found to be severely damaged the following morning (Panou et al. 1993).

But is the seal's net-raiding simply another tortured legacy of industrial age?

"For the Seal no hooks are fashioned nor any three-pronged spear which could capture it: for exceeding hard is the hide which it has upon its limbs as a mighty hedge. But when the fishermen have unwittingly enclosed a seal among the fishes in their well-woven nets, then there is swift labour and haste to pull the nets ashore. For no nets, even if there are very many at hand, would stay the raging seal, but with its violence and sharp claws it will easily break them and rush away and prove a succour to the pent-up fishes but a great grief to the hearts of the fishermen. But if betimes they bring it near the land, there with trident and mighty clubs and stout spears they smite it on the temples and kill it: since destruction comes most swiftly upon seals when they are smitten on the head."

Given its uncanny resemblance to today's stormy relationship between fishers and monk seals, readers may be surprised to learn that this particular passage was penned by the Latin poet Oppian of Cilicia in the second century A.D. Does this, then, lend credence to the theory that it is the seal's natural inclination to save energy – its alleged "laziness" – that drives it to raid the nets of fishermen? Not necessarily, since coastal overfishing during Oppian's time may have been as severe in some areas as it is today (Johnson & Lavigne 1999a).

In fact, it seems likely that both explanations – overfishing and the natural urge to save energy – hold an element of truth. Since it is impossible to determine which of the two holds the greatest merit, how should both be viewed in terms of conservation of the species?

## Assessing damage

Fishermen have always asserted that the damage inflicted upon them by seals is severe enough to warrant compensation for destroyed nets and reduced catches. Most also claim to be able to identify the animal species attacking their nets by the type of damage each causes. In snatching fish from the net, monk seals tear holes about 20-30cm in diameter (Marchessaux & Duguay 1977). They often leave a characteristic triangular three-hole pattern, representing the animal's mouth and foreflippers (Goedicke 1981, Johnson 1988). When entangled, however, monk seals will often tear the net to shreds in their desperation to escape. In contrast, dolphins and dogfish are reputed to tear large, single holes (Berkes 1976), while moray eels (*Muraena helena*) produce holes about 10cm in diameter (Marchessaux & Duguay 1977).



An Aegean fisherman mending his seal-damaged net

Despite the lack of thorough scientific research in this field, there appears to be little disagreement regarding the capacity of monk seals to inflict substantial financial losses upon traditional fishers whose livelihoods may already be precarious because of other factors.

But what type of fishing is most vulnerable to seal attack? Research in the Ionian Sea monitored three types of fishing gear for monk seal damage. These were [1] Gill nets (a net suspended vertically in the water, and traditionally set close to the shore from where it extends into open water). [2] Trammel nets (a three layer construction, with two outer nets having a large mesh sandwiching a middle one with fine mesh, usually set close to the bottom near the shore or in shallow water). [3] Bottom long lines, consisting of a series of baited hooks on a line laid close to the seabed.

Of the 1,864 fishing trips monitored during the survey, 136 (7,3%) reported damage. Inshore trammel nets suffered the highest frequency, followed by offshore trammel nets and gill nets. Bottom long lines sustained the least damage, possibly because the fine nylon lines tend to elude discovery (Panou et al. 1993). These findings appear to corroborate the opinions of fishers from Karpathos, who claim that monk seals take few fish out of nets set deeper than 30m (Ronald & Healey 1974). Turkish Aegean fishermen have also reported that most seal damage occurs within a depth of 20m (Sergeant et al. 1978).

Although fishers may have good reason to accuse the monk seal for damaging their nets and reducing their catch, there can be no justification for blaming the animal for the overfishing crisis. To begin with, marine mammals often consume species of no commercial value to humans. Even more importantly, if the 750 kg daily intake of fish by the entire Greek Aegean monk seal population can be regarded as reliable, then the total mass of fish consumed would not exceed the by-catch of a large fishing vessel (Ronald 1984).

## A vicious circle

Despite the undeniable damage the species does inflict, there can be little doubt that the monk seal has long been a convenient scapegoat for coastal fishers (Johnson 1988). The attitude is epitomised by a former fisher on Leros, who is quoted as saying: "The seals are our enemies; they take the bread out of the mouths of our children, consequently we will eliminate them" (Goedicke 1979).

Unfortunately, while hostility is focused on monk seals, there appears to be little time or inclination to confront threats far more damaging to the livelihoods of traditional fishers. Fishing grounds begin to collapse under fierce commercial competition, and staggering waste. Regulation drives up operating



costs. Spawning grounds are damaged by dynamite fishing, fishing with chemicals such as chlorine, and by the capture of young fish for aquaculture installations. Industrial trawlers encroach into coastal fishing grounds, further depleting stocks. Purse seiners deploy nets with illegally-small mesh (Karavellas 1994). Hobby fishers – in some areas responsible for landing the same volume of fish as their professional counterparts – drive up pressure on the ecosystem (Boudouresque & Lefevre 1991, Johnson & Lavigne 1999b) and compete with locals in selling their catches (Karavellas 1994).

These are some of the much-neglected issues that continue to fuel the conflict between fishers and seals (Karavellas 1994, Johnson & Lavigne 1999b). But how can this knowledge be applied to the conservation of the species, and act as a catalyst to preserve the culture of traditional fishers?

### Conservation measures

Established threats to the survival of *Monachus monachus* have long been categorised by rank according to perceived severity. Largely since the Rhodes Conference 1978, these have been ordered as:

1. Increased adult and juvenile mortality because of deliberate killing (mostly by fishers).
2. Increased adult and juvenile mortality caused by incidental entanglement in fishing gear.
3. Increased adult and juvenile mortality due to human disturbance.
4. Increased pup mortality caused by pupping in unsuitable locations, due to loss of preferred habitat.
5. Poor condition due to lack of food as a result of overfishing.
6. Reduced fecundity and pup survival (possibly caused by inbreeding depression).

Although such categorisation may be useful in conveying the rudiments of the issue, it also tends to obscure the fact that most mortality factors are inter-related, a fact that has long eluded a conservation movement mired in its own fragmentation (Johnson 1988, Johnson & Lavigne 1998).

The categorisation of monk seal mortality is no exception to the rule. Studying the list above, we can safely conclude that the six categories actually fall into two broader groups. The first, **habitat loss**, is responsible for threats 3 and 4. The second group, covering points 1, 2 and 5 relate almost exclusively to **fisheries**. (Point 6 may be regarded as a consequence of the preceding threats.)

Logic dictates that conservation measures must ensure the protection of sufficient habitat to hold a minimum viable population. Despite the fact that interconnecting networks of reserves have been proposed since the 1970s, little progress has been made towards achieving that goal. Furthermore, even if this were to be accomplished, monk seals would still be vulnerable to the wrath of fishers when venturing or dispersing beyond the boundaries of their reservations. The social and breeding interaction between monk seal colonies, the mechanism responsible for sustaining a healthy and stable population, would almost certainly be jeopardised unless parallel action can be taken to combat mortality factors associated with fishing.

Public awareness programs and financial compensation (long considered an onerous and unsustainable burden by those who hold the purse strings) may soothe fishers' hostility towards the monk seal, but how can conservation hope to combat incidental entanglement? It is here that the motivating cause of this particular behaviour becomes particularly significant. If monk seals become trapped in fishing nets out of coincidence, then there is little conservation can do about it. Conservation probably faces the same limited options if monk seals raid fishing nets because they present an easier, energy-saving target than hunting. Acoustic devices can theoretically drive marine mammals away from stationary nets, but there remains doubt over their long-term effectiveness, and the costs associated with their deployment over a wide geographical area is likely to be prohibitive. Fishers might be dissuaded from setting their nets in the immediate vicinity of monk seal caves, but it is unlikely that a social group renowned for its strong traditions and its suspicion of regulation would take kindly to such a restriction. If, on the other hand, seals are driven to attack nets due to food scarcity caused by overfishing, then more avenues are open to conservation action.

This approach, which sees traditional fishers playing a key role in the conservation process, has long been advocated (Ronald & Duguay 1979, Johnson 1988), yet its application has been hampered by a lack of political will and by the potent lobbying power of industrial fishing fleets. In spite of this

handicap, fishers, seals and protected habitat have all benefited from this holistic approach in several areas. In the Northern Sporades Marine Park in Greece and the Foça SPA in Turkey, there is compelling anecdotal evidence (not least of all, the testimony of local fishers) that fish stocks have recovered since the implementation of regulations prohibiting industrial fishing within protection zone boundaries. Although fishers are also being brought into the conservation process in other areas, such as the Cilician Basin, the examples of where this principle is being applied remains few and far between.

While schemes of this type yield undoubted conservation benefits, continued fishing in protected areas by traditional fishers cannot help but pose some risk of entanglement. An adult female seal known to researchers as *Disi Korsan*, for example, was found dead in the Foça SPA in 1998. The health and welfare of the animal had been an issue of deep concern for several years due to the rope that was observed cutting deep into her head – most probably the result of entanglement in fishing gear (Johnson 1998). In February 1997, a monk seal pup was also found dead in the Foça SPA, apparently the victim of entanglement (Harun Güclüsoy pers. comm. 2000). Possibly reflecting political sensitivities, little similar data has been reported by groups operating in other protected areas. Regardless, accidents of this type might conceivably be prevented with tighter regulation of core zones (where all types of human activity should ideally be prohibited).

While fishers will undoubtedly continue to complain – as they have done for a thousand years or more – about the damage they suffer from the teeth and claw of the monk seal, and as politicians continue to dodge their obligations, it is important not to lose sight of the fact that a conservation blueprint has been slowly evolving in protected areas for a number of years. At centre stage is the traditional fisher as a partner in conservation. Although there is a long, long way to go, it appears that the message is gradually making its way through the Aegean. Hearing of recovering fish stocks in the Sporades Marine Park, fishers who once viewed monk seal conservation with disdain and suspicion are suddenly sitting up and taking notice. Others are even beginning to demand their own protected areas.

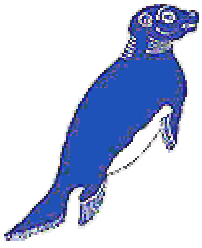
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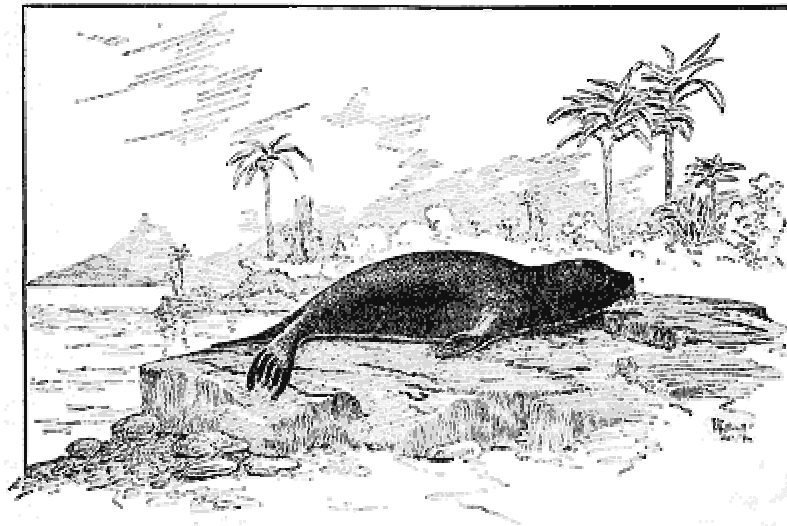
## In Focus

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### FINAL MILLENNIUM FOR THE CARIBBEAN MONK SEAL

Gail Swanson

Imagine 6 to 9 foot, 500 pound seals basking on the sunny beaches of the Florida Keys. We can only imagine, for the seal that did inhabit Keys waters since the islands were formed from a reef is now extinct. The last century was the final one for the tropical seal of the Bahamas, south Florida, Caribbean Islands and Gulf of Mexico. Exploited by European man, the 15-million-year-old seal has just lived its final millennium.



The Caribbean monk seal *Monachus tropicalis* as depicted by Henry W. Elliott in 1884

The last sighting of the seal at the Keys was at Key West in 1922, and that animal was shot. The last known sighting in the world was in 1952 on Serranilla Bank in the western Caribbean. Wildlife biologist Karl W. Kenyon carried out a 4,000-mile aerial search for the seal in 1973, and wrote in May 1980: "My reluctant conclusion is that the Caribbean Monk Seal became extinct soon after the last one was observed in 1952" (Kenyon 1980).

Columbus' men, on his second voyage, were the first to record the seal's existence. They killed a herd of eight in August, 1494, at an island just south of Haiti.

Called "sea wolves" by the Spanish, they were recorded at the Keys first by Ponce de Leon in his 1513 voyage. Based on original papers which have since been lost, Spanish historian Herrera wrote 90 years later on his voyage: "...they ran on the same course, until Tuesday the 21st, when they reached the *isleos*, which they named *Las Tortugas*, because in one period of the night they took on one of these islands 160 turtles, and might have taken many more if they wished, and also they took 14 *lobos marinos* [sea wolves], and killed many gannets, and other birds..." (Kelley 1991).

The next record of the seals at the Keys was written by Hernando d'Escalante Fontaneda, shipwrecked at the Keys in 1549 (Swanson 1999). He wrote of the Indian people that "Some eat sea

wolves; not all of them, for there is a distinction between the higher and the lower classes, but the principal persons eat them" (Fontaneda 1944).

For a larger regional record, to the north of the Keys a seal jaw has been found in an Indian shell mound on the mainland near Lake Helen Blazes (Neill 1957). Dog Rocks, so named by the Spanish (*Cayo Lobos*), south of the Keys, may be named after the seals, and to the east of the Keys there is at least one Bahamian record from the early 1700s. The historian Hans Sloan was quoted by Peter M. Knudtson in his article *The Case of the Missing Monk Seal*: "The Bahamas are filled with seals; sometimes fishers will catch one hundred in a night. They try or melt them and bring off their oil for lamps to these islands" (Neill 1957, Knudtson 1977).

Back to the Keys. Keys resident Louise White found monk seal bones in her search of lower Keys Indian sites; her collection is now at the Tropical Crane Point Hammock Museum in Marathon, Key Vaca. And archaeologist Robert S. Carr has found monk seal bones at the Cuchiaga Indian site on Stock Island.

In 1742 a British warship named H.M.S. *Tyger* was wrecked at the Dry Tortugas and her crew of over 200 men were marooned on the islets for 63 days. The ship's log, brought ashore, records almost daily capture of seals for men to eat (Public Record Office, London 1742). In a 1763 report of Florida by William Roberts, it is written that "On *La Sonda* [the sound], north of the [Dry] Tortugas, there is a very good fishery...it also abounds with great plenty of seals, the fat of which the Spaniards pay [coat] the bottom of the ships with at the Havana" (Roberts 1763).

Most closely related to the seals of the Antarctic, it is a mystery how the tropical seal came to be; the others of the family are far away from the Caribbean: the Mediterranean monk seal and the Hawaiian monk seal. They still maintain a small foothold in the world, one that our monk seal lost due to European man's arrival in the New World.

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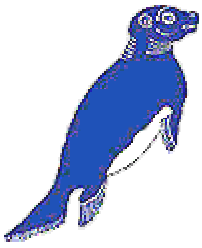
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## Perspectives

### **SURF'S UP, LIVE! MAUI ON LESS THAN \$500 A DAY**

**William M. Johnson**

If the 13th Biennial Conference on the Biology of Marine Mammals was seen to be tempting fate with its choice of unlucky numbers, it has to be said that no one appeared to be particularly spooked as they packed their bags and headed off to sub-tropical, palm-bedecked, ukulele-twanging, hip-sashaying Maui.

"Hi! Aloha! I'm Kim and I'll be your greeter tonight!" gushes a beaming, incandescent Hawaiian shirt at Kahului arrivals. Before anyone can stutter a word, we're festooned with flower and seashell necklaces and bundled into a Courtesy Bus. We head off into the night towards ritzy Kihei, a manicured little enclave for the rich and not-so-famous.

Here, scattered along several miles of coral sands are the resort complexes and condos that, for five long, arduous conference days (and several more to recover from the stress, obviously) would be our home away from home. Taxis rarely venture down here, so don't bother to ask, but there's a rental outfit a couple of miles down the street that does a nice little line in Mustang convertibles.

Like glamorous Monaco two years earlier, it's clear that the convenors, the Society for Marine Mammalogy (SMM) had done their homework. You could tell that no one in the SMM hierarchy had been sitting around darting world atlases with their eyes blindfolded. Choice of venue is probably a science in its own right. Just imagine the mind-boggling variables involved in judging a host candidate's ability to entice the genuine marine mammalogist while discouraging riffraff — yes, including those to happen to believe that dolphins are on an extraterrestrial mission from the planet Zorg.

No doubt in keeping with that policy, the Outrigger Wailea Resort (and several overspill hotels along the beach) were persuaded to slash their room rates, charging a reasonable but riffraff-busting \$159.00 per night (plus federal, state and local taxes and tips, obviously) for ocean views (just there, around the corner, in between the palm trees).

The Outrigger, like so many SMM resorts before it, graciously provided every conference amenity one could hope for — including championship golf courses, tennis courts, mosaic-tiled swimming pools, frothing Jacuzzis, grass-skirted hula-hula girls, and other essential services for the jet-lagged nature manager too numerous to recite here. It was, in fact, just what the doctor ordered... or rather, what about 2000 doctors ordered given the hordes of marine mammal biologists and nature managers that were suddenly thronging the corridors by Monday morning.

Crowds come jostling their way along the open galleries. Chalk and blackboard professors in beige slacks. Bearded explorer-types from



anywhere between Amazonia to Zaliv Shelikhova. Students as fresh-faced as the day they were first exuded, plastic-like, from the laboratory moulds cast by the professors and mentors. Well, even Dolly the sheep wasn't *that* unique.

Shiny-eyed postgrads linger about the commercial booths that are busy touting satellite tags, radio transmitters, critter-cams and other erotic high-tech hardware. Can you imagine the whale biopsies with these suckers? Oh baby...

Silicon tracking carbon. Instruments that are mere extensions of human perception, peering into the depths of an alien briny world. Locking onto sea beings that just 400 years ago were not marine mammals at all, but mermaids and sirens and monsters. It must be a measure of human progress that such intricate, interwoven lives can now be reduced to arcane strings of words and numbers, binary codes on a computer screen. We will probe, cogitate and analyse, and then declare to all the world that we knew you.

"Welcome to Paradise," our local cable channel announces. Indeed, just look around. There's nothing quite like America to renew one's faith in ecology. Specially-customised 4-wheel-drive trucks with tyres that look like they've been ripped off a farm tractor growl by on their way to the Mall. Tourists crank up their air-conditioners to Arctic mode, probably not even realising that they've just endured 2 days of airline hell and spent several thousand dollars to escape the same freezing temperatures back home. Obese people in search of the silver slimming bullet drive their cars for 20 miles to do their group aerobics, and then stop off at a McDonald's drive-in on the way home. There's even a drive-in cemetery where you can park right next to your beloved's tombstone ("Caution: egress from vehicle may be required for wreath-laying access"). Down in Kihei, the manicured pathways with multiple anti-litigation signs warning of steep drops, poisonous plants, steps, slippery surfaces, illegal dog excrement and low-flying birds seem to convey the impression that nature is too dangerous, too crude, too unrefined to be permitted beyond civilisation's perimeter fencing.

After a few days of this subliminal conditioning, it becomes clear enough to any dullard that the environmental crisis has already been quite adequately solved to everyone's satisfaction, thank you very much.

Inadvertently, so does the Conference itself, which can't exactly claim a gold star from teacher for promoting conservation issues (N.B. the words 'animal welfare' are not spoken in polite company here).

The other problem for Europeans who have grown up on imported American television is that we all kind of assume that Hollywood is just make believe. We didn't expect to step off the plane and find ourselves on a film set. We didn't realise that surfers on Maui actually *do* talk like Keanu Reeves on a bad day. We didn't realise that cool undercover cops actually *do* drive around in red Camaros with racing stripes. We didn't even realise that six-door, dazzling-white, stretch limos actually existed beyond Paramount Studios until one disgorged about thirty Japanese marine mammalogists at the foyer of the Outrigger.

In the conference chamber, meanwhile, some proud throwback to Cartesian cellar science is spouting about her team's success in repeatedly rounding up Stellar sea lions from fast inflatables and bringing them back to "**The Mother Ship**". Can you imagine the scene? The sea lion is strapped onto the examination table under the fuzzy glare of Operating Room lights, surrounded by latex-gloved researchers in surgical masks, prod and probe already in hand. My god, and you thought all those people with alien abduction stories were nuts...

But now, some other conference highlights:

**Are Hawaiian monk seals moving back to the 'downtown islands'?** Historically, status reports have consistently overlooked the presence of monk seals on the main, human-inhabited, Hawaiian islands (Hawaii, Oahu, Maui, Kauai *etc.*), some even going so far as to suggest that the species never inhabited these places. But with some high-profile harassment, accident and seal-tourist culture clashes breaking the news, it seems that the government may finally have to bite the bullet and admit that there is a significant *Monachus schauinslandi* population that needs protecting in populated Hawaii's backyard. In fact, credible rumours doing the rounds on Maui suggest that there may be at least 70 monk seals around the 'downtown islands' (*i.e.* excluding their traditional habitat in the northwestern Hawaiian islands — Nihoa, Kure, French Frigate Shoals, Pearl & Hermes *etc.*). NMFS, perhaps unfairly, has been accused of ducking the issue in the past. Conspiracy theorists who have



grown up on American TV have tended to attribute the blind eye syndrome to the fact that an admission of the seal's existence here would trigger a legal obligation to protect the animals, even on prime touristic sites. While admitting that tourists will not be evicted from Waikiki Beach anytime soon, NMFS has announced a monk seal survey around the main islands (see [Monk Seals in the Main Hawaiian Islands](#) and [High levels of human interaction with a Hawaiian monk seal on the island of Maui](#), this issue).

**Midway blues:** After having largely deserted the Atoll through the military occupation years, the Hawaiian monk seal's recolonisation of Midway has been an outstanding conservation success story, even if — as veteran researcher Bill Gilmartin cheerfully admitted during his presentation — science actually had very little to do with it. Threats to the new arrivals, however, appear to be on the increase, and have become a source of tension between monk seal researchers, the Fish and Wildlife Service and Midway's new corporate overlords, Midway Phoenix Corp. (see [The Old Woman Who Swallowed the Fly](#)). According to Gilmartin, tourists are wandering onto prohibited access beaches, and incidents of harassment are on the rise. Midway Phoenix's intention to crank up visitor numbers (*i.e.* till receipts) is unlikely to help matters.

**Off the menu:** It may not have been explicitly stated in the abstract, so those monk seal aficionados who crammed into the *Pikake Room* to hear updates on the mysterious 1997 mass die-off of Mediterranean monk seals in the western Sahara can be forgiven for missing an off the cuff remark that crept into Jaume Forcada's presentation (see [Recent Publications](#)). According to the former University of Barcelona researcher (now at NMFS), lowered female reproduction with higher pup mortality has so compromised the *Côte des Phoques* colony that translocation and captive breeding should no longer be considered.

**Captive breeding:** We learn from NMFS that those responsible for promoting an ambitious, though unapproved, captive breeding plan for the Hawaiian monk seal (news brought to you by your intrepid correspondent in Monaco two years ago) will now be sent to work in far colder climes. The thought of these poor unfortunates being banished to some kind of frozen Siberian wasteland or NMFS gulag is heart-wrenching. Nothing we said, surely?

Apparently not. Rumour has it that sensitive captive breeding experiments will now be handled by — wait for it — the world's premier amusement park, marine circus and purveyor of Bud Lite, SeaWorld of San Antonio, Texas. As readers may remember from our last issue ([Off on another adventure](#)) SeaWorld obtained ten female Hawaiian monk seals in April last year. The animals had become an unwanted financial liability to NMFS after a translocation experiment ended up blinding the animals in NMFS' Kewalo Research Facility in Hawaii. We have it on good authority that up to four males will be dispatched to Seaworld to kickstart the reproductive physiology experiments. NMFS considers it unnecessary to discover the cause of the blindness affecting the study group prior to commencement (or, indeed, to discover whether it is contagious, or transmittable to any pups produced), since any captive bred animals would remain precisely that: captive in perpetuity. Antibes Marineland, eat your heart out.

All of which just goes to show that what you learn *outside* the conference room easily rivals anything you hear *inside*.

As I recline on my sun lounger poolside, I am left to ponder some of the unkind things muttered about this prestigious international gathering. To say that this Maui glamour-feste will inevitably fall into the obscurity it so richly deserves (no pun intended) is to belittle its deeper role in the advancement of human knowledge. It is here where we forge experiments in cutting edge scientific research, it is here among our peers that we are inspired to pluck pinnipeds from the deep and bring them back to The Mother Ship.

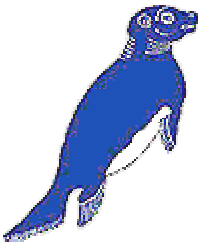
One misguided soul writes from the Mediterranean: "As a biologist I always ask why they have to have these kinds of meetings in fancy resorts. We can't afford to go, but maybe they don't want us to."

Although this kind of thing is also not mentioned in polite company, our correspondent is, of course, referring obliquely to those hand-to-mouth conservation projects from the front line.

Really, haven't these people heard of credit cards?

Waitperson! Another strawberry daiquiri please...

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## Monachus Science

### OSTEOPOROSIS IN AN ADULT FEMALE MONK SEAL *MONACHUS MONACHUS* FROM ÇESME, TURKEY

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On 7 March 1999, a female Mediterranean monk seal (*Monachus monachus*) was found dead near the town of Çesme, on the peninsula west of Izmir, Turkey. The seal was necropsied the following day by a veterinarian, Dr Avni Gök, and the second author. The seal weighed 116 kg and its 'nose to end of tail length' was 200 cm. The animal was emaciated; blubber thickness (measured at the abdomen) was 0.5 cm, and the vertebrae and hip bones were visible through the skin. Unidentified follicles were observed in both the left and the right ovaries. The large uterus suggested she had given birth before. The above information, together with the appearance of the teeth and the closure of skull sutures, all indicate the animal was a young adult.

Upon dissection, it was immediately apparent that the ribs were less solid than those observed in previous monk seal necropsies. The stomach contained two pieces of sea sponge, approximately 15 cm in length, two roots of Mediterranean sea grass, *Posidonia oceanica*, and a few of its leaves, five cephalopod beaks (currently under further study at the Aqua Products Faculty of Aegean University, Izmir, Turkey) and some parasites.

Soft tissues were dissected from the skull, the long limb bones, scapulae and pelvic bones, which were subsequently cleaned by maceration (Anderson 1948). The skull and dentition appeared quite normal but some of the postcranial bones were remarkably light in weight and had small bony outgrowths (osteophytes) on the articulating surfaces (see figure 1). The low mass of the postcranial bones and marginal osteophytes in a young adult seal are typical features of osteoporosis with secondary arthrosis.



Fig. 1: Some postcranial bones were notable both for their lightness in weight and for the small bony outgrowths found on articulating surfaces.

Osteoporosis is a condition in which the amount and structural quality of bone tissue are reduced, commonly leading to fractures of isolated bones (osteoporotic fractures). Established factors for increased risk of osteoporosis in humans are female gender, advanced age and hyperthyroidism. Other factors that may increase the risk of osteoporosis are early natural menopause, premenopausal oestrogen deficiency, family history of osteoporosis, and a low dietary calcium intake.

In humans, bone mass increases during childhood and adolescence. Thereafter, bone loss occurs in both sexes, more in females than in males. In females, spinal bone loss accelerates in relation to menopause but the pattern of postmenopausal bone loss in the hip bones is not known.

The pattern of bone loss in wild mammals is not well studied. In zoo mammals, and in captive seals, bone loss – defined as osteoporosis – has been observed, especially in the axial bones, as a result of insufficient feeding (examples are found in the collection of the Zoological Museum, University of Amsterdam, and the collection of the Natural History Museum Rotterdam). In our Çesme seal, only the humeri, femora, scapula and pelvic bones could be studied, since the remainder of the skeleton was buried before the osteoporosis was diagnosed. Unfortunately, this also meant that the vertebrae of the seal were not accessible for study. Regardless, in the bones available, bone loss was particularly evident in the pelvic bones and scapula.

It is well established in humans that the main cause of female osteoporosis is oestrogen deficiency. Oestrogen deficiency could result from natural or premature menopause or a polycystic ovarian syndrome.

In the case of our monk seal, the cause of the bone loss is difficult to determine. The animal was a young, sexually mature female, which had ovulated in recent years. Bone loss due to natural menopause is, therefore, not plausible and premature menopause appears equally unlikely.

A more plausible cause in this seal is osteoporosis due to a chronic insufficient dietary calcium intake. The role of calcium intake in the etiology of osteoporosis in mammalian species has been the subject of controversy for years (e.g. Kanis 1989, Nordin & Heaney 1990). In humans, several studies have shown a relation between the consumption of low calcium dairy products and the incidence of osteoporotic fractures (e.g. Matkovic et al., 1979). Nutritionally related osteoporosis is also a well known condition in zoo animals offered low calcium "cafeteria-style diets" (Allen & Montali 1995).

The mammalian skeleton contains about 99% of the calcium in the body. In order to preserve the skeleton, calcium absorption should equal the obligatory loss in faeces and urine. Sufficient calcium intake and absorption are important for the optimal development and the maintenance of the skeleton. Calcium-related problems in captive marine mammals have been mentioned by some authors (e.g. Bossart & Dierauf 1990), but not others (e.g. Worthy 1990). The IUCN Seal Specialist Group (1991) notes that "the poor condition due to lack of food as a result of overfishing" is one of the threats facing the Mediterranean monk seal. Israëls (1992) also noted that heavy fishing in areas that are important to monk seals for feeding may reduce local fish stocks to such low levels that the seals cannot obtain sufficient food. Lack of food could affect growth rates in the juvenile seals and possibly induce osteoporosis in older animals, especially in females following lactation. The poor condition of the seal we examined, and the fact that its stomach contained such unlikely food items as pieces of sponge and the roots and leaves of *Posidonia oceanica*, would be expected in an animal suffering from a chronic lack of food. As a substitute for fish or invertebrates – the normal monk seal diet – this animal may have started to eat whatever it found drifting at sea. Such behaviour has also been observed in a harbour porpoise *Phocoena phocoena* (Kastelein & Lavaleije 1992) and in a harp seal *Pagophilus groenlandicus* found by the first author along the Dutch coast. Of course, other causes of osteoporosis, such as diabetes, hyperthyroidism, hypoparathyroidism or renal failure, cannot be rejected on the basis of the available evidence.

In monk seal research little attention is paid to the postcranial skeleton. In attempting to understand the current status of monk seals, including their limited reproductive capacity (Harwood 1987), our observations suggest that it may be important to examine the postcranial bones of other dead monk seals, and to preserve complete skeletons of these seals for detailed examination.

## Acknowledgements

The second author would like to thank his colleagues at the Underwater Research Society in Foça, and, in particular, Avni Gök, whose assistance made this note possible.

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## DO MONK SEALS EAT ABORTED FETUSES?

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On 1 August 1984, the second author found in a cave, situated about 3 metres up the beach on the island of Piperi, Northern Sporades, Greece, the faeces (less than one day old) of a monk seal, *Monachus monachus* (Hermann, 1779). Droppings of monk seals are often found in caves (Bareham & Furredu 1975, Panou & Ries 1985, Jacobs & Panou 1988), but this time mammal bones were found in the faeces. The bones were collected, cleaned and the larger ones were sent to the first author for identification. They turned out to be the bones of a monk seal fetus or perhaps a still-born pup.

The bones were all *in* the faeces, not under it and not arranged as might be expected if the animal had died *in situ*. Thus it follows that, most probably, a monk seal ate the aborted fetus or the stillborn young and that the bones of the young left the body together with the faeces. This would mean that monk seals, like some other mammals, eat dead young, a behaviour of the species not known until now. Conceivably, it might also be a case of cannibalism as has been described in grey seals (Kovacs et al. 1996).

Other explanations are possible. Given that so little is known about the general biology of monk seals, however, and that so few observations have been made concerning its behaviour, especially during parturition, this note is published to draw attention to this curious phenomenon.

The bones of the monk seal fetus or still-born young could be identified owing to the fact that the Amsterdam Zoological Museum received in December 1989 the body of a very young female monk seal. This abandoned seal was found alive on the island of Ikaria, Dodecanese, Greece. It was brought on 21 October 1988 to the Seal Rehabilitation and Research Centre at Pieterburen, the Netherlands, where two pup monk seals had previously been reared successfully ('t Hart & Vedder 1990). Unfortunately, the animal died on 13 December 1988 due to a *torsio omentum mesenterialis*.

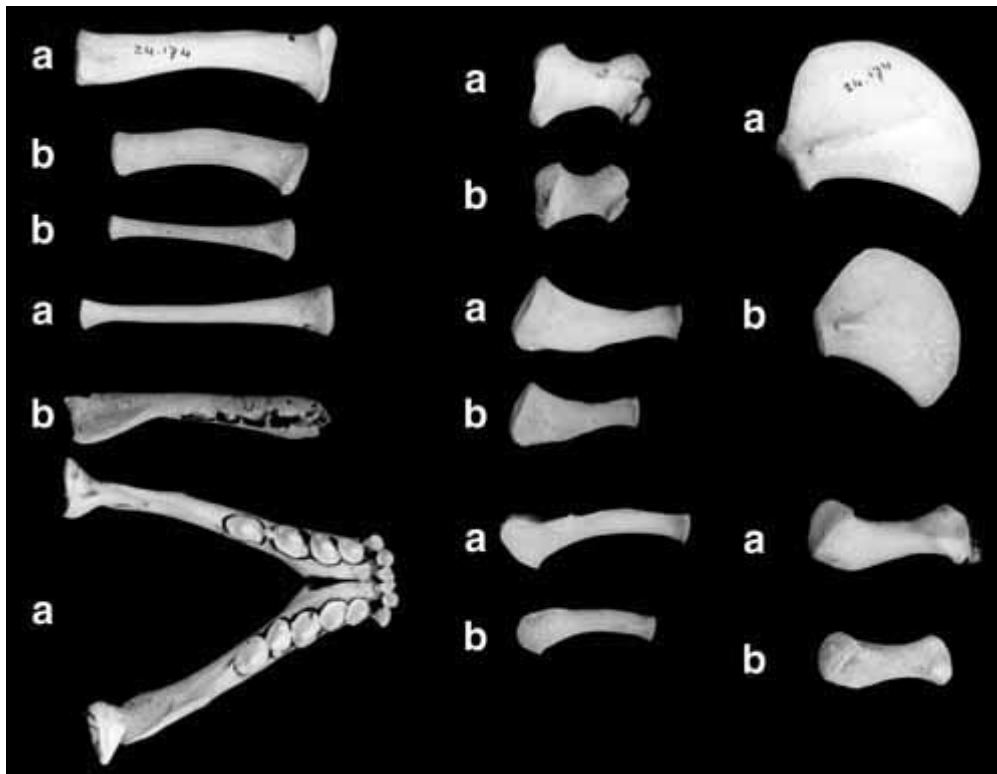


Fig. 1. The larger bones of a monk seal of about three months old (a) compared to the bones found in the faeces of an adult monk seal on the island of Piperi, Greece (b). The length of the mandible of the first specimen (ZMA 24.174) is 119 mm. Photograph by Hans van Brandwijk.

When the young seal arrived in the Netherlands it weighed 13 kg and at its death 19.5 kg. At the time of its death it had a total length of 91.8 cm, a tail length of 11.8 cm and a hind foot length of 21.0 cm. At arrival at Pieterburen it had already lost its lanugo and at death the front teeth just cut the gums. These facts suggest the animal probably was born at the beginning of September 1988.

The bones in the faeces are very similar to the bones of this very young monk seal present in the Zoological Museum of Amsterdam (reg. nr. ZMA 24.174); see fig. 1. Although almost nothing is known about the duration of pregnancy in monk seals and of the development of the fetus in the species, the authors estimate, in view of the sizes of the bones and the development of the mandible, that the fetus was aborted shortly before the normal birth date.

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## HIGH LEVELS OF HUMAN INTERACTION WITH A HAWAIIAN MONK SEAL ON THE ISLAND OF MAUI

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The majority of Hawaiian monk seals (*Monachus schauinslandi*) live in the northwestern Hawaiian Islands, though small numbers are regularly found around the main islands. On the island of Maui, one of the main Hawaiian islands, several individuals have been born in the last few years, and some seals occasionally haul out on beaches heavily used by humans. Management of monk seals in Hawaii is the joint responsibility of the U.S. federal government (through the National Marine Fisheries Service – NMFS) and the State of Hawaii (through the Department of Land and Natural Resources – DLNR) (Lavigne 1999). Volunteer organizations, such as the Hawaii Wildlife Fund, also play a role, particularly in public education efforts when seals do haul out in public areas. Such non-governmental organizations are limited, however, being unable to enforce laws, but they are able to establish on-site education programs informing members of the public about monk seal biology and federal regulations protecting these animals, and encouraging people to voluntarily keep their distance. Volunteers from such non-profit groups will often cordon off an area around a hauled out seal with yellow police tape, and place signs informing individuals of legal restrictions, as well as talking to individuals who are in the area. In Hawaii, a 100 foot (30 m) distance guideline is in place for approaching monk seals and, in theory, the species is protected from disturbance by two U.S. laws, the Marine Mammal Protection Act (MMPA), and the Endangered Species Act (ESA).

On October 27, 1999, a monk seal hauled out at the west end of Ho'okipa Beach (20° 56'N, 156° 21'W), on the north shore of east Maui. This site is one of the most popular windsurfing and surfing areas on the island. Although the beach itself is several hundred meters wide, a small sandy area at the west end of the beach (approximately 20 meters wide) is the main site for both surfers and windsurfers to enter the water. The seal reportedly hauled out at 6:30 AM, and was observed by DLNR staff from 8:30 to 9:30 AM (S. Hau, personal communication), with relatively few interactions with humans during that time. Hawaii Wildlife Fund volunteer staff arrived at 10:30 AM, and stayed through to 5 PM. Education efforts were begun by one to two volunteers, and yellow police tape was placed along the beach on two sides of the seal. Because of the large numbers of people using the beach, such "soft-sell" education efforts were largely ineffective. While no counts of people approaching close to the seal were made for the first few or last few hours of the observations, approaches within about 15 meters of the seal were documented for a 2 hour and 50 minute period (between 1:05 PM and 3:55 PM). During this time, a total of 329 people approached within about 15 meters of the hauled out seal (almost 2 people per minute). Virtually all of these interactions were from windsurfers launching and landing from the beach. Because the seal was between 2 and 10 meters from the water's edge, it was not possible to contact windsurfers as they returned to the beach to inform them of the seal's presence, or of the relevant regulations and guidelines for minimizing harassment. Many windsurfers, or parts of their windsurfing board or sail, passed within 2-3 meters of the seal.





A monk seal hauled out on the popular Ho'okipa Beach on Maui

While I was present for only a short period, I observed clear harassment on several occasions, involving the seal lunging towards people walking by. Most disturbing was the presence of a dog within 15 meters of the hauled out seal. The dog was upwind of the seal and did not appear to detect its presence; however, such observations suggest that there is a strong potential for interactions between domestic dogs and monk seals in the main Hawaiian Islands. Risks associated with the presence of dogs not only include disturbance or injury, but also the potential for disease transfer, which could affect the entire population of Hawaiian monk seals.

The observations from October 27, 1999 were probably close to the "worst-case" scenario for a monk seal hauled out on Maui (perhaps exceeded by the case of the seal being pummelled by coconuts and whipped by a nylon rope on Maui just over a year earlier, see Jordan 1998). The former monk seal has used the Ho'okipa beach on a number of occasions both since and before the October 1999 observations. The fact that the seal was hauled out on one of the most popular windsurfing beaches, and the resulting large numbers of people, made any sort of educational efforts to control human activities largely ineffective, and clearly official enforcement presence was needed. If Hawaiian monk seals do continue to use the main Hawaiian islands, such high levels of interactions with humans, and with domestic dogs, are likely to increase. A combination of enforcement presence and increased educational efforts will be needed to mitigate such interactions.

### Acknowledgements

I would like to thank Allan Ligon and Michele Morris for providing details of their observations from October 27, and for making comments on this review.

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# MONITORING HUMAN AND MEDITERRANEAN MONK SEAL ACTIVITY IN THE NATIONAL MARINE PARK OF ALONNISSOS AND NORTHERN SPORADES, GREECE

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## Introduction

The Mediterranean monk seal (*Monachus monachus*), one of the rarest mammals on earth, has disappeared from most of its original range. Once an open beach dweller, the species now frequents rocky sea caves for resting and reproduction. One of the last refuges of the monk seal is in the National Marine Park of Alonnisos and the Northern Sporades (NMPANS), a 2200 square kilometre area in the northern Aegean, set aside in 1992 by the Greek Government for the protection of the unique ecosystem and, particularly, the Mediterranean monk seal. The NMPANS is divided in two zones (Fig. 1), with varying degrees of protection.

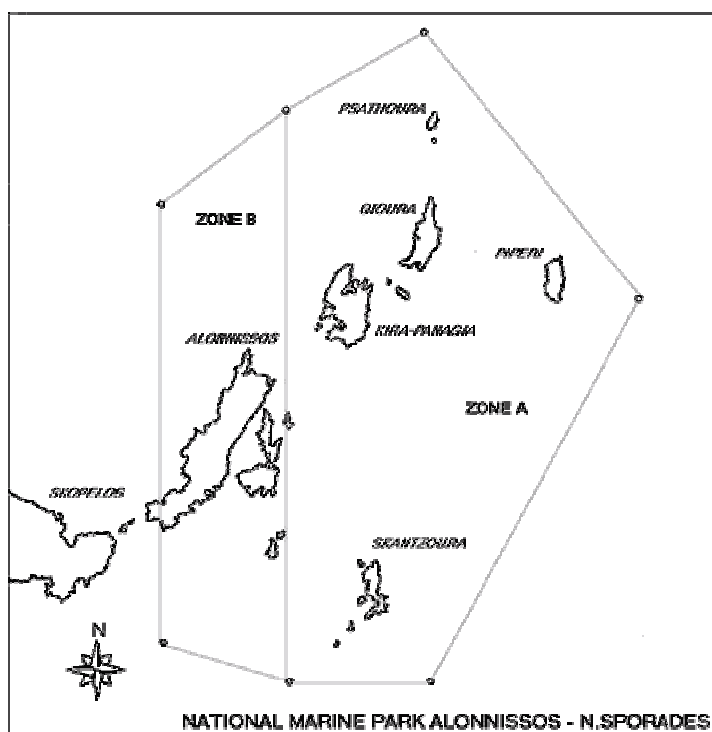


Fig. 1: The National Marine Park of Alonnisos and Northern Sporades

## Zone A

Zone A includes 7 large and several smaller islets as well as the marine area surrounding them. These include Kira Panagia, Gioura, Piperi, Psathoura and Skantzoura. The Core Zone of the NMPANS is situated within Zone A and includes the uninhabited island of Piperi and a three nautical mile marine area around it. All human activities in the Core Zone, except scientific research with special permit, are prohibited.

Special protection measures have been taken also for the island of Gioura, where tourists may not approach closer than 400 metres. The remainder of Zone A has fewer restrictions and is basically open to tourism and to small-scale coastal professional fisheries.

## Zone B

This Zone includes the only inhabited island of the NMPANS (Alonnissos), several smaller islands and the marine area around them. Apart from regulations on purse-seine and trawler fishing, most other activities are permitted in this Zone (MOM 1996).

Monk seal research in the Northern Sporades has been carried out sporadically since the early 1970s (Schultze-Westrum 1976). Systematic monitoring of the monk seal population of the area started in 1988, when the Hellenic Society for the Study and Protection of the Monk Seal (MOM) was founded. Since then, this organisation has become active in monk seal research, as well as in various conservation projects in the area (guarding, rehabilitation, public awareness, oceanographic surveys, etc.). Within the framework of the activities of MOM for the year 1996, the author had the opportunity to carry out a project that was partly funded by MOM. The project was designed in collaboration with the field research team of MOM and the infrastructure of MOM was utilised.

The aims of the project were:

1. to monitor the human activity in the National Park during the high tourist season.
2. to gain further information on the ecology of *Monachus monachus* and particularly on habitat use of specific seal shelters through direct observations and through the use of automatic cameras. Visits to the four most frequented seal caves of the islands of Kira Panagia, Gioura and Piperi provided information on the significance of these areas for the monk seals in the tourist season.
3. to evaluate the relationship between the habitat use of the species relative to patterns of human activity in the area.

## Methods

Human activity in the NMPANS was monitored and recorded from 25 July to 2 October 1996, through regular patrols in the Park. The patrol-boat, *Alonnissos II*, with its experienced guarding crew and its accommodation facilities, offered the most favourable monitoring conditions. In the process of recording human activity, the data recording system of the guarding team of MOM was used. The system was based on dividing the NMPANS into numbered "quadrats" in order to facilitate the recording of each activity. Every time a quadrat of the National Park was patrolled, the identity, the activity and the position of boats present were recorded. Navigation instruments were often required to identify the exact position of vessels.

The methodology used in the study of habitat use was based on the protocols and methods used in the monitoring programme of MOM for the monk seal population in the area. In devising the methodology of the project, avoiding disturbance to the animals was of utmost concern. The inspected caves were approached with caution, and swimming into them was decided, only when no resting animals were thought to be inside. The whole procedure of the cave inspection did not last more than 10 minutes. This method of collecting data has been used successfully in the Sporades for the past ten years (Kouroutos 1987, MOM 1990, MOM 1995b). Since in the Sporades seals exhibit a preference in using caves at night (Dendrinos et al. 1993), cave inspections were carried out during the day.

## Results

### Human activity in the NMPANS

During this project 593 vessels of various types were recorded. In the process of information evaluation, two different boat groups were distinguished (Fig.2):

- Boats related to professional fishery activities (4 Purse-seine boats, 2 Trawlers, 161 Coastal fishing boats)
- Boats involved in various tourist activities (297 Sailing boats, 54 Inflatables, 59 Speedboats, and 16 Tour boats).

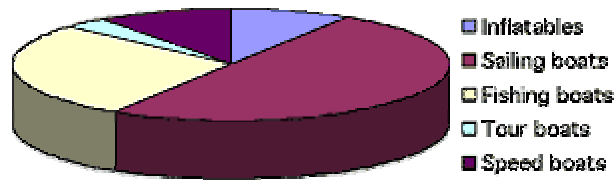


Fig. 2: Boat types recorded within the NMPANS

More than 70% of the recorded boats were involved, in one way or another, in tourist activities.

### Boats travelling within the NMPANS (Fig. 3)

Of the 593 boats recorded during the project, 70 were travelling at the time of the observation. Of these, 10 were distributed in Zone B and 60 in Zone A. A closer look at the position of the recorded boats reveals that all the non-prohibited coastal waters were visited by tourists and fishermen. The highest concentration of travelling boats was recorded in the coastal waters of Alonnissos, Peristera and Kira Panagia. An observation made on site and partly confirmed by the data collected, was, that the north side of Kira Panagia was, compared to the south one, the preferred travelling route.

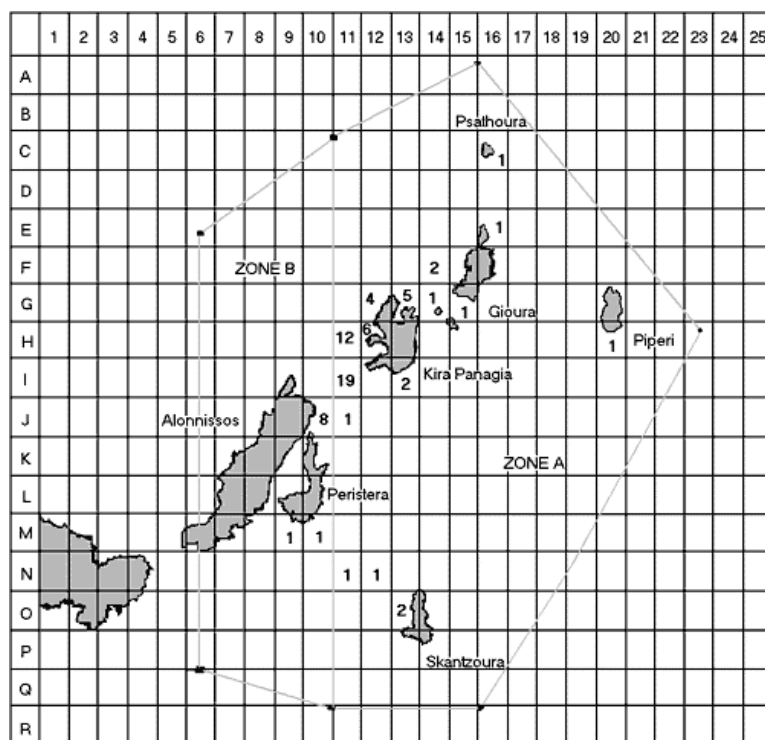


Fig. 3: Distribution of vessels recorded travelling within the NMPANS during the project

### Boats anchored within the NMPANS (Fig. 4)

From the total number of recorded boats (593), 453 were seen at anchor. A closer look at the position of the anchored boats shows that they were concentrated mainly in three areas. The bay of Planitis in the north of Kira Panagia (quadrat G 13) was the busiest anchorage in the NMPANS, followed by the bay of Agios Petros in the south of the same island (quadrat H 12). The number of boats recorded anchored at the island Skantzoura (quadrat O 13 and O 14) was relatively lower due to the low number of visits conducted to this island during this project.

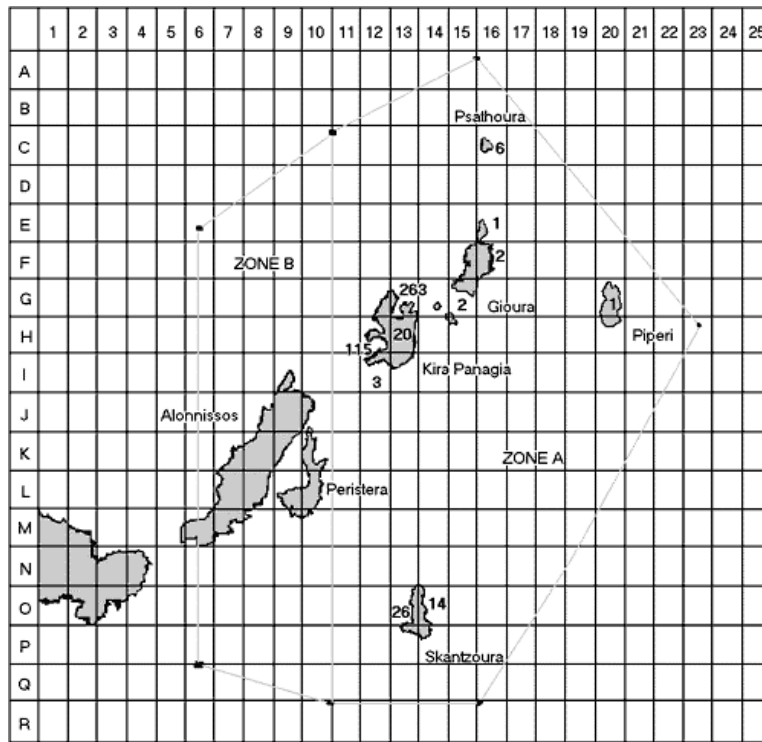


Fig. 4: Distribution of vessels recorded anchored within the NMPANS during the project

**Boats fishing within the NMPANS (Fig. 5)**

Of all vessels recorded, 69 were observed to be engaged in some form of fishing activity. Eleven were found fishing in Zone B and 60 in Zone A. The latter number refers to professional fishermen, as Zone A is off-limits for amateur fishermen. A closer look at figure 5 shows that professional fishermen frequented all coastal waters of the Park for their fishing activities, with a slight preference for the coastal waters around the island of Gramiza (quadrat G 15) and the reef area north-east of the island of Gioura (quadrat E 16), a well known fishing ground. In addition, three fishing boats were recorded in the Core Zone, an area restricted to fishery, and the guarding team took the necessary action against them.

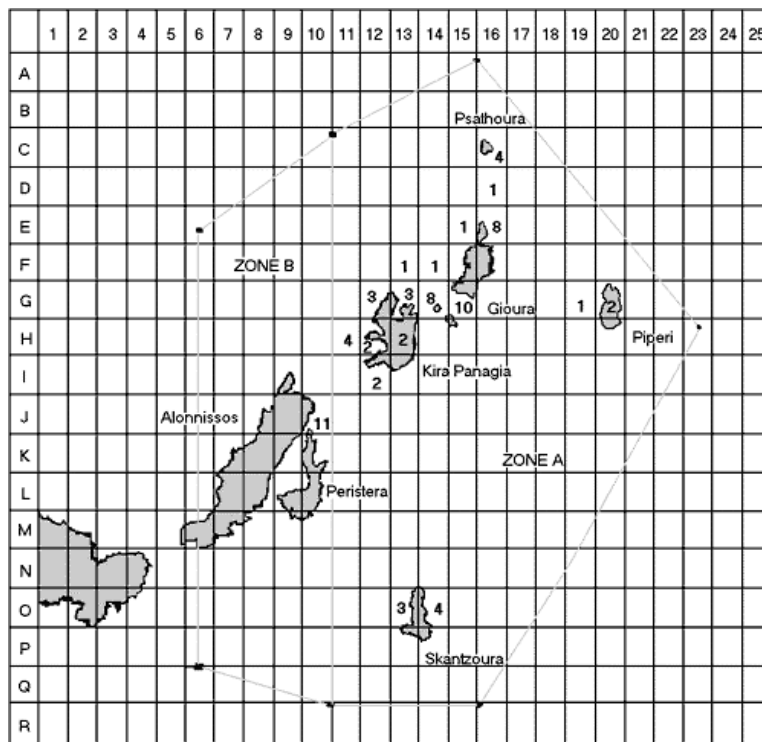


Fig. 5: Distribution of vessels recorded fishing within the NMPANS during the project

## Human activity intensity of different areas of the NMPANS

In order to estimate the intensity of human activity in the protected area of the NMPANS, 77 different quadrats of the NMPANS were visited and the number of boats in each of these quadrats was recorded. The monitoring effort concentrated mainly in the highly sensitive area of the Core Zone and the areas with the highest human activity. To minimize bias, the number of boats per survey was used as an indicator for the intensity of human activity (see Fig. 6).

Human activity was recorded in 28 of the 77 quadrats visited. The quadrats with the highest number of boats per survey were located at the coastal waters of the islands of Kira Panagia (G13 and H12) and Skantzoura (O13 and O14). Intermediate numbers of boats per survey were recorded at the quadrats C16, E16 and H13. The marine areas between Alonnissos and Kira Panagia, Alonnissos and Skantzoura as well as between Kira Panagia and Gioura, which were used for fishing and sailing, presented low numbers of boats per survey.

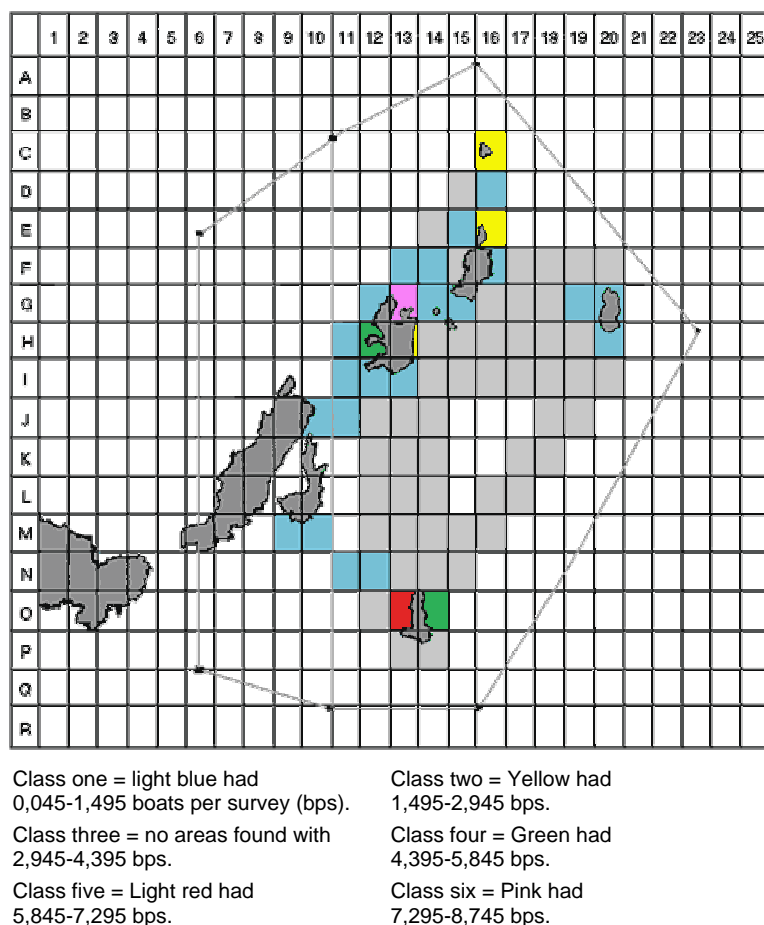


Fig. 6: Relative usage frequency of different areas of the NMPANS

## Cave visits

Sixty-nine cave visits were carried out and, in 16 of them, there was evidence of cave use by seals (tracks of movement on the cave beach, blood stains, faeces) (Table 1).

|                                 | Kira Panagia | Gioura | Piperi | Total |
|---------------------------------|--------------|--------|--------|-------|
| Number of caves surveyed        | 1            | 1      | 2      | 4     |
| Caves with evidence of seals    | 1            | 1      | 2      | 4     |
| Total number of visits to caves | 17           | 18     | 34     | 69    |
| Number of cases with evidence   | 1            | 4      | 11     | 16    |
| % of visits with evidence       | 6%           | 22%    | 32%    | 23%   |

Table 1. Cave use by seals in the study area.



For the 4 caves together, the average percentage of evidence of seal presence per survey was 23% (Table 1).

The data collected during this project indicate that the four caves inspected were being used in a different degree by the local seal population (Fig.7).

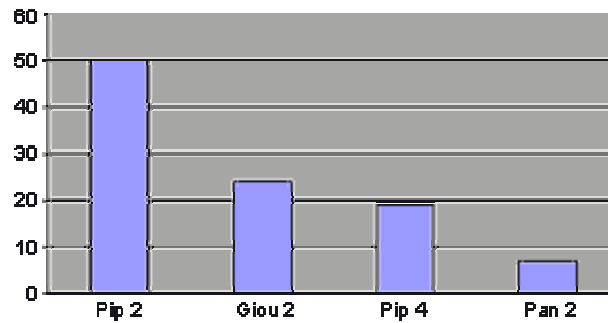


Fig 7: Cave preference recorded during this project

## Discussion

The findings of the project allow some tentative conclusions regarding human activity in the National Marine Park of Alonnissos and Northern Sporades. Human activity in the summer months is especially high, mainly due to the presence of tourists in the area, who usually remain in the coastal, non-prohibited waters of the park. Professional fishermen working in the area usually visit the areas prohibited to tourists as well.

Regarding the intensity of human activity in the different Zones of the Park, this project showed the following:

- Zone A: Human activity in this Zone varied from island to island. The reason for the high intensity of human activity in the coastal waters of the islands Kira Panagia and Skantzoura is because of the presence of well protected mooring bays on these islands. The intermediate number of boats per survey registered at the quadrats H13, C16 and E 16 are due to the presence of small natural harbours and the reef area in these quadrats respectively. The legal restrictions imposed on the island of Gioura were usually respected by the tourists visiting the area.
- Core-Zone: Human activity was in all the areas of the Core-Zone minimal and the legal restrictions were generally respected by tourists and fishermen.

The specific pattern of traffic and human activity of the marine areas of the NMPANS presented above, is similar to the activity pattern of previous years (MOM 1995a).

Considering the low number of seals living in the area, the average percentage of seal presence per survey (23%) indicates an intensive cave use by *Monachus monachus*. The fact that from 16 recorded cases of cave use, only one animal was observed in a cave during the daylight hours, is consistent with the evidence provided by other researchers (Dendrinou et al. 1993, Matsakis et al. 1985) that the monk seal population of the Sporades uses caves mainly at night.

During this project 4 "active" caves at three different islands were monitored. The monk seals showed a preference for the shelters Pip 2, Pip 4 and Giou 2 (Fig. 7). Possible explanations for this apparent shelter preference could be:

### 1. Human activity in the vicinity of the cave

A comparison between Figures 6 and 7 shows that the caves Pip 2, Giou 2 and Pip 4 of the quadrats H20 and Z16 (quadrats with minimal human activity) were visited more often than the cave Pan 2 at quadrat H12, which is located in an area of intense human activity. Thus, it is logical to assume that monk seals reacted to human activity in the NMPANS and chose undisturbed places to rest at night.

Regarding the low percentage of cave use of Pan 2, one should not suppose that the island of Kira Panagia is not suitable monk seal habitat. While monk seal tracks were not found in Pan 2, evidence

of monk seal presence was found in another cave on the same island, which had the same direction of entrance as Pan 2 ( P. Dendrinis and E. Tounda, pers. comm.). According to what is known about monk seal habitat, the latter cave is less suitable than Pan 2, since the substrate of the beach is not as suitable for the seals to rest on. It does offer them, however, better protection against humans, as it has a small, narrow entrance, allowing access to the cave only by swimming whereas Pan 2 has a large entrance and the beach in it is visible from outside. In this case, one might assume that seals in search of solitude and avoidance of humans, would choose such caves during periods of intense human activity. Following the tourist season, they might likewise be expected to return to their "preferred" caves, such as Pan 2. A similar pattern of cave use has been observed in monk seals in the Ionian sea (Panou et al. 1993).



Fig. 8: Juvenile Mediterranean monk seal (*Monachus monachus*) in the NMPANS

## 2. Wind force and direction in the vicinity of the cave

'Human activity' is, however, insufficient to explain the marked difference in cave use of the other three caves (Pip 2, Pip 4, Giou 2), which are all located in quadrats with minimal human activity. The difference in cave use between Pip 2 (50%) and Pip 4 (19%), which are both located in the same quadrat, is striking.

In search for an explanation for the large difference in cave use between Pip 2 and Pip 4 one must consider the factors of wind, and wave force and direction. The prevailing winds in the Aegean during the summer months are blowing from the North. In this respect cave usage can be explained in two different ways:

- Monk seals use caves independently from the force and direction of the winds. The absence of evidence of use in caves exposed to the prevailing winds is due to the fact that evidence of seal visits is removed by the waves.
- In search of protection against wind and waves, monk seals visit only those caves that can provide them with adequate shelter. For this reason, evidence of cave use can be found only in caves that are not "open" to the prevailing winds.

The research on monk seals in the Sporades by Kouroutos (1987) supports the second hypothesis. Further support is provided by the results obtained from cave-installed automatic cameras. A camera installed in Pip 4, during a period when the winds were blowing continuously from the North, did not record any seal in the cave, whereas cave Pip 2, with an entrance facing to the South, was used twice.

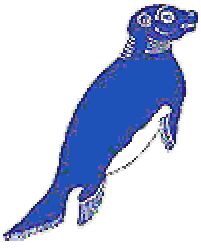
The data presented above suggest that cave preference is dependent on various interrelated factors. Such conclusions, however, must be considered preliminary as they are based on a relatively limited number of visits over a short period of time. Nonetheless, it is known that both cave use and human activity in the Park vary throughout the year (MOM 1995b, MOM 1996).

## Acknowledgements

I would like to thank the Hellenic Society for the Study and Protection of the monk seal and especially Mr. V. Zavras for the generous organisational and financial support as well as Mrs. E. Tounda, Mr. P. Dendrinis and Mr. S. Kotomatas for their experienced guidance in the field work. Finally, I wish to express my appreciation to all the numerous persons that helped me writing my thesis and this paper.

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## Letters to the Editor

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### Sightings on the Main Hawaiian Islands

I became interested in the monk seal while in Kauai, Hawaii. While there in November, we had 14 seal sightings in 6 days around the Poipu Beach area. We saw up to 4 different seals on one day. We were wondering if this was an unusual occurrence?



I took a bunch of pictures, hoping some would turn out. Unfortunately I did not get any pictures of the one monk seal we saw playing, rather actively, with one of the warning signs in the sand. He (or she?) went right for the sign, dug his nose into the sand right below it and then raised his head, uprooting the sign. He then continued to toss the sign about with his head for at least 10 minutes (the time we were watching). Since all of the other times we saw them they were generally just sleeping, we were pretty amazed watching this playful activity.

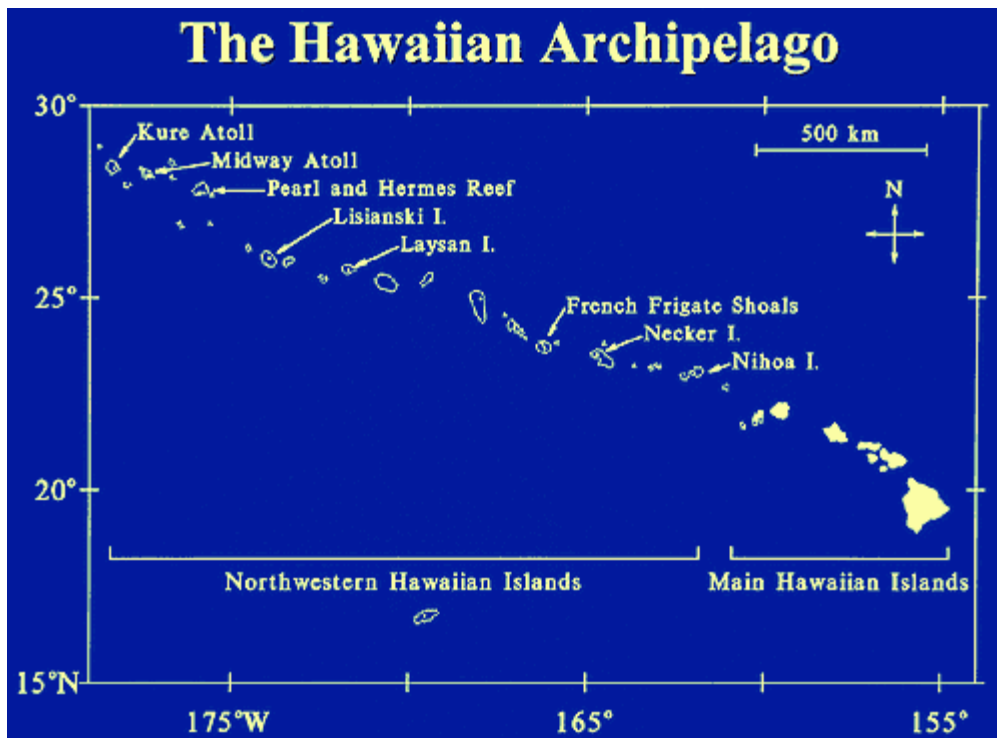
*Heather Huszti, USA*

✓ **Thea Johanos, Wildlife Biologist at the NMFS Honolulu Laboratory replies:**

### **MONK SEALS IN THE MAIN HAWAIIAN ISLANDS**

The Hawaiian monk seal is highly endangered and is found only within the Hawaiian Archipelago. Nearly all monk seals are at six main reproductive sites in the Northwestern Hawaiian Islands (French Frigate Shoals, Laysan Island, Lisianski Island, Pearl and Hermes Reef, Midway Atoll, and Kure Atoll). Current abundance is approximately 1,300 to 1,400 animals. The total number of seals has declined 60% since the late 1950s, and 4% to 5% annually from 1985 to 1993. Counts have remained essentially unchanged since 1993, but may decline further in the near future because of poor juvenile survival rates, and the resulting low number of young females reaching reproductive age at French Frigate Shoals, the most populous breeding location.

The Hawaiian monk seal actually has a metapopulation (a population composed of several relatively discrete subpopulations). Although some seals travel between breeding areas, most monk seals remain where they are born for their entire lives. Having a metapopulation may lower the risk of extinction for monk seals because local population trends are independent (i.e., the subpopulations don't all increase or decrease at once), and local populations that have declined can be bolstered by immigration from other areas. For example, while the population at French Frigate Shoals has recently declined, numbers at Pearl and Hermes Reef, Kure Atoll, and Midway Atoll have increased. Also, much of the present population recovery at Midway Atoll is because of immigration of seals from nearby atolls.



Because the stability of a metapopulation may increase with additional population units, a healthy subpopulation in the main Hawaiian Islands could promote the long-term existence of monk seals. A relatively small number of monk seals are distributed throughout the main Hawaiian Islands. They are highly dispersed, and have been sighted at all the islands, including Nihoa and Kahoolawe. Pupping has been recorded on Kauai, Oahu, Molokai, and Maui. An unknown number of seals are naturally found in the main islands. In addition, 21 adult male seals were taken from Laysan Island and released around the main islands in 1994 by the National Marine Fisheries Service (NMFS) in order to balance the sex ratio of the Laysan Island population, where an excess of aggressive males was causing high female mortality.

Reported sightings of monk seals in the main islands are sporadic and must be highly biased towards seals that frequent populated areas. Although these reports are valuable, we cannot infer abundance trends from them. Monk seals are vulnerable to human disturbance, especially when nursing pups, and avoid pupping and hauling out to rest where disturbance is high. Thus, it is likely that additional births and seal haulouts occur in remote areas and go unreported. This year, we plan to conduct our first complete aerial survey of all main Hawaiian Islands in order to estimate the minimum number of seals using these islands and to characterize their habitat use. Previously, in 1998, eight seals were counted during a single aerial survey of Kauai as part of an oil spill response. Monk seals in the main Hawaiian Islands are much more vulnerable to human-caused harm given the proximity to large numbers of people, nearshore fisheries, marine industry/commerce, and boat traffic. In the event of an oil spill, it would be invaluable to possess baseline data on population size and whether affected areas are known monk seal habitat.

You are fortunate to have seen Hawaiian monk seals in the wild. Although most people in Hawaii have never seen a monk seal, reported seal sightings have increased in the main Hawaiian Islands, particularly on Kauai. On Kauai's south shore, near Poipu Beach, monk seals are seen almost daily in the winter months, and several of them may haul out at a time. For example, this past fall at least five seals went through their annual molt (a process which takes several weeks) in the vicinity of Poipu. The number of reported pups born in the main Hawaiian Islands has also clearly increased; a total of 18 seal births have been reported since 1962 in the main islands, 12 of which have occurred since 1996. At least three pups were born in the main islands last season, one each on Kauai, Molokai, and Maui. Sadly, the Kauai pup died shortly after weaning because of trauma, possibly incurred in a collision with a boat.

Because of the increased presence of monk seals, State and Federal agencies, environmental groups, and members of the community have joined in a cooperative effort to protect and enhance the monk seal population in the main Hawaiian Islands. The Monk Seal Watch Program combines

management and monitoring, community participation, environmental education, and cultural awareness. Volunteers identify and document resting seals, place warning/education signs strategically around seals resting on the beach (particularly at high-use beach parks in order to eliminate or minimize human disturbance), and provide environmental education to beach users.

You can help protect the Hawaiian monk seal by preventing disturbance to them and reporting seal sightings and/or seal harassments by calling the monk seal hotline at (808) 983-5715. State and Federal laws prohibit harassment of these animals. To prevent disturbance, view seals from a distance and remain out of sight if possible. Keep at least 100 feet away, more if encountering a mother and pup. These endangered seals feed offshore, often at night, and uninterrupted rest on land is critical for their survival. Furthermore, seals are wild and may bite if disturbed. Contact with humans or dogs may transmit diseases and an epidemic could cause the seal's extinction. Although monk seals may approach people, you should always move away to avoid interaction, and keep dogs away from seals.

Thank you for your interest in Hawaiian monk seals, and for sharing your observations with us.

### **Thea Johanos**

Wildlife Biologist, Protected Species Investigation, NMFS Honolulu Laboratory

Web: [www.nmfs.hawaii.edu/psi/home.htm](http://www.nmfs.hawaii.edu/psi/home.htm)

### **Tourism's Day in Court**



The November 1999 issue of *The Monachus Guardian* delivered a few home truths that the leisure, travel and tourism industry will not like to face up to. The image they want to project is one of unspoiled landscapes, romantic sunsets, sun and sea drenched relaxation – not death and destruction. Yet *Monachus* has been brought to extinction's door in one Mediterranean country after another. Even in today's allegedly more ecologically enlightened times, the mass tourism industry continues to chase its billion dollar profits, with no conscience, no care, no help for such a shy, beautiful animal that must now hide away from all the noise, vulgarity and pollution – places that are increasingly few and far between. What I don't understand is this. Tourism's responsibility for the decline and extinction of the species has been established without a shadow of a doubt. As Sadruddin Aga Khan points out in his editorial, grassroots conservation organizations are actually underwriting this mega-profit, mega-arrogant industry by tackling the environmental problems it is causing. Can't the industry be dragged into court, and sued for damages? At least there might finally be some justice for the monk seal!

*J. J. Wilcox*

✓ **Editor's reply:** We appreciate the sentiment. Although the prospects look bleak –as in most cases where powerful industrial interests are stacked against a vulnerable species or habitat – The Monachus Guardian is taking legal advice. We will report our findings in the November issue.



## **Dynamite, Seals and the Dilek Peninsula National Park**

Re. [Mass Tourism & the Mediterranean Monk Seal](#)

There is yet another example of development interests invading monk seal habitat and monk seal protected areas.

In January 1997, we received a letter from a diving instructor from Aydin, who informed us that he had photographed a monk seal on the southern coasts of Dilek Peninsula National Park. Both the seal and the Dilek coastline were clearly identifiable in the pictures he sent us.

At the same time, the diver also alerted us that a road was being cut through the National Park from the south, causing serious damage. He reported that, while in his car on the road, he himself observed stones falling near the monk seal swimming nearby, and that he saw the seal fleeing the area because of the dynamite blasting!

As indicated in your November 99 article on tourism's impact on the monk seal ([Mass Tourism and the Mediterranean Monk Seal](#)), the northern zone of the Dilek National Park is already swarming with tourists during the summer period. It was our concern that the new road being built from the south would cut through the Peninsula linking up with the north, thereby increasing tourism dramatically in monk seal habitat.

We received no reply to our initial complaint to the authorities. Then on 2 May 1997 I visited the area and saw for myself how the Ministry of Forestry (MoF) had opened up a brand new road extending from Karina to Dip Burun along on the southern shore of the Peninsula.

We then compiled as much information as we could and submitted it to the relevant authorities with a formal complaint. It was our contention that the development was in violation of the Bern and Barcelona Conventions, particularly their stipulation that the habitats of endangered species must be protected.

In a letter to the Forestry General Directorate (copied to SAD-AFAG), the National Parks General Directorate (NPGD) requested an explanation for the construction, and asked for it to be halted because of the importance of the region's wildlife. In their reply, the Forestry General Directorate declared that the road had been opened up only to salvage forest products after a fire. They also assured the NPGD that the road would not be used for any other purpose and that it would remain strictly closed to visitors.

While there is reason to believe that the authorities will live up to their promises, the events related above indicate how easy it is for sensitive monk seal habitat to be threatened and destroyed. It seems that our vigilance is necessary all of the time – even in protected areas.

*Cem O. Kiraç, SAD-AFAG, Ankara.*

## **Vote With Your Feet**

Why not draw up a list of tourist companies most to blame for eradicating the [Mediterranean] monk seal? You point to hotels being built over seal caves and tour boats deliberately searching out the animals... Why not begin listing names so that we as customers can vote with our feet? It is absolutely outrageous that an industry should be getting away with something that is actually even worse than murder – the extinction of an entire species.

*Susan Streitfeld, USA.*

### **English Nursery Rhyme?**

Re. [The Old Woman Who Swallowed the Fly](#)

A quick note to set the record straight. In *The Monachus Guardian* Vol. 2, No. 1 you mention "The Old Woman Who Swallowed a Fly" as being an English nursery rhyme. Allen Mills, Canadian folk singer from Montreal, wrote the song back in the 1950s in Montreal.

*W. Hoek*, the Netherlands.

### **Sea Otters and Seals**

Thank you for sending me a copy of your excellent *Monachus Guardian*. The magazine is wonderful (the web site too) and I hope that it will contribute to exchanging experiences on monk seal conservation.

Our society is the largest Bulgarian conservation NGO. We have branches in all big Bulgarian cities along the Black Sea. Unfortunately the monk seal was exterminated in Bulgaria a few years ago, but we hope that it will be reintroduced in the future...

I have some remarks about the sightings of monk seals around Italy [[The Monachus Guardian Vol. 2 No. 1, May 1999](#)]. Are there otters there? During our investigations on monk seals in Bulgaria, we found that there is a sea population of otters. Unfortunately, some fishermen very often confuse the otter with the seal...

*Stefan Avramov*

Bulgarian Society for the Protection of Birds / BirdLife Bulgaria

### **Caribbean Seal No More**

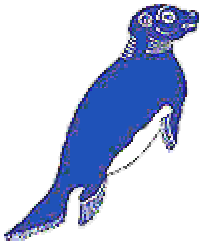
Re. [Has Anyone Seen a Caribbean Monk Seal?](#) and [Caribbean Monk Seals – Are they Extinct?](#)

Just a brief comment on the Ian Boyd report on "circumstantial" evidence [for the continued existence of the Caribbean monk seal, *Monachus tropicalis*, TMG 1(2): December 1998]. Local fishermen are often quite eager to please inquiring people with what they want to hear. It is also a fact that Hooded Seals (*Cystophora cristata*) and Harp Seals (*Phoca groenlandica*) and also Harbour Seals (*Phoca vitulina*) can often be found off course, e.g. the Azores, Florida, etc. Let's not beat a dead horse. Circumstantial evidence is not evidence. I'm afraid the Caribbean monk seal is no more.

*W. Hoek*, the Netherlands.

**The editor reserves the right to edit letters for the sake of clarity and space**

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## Recent Publications

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- **Aguilar, A.** 1999. Status of Mediterranean monk seal populations. RAC-SPA, United Nations Environment Program (UNEP), Aloès Editions, Tunis: 1-60.
- **Forcada, J.** 2000. Can population surveys show if the Mediterranean monk seal colony at Cap Blanc is declining in abundance? *Journal of Applied Ecology* 37(1): 171-181. [Online Abstract](#).
- **Forcada, J., P.S. Hammond & A. Aguilar.** 1999. Status of the Mediterranean monk seal *Monachus monachus* in the western Sahara and the implications of a mass mortality event. *Marine Ecology Progress Series*, 188: 249-261. [Online Abstract](#).
- **Gazo, M., J.F. Layna, F. Aparicio, M.A. Cedenilla, L.M. González & A. Aguilar.** 1999. Pupping season, perinatal sex ratio and natality rates of the Mediterranean monk seal from the Cabo Blanco colony. *Journal of Zoology (London)* 249: 393-401.
- **Gazo M., L.M. González & E. Grau.** 2000. Age at first parturition in a Mediterranean monk seal monitored long-term. *Marine Mammal science* 16 (1): 257-260.
- **Gazo, M., F. Aparicio, M.A. Cedenilla, J.F. Layna & L.M. González.** 2000. Pup survival in the Mediterranean monk seal (*Monachus monachus*) colony of the Cabo Blanco peninsula (Western Sahara-Mauritania). *Marine Mammal science* 16 (1): 158-168.
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- **Parrish, F.A., M.P. Craig, T.J. Ragen, G.J. Marshall & B.M. Buhleier.** 2000. Identifying diurnal foraging habitat of endangered Hawaiian monk seals using a seal-mounted video camera. *Marine Mammal Science* 16(2): 392-412.
- **Samaranch, R. & L.M. González.** 2000. Changes in morphology with age in Mediterranean monk seals (*Monachus monachus*). *Marine Mammal science* 16 (1): 141-157.
- **Swanson, G.** 2000. Final Millennium for the Monk Seal. History Talk from the Upper Florida Keys, Winter (99/2000): 156-158.

### Proceedings

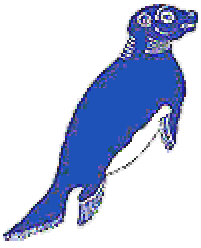
The Society of Marine Mammalogy's 13<sup>th</sup> Biennial Conference convened in Maui, Hawaii, in November 1999. Abstracts of presentations and posters are available in the following publication:

- Abstracts. The Society for Marine Mammalogy. 13<sup>th</sup> Biennial Conference on the Biology of Marine Mammals. Nov. 28–Dec. 3, 1999. Wailea, Maui, Hawaii: 1-226.
  - **Adamandopoulou, S., E. Androukaki, P. Dendrinis & S. Kotomatas.** 1999. Evidence on the Movements of the Mediterranean Monk Seal (*Monachus monachus*) in Greece: 2.
  - **Aguirre, A.A. J.S. Reif & G. Antonelis.** Serologic evidence of zoonotic diseases in the Hawaiian monk seal; are they limiting population recovery: 2.
  - **Antonelis, G.A., J.D. Baker, T.C. Johanos.** Population dynamics and status of the endangered Hawaiian monk seal, *Monachus schauinslandi*: 7.
  - **Atkinson, S.** Body composition and metabolic hormones in Hawaiian monk seals: 8.
  - **Baker, J.D., T.C. Johanos.** Effects of research handling and instrumentation on Hawaiian monk seals, *Monachus schauinslandi*: 10.
  - **Becker, B.L., & T.C. Johanos.** Trends in Hawaiian monk seal (*Monachus schauinslandi*) pupping site fidelity and juvenile survival at Laysan Island: 15.
  - **Boland, R.C.** Surveys of submerged marine debris; a persistent and ongoing threat to the endangered Hawaiian monk seal: 19-20.
  - **Craig, M.P., M. Shaw, G. Mo, M. Rutishauser.** Aggressive male behavior and shark predation dramatically increase mortality of Hawaiian monk seal pups at French Frigate Shoals: 40.
  - **Dendrinis, P., E. Tounta, S. Kotomatas.** A field method for age estimation of Mediterranean monk seal (*Monachus monachus*) pups: 48.
  - **Early, G., R. Cooper, S. Kraus, M. Williamson.** The movements and behaviour of released, rehabilitated seals: 52
  - **Forcada, J., R. Pradel, M. Gazo, A. Aguilar.** Demographic trajectory and projections of the Mediterranean monk seal population in the Western Sahara: 58.
  - **Gazo, M., J. Forcada, T. Pastor, G. Cantos, A. Aguilar.** Effects of the 1997 die-off on the reproductive parameters of the Mediterranean monk seal colony of Cabo Blanco: 65.
  - **Gilmartin, W., S. Canja, C. Vanderlip, J. Mangel.** Managing human activity aids recovery of endangered Hawaiian monk seals at Midway Islands: 67.
  - **Horn, D., & S. Atkinson.** Seasonal reproduction and metabolism in the male Hawaiian monk seal: 85.
  - **Johanos, T.C., B.L. Becker, T.J. Ragen, J.D. Baker.** Population impacts of absolute and functional sex ratio fluctuations on the endangered Hawaiian monk seal: 91.
  - **Keith, Lucy W.** Haul-out behaviour of weaned pup and juvenile Hawaiian monk seals (*Monachus schauinslandi*) at Midway Atoll: 96.
  - **Kliks, M.M., & A.A. Aguirre.** Hawaiian monk seal helminthology survey: analyses of 1997 specimens: 99.
  - **Krussell, K., & S. Atkinson.** Temperature loss in the Hawaiian monk seal: 102.
  - **Oki, C., & S. Atkinson.** Body condition and hormone analysis of yearling Hawaiian monk seals: 138.
  - **Parrish, F.A., M.P. Craig, K. Abernathy, G.J. Marshall, B.M. Buhleier.** Use of deepwater coral beds by monk seals at French Frigate Shoals, Hawaii: 145.

- **Pastor, T., J. Gaza, J. Carlos, P. Allen, B. Amos, A. Aguilar.** Very low levels of nuclear genetic variability in the endangered Mediterranean monk seal after a population bottleneck: 145.
- **Polovina, J.J., J.D. Baker, G.A. Antonelis.** Do Hawaiian monk seals benefit from El Niño?: 149.
- **Ryon, B., R. Braun, L. Dalton.** Sedation effects of Midazolam and its antagonist Flumazenil in the Hawaiian monk seal: 164.
- **Schmelzer, I. & T. J. Ragen.** Seals and seascapes: covariation in Hawaiian monk seal subpopulations and the marine environment of the Hawaiian archipelago: 167.
- **Stewart, B.S., M.P. Craig, G.A. Antonelis.** Foraging habitats and conservation of Hawaiian monk seals: 179.
- **Wilcox, M., J. Buzitis, L. Woodward, S. Atkinson, G. Antonelis.** Survey for select xenobiotics in the free-ranging Hawaiian monk seal (*Monachus schauinslandi*): 201.

### In press

- **Forcada, J. & A. Aguilar.** Use and reliability of photographic identification in capture-recapture studies of Mediterranean monk seals. *Journal of Applied Ecology*.
- **Jiddou, Azza Mint, Sidina ould Dedaii, Mohamed M'Bareck ould Soueilem, Mika Diop, Ba Abou Sidi, Mohamed ould Ely ould Braham, Mohamed ould Mohamed Lemine, Mohamed Vall ould Cheikh, Moustapha ould Mohamed Ahmed, Elisabeth Vedder, Lisette Egberts, Byron Martina, Marco v/d Bildt, Lenie 't Hart, Albert Osterhaus, Sjef Vos.** 2000. Memorandum on the mass die-off of monk seals on the Cap Blanc peninsula. CNROP/SRRC December 1997. Republished by the Seal Rehabilitation and Research Centre (SRRC), Pieterburen, the Netherlands.
- **Pastor, T., A. Aguilar, J.C. Garza, P. Allen, & B. Amos.** Low levels of genetic variability assessed by DNA microsatellites in a highly endangered species: the Mediterranean monk seal. *Conservation Biology*.
- **Pires, R.M. & H.C. Neves.** 2000. Monk seal sightings on open beaches in Desertas Islands, Madeira Archipelago.



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