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MARIA LOURDES D. PALOMARES, ELIZABETH MOHAMMED, AND DANIEL PAULY ON EUROPEAN EXPEDITIONS AS A SOURCE OF HISTORIC ABUNDANCE DATA ON MARINE ORGANISMS: A CASE STUDY OF THE FALKLAND ISLANDS

IN READING THE narratives of historic seagoing expeditions, we came to realize that observations made by early naturalists provide usable data on relative abundance, size, and habitat, feeding behavior, and uses and trade by the local people, for a time depth not usually provided by other methods used in the study of biodiversity. We offer here an approach for recording and "scoring" these observations in a reproducible fashion, such that temporal trends in biodiversity can be inferred. This method can be employed by environmental historians to reach further into the past, especially in areas where reliable statistical data is missing, as is often the case with ocean issues. We chose to focus on the Falkland Islands for our case study, as these islands apparently were uninhabited when Europeans discovered them, and have since been a port of call for many vessels.

MATERIALS AND METHODS

OUR INITIAL BIBLIOGRAPHIC search identified more than five thousand records corresponding to a combination of these keywords: Falkland, expedition, survey, voyage, and natural history. However, only fifty were pertinent to our study, of which sixteen (3,700 pages) were available at the University of British Columbia library (see Table 1).

Accounts of marine organisms occurring in a specific locality were extracted and encoded into the historic expeditions and surveys database, a relational

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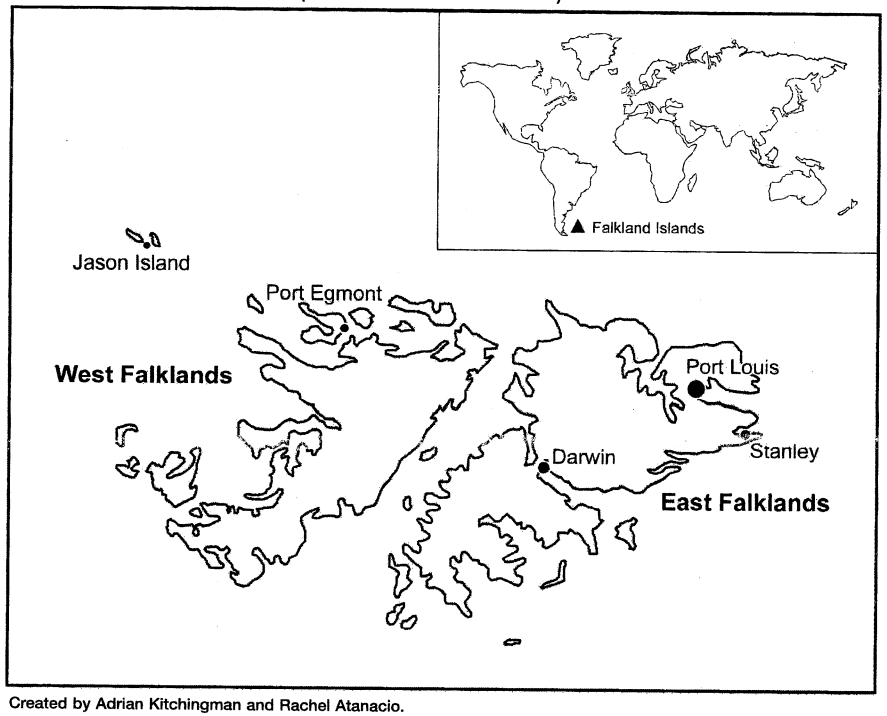
Map 1. The Falkland Islands (southwest Atlantic Ocean).



Created by Adrian Kitchingman and Rachel Atanacio.

The dots indicate the areas where natural history observations are available in the historic expeditions and survey database of the *Sea Around Us* Project. The sizes of dots represent the number of observations at each locality.

Microsoft Access database hosted by the *Sea Around Us* project website (see www.seaaroundus.org). Each observation or "anecdote" (comprising one or several sentences or paragraphs) was coded according to the perceived abundance of a group of species, using a multi-level system suggested by Dr. Jeremy Jackson of the Scripps Institution of Oceanography, University of California, San Diego, using these categories: extremely abundant; abundant; very common; common; rare; absent; and unknown (an "occurrence" where no inference on abundance was possible).

Table 1. Sources and Number of Abundance "Anecdotes" Included in this Study.

	Expedition Name	Years	No.
1.	Sebald de Weert's voyage to the South Sea and Magellan Strait[1]	1598-1600	13
2.	Strong's voyage to the South Seas[2]	1689	6
3.	De Gennes' voyage to the Straits of Magellan[3]	1696	12
4.	Dampier's voyage to the South Seas[4]	1703	2
5.	L. A. de Bougainville's voyage to the Malouine (or Falkland) Islands[5]	1763-1764	117
6.	L.A. de Bougainville's voyage around the world[6]	1766-1769	13
7.	Observations of natural history by individual voyagers[7]	1817-1829	1
8.	Voyage of the *Beagle*[8]	1831-1836	41
9.	George Nares' voyage around the world[9]	1872-1876	2
10.	Rupert Vallentin's independent voyages to the Falkland Islands[10]	1897-1911	133
11.	Observations of natural history by individual voyagers[11]	1725-1924	80
	Total		**390**

Table 2. Examples of Anecdotes and the Codes Applied to Them.

Anecdote	Functional Group	Rank
"The island which M. de Bougainville set on fire, was at first called Penguin Island because these birds were found there in such numbers, that upwards of two hundred perished in the flames. There remained however, a prodigious quantity; and we found some of them at every step."[12]	Seabirds	Extremely abundant
"Toutes les côtes abondent en poissons, la plupart peu connus."[13]	Fish	Abundant
"Notothenia sima, Richards. Stanley Harbour. Very common."[14]	Fish	Very common
"On the hulks at the extremities of both the dockyard jetty and also the Falkland Island Company's west store, numbers of Trophon geversianus in the most perfect condition can be obtained."[15]	Invertebrates	Common
"... les boeufs, chevaux, porcs et lapins importés par les Français et les Espagnoles s'y sont depuis considérablement multipliés à l'état sauvage. Au contraire les amphibies, qui étaient extrêmement nombreux, y ont été à peu près détruits par les pêcheurs anglais et américains."[16]	Marine mammals	Rare
"Here are no sea-tortoises, but many land ones."[17]	Sea turtles	Absent
"Once when out on a whaler we had the good fortune to secure a fine whale and while making it fast to the side of the steamer some dozens of these birds suddenly appeared round the ship."[18]	Whales and seabirds	Occurs

Coding was based on words used in the descriptions indicating relative amounts of observed marine organisms (see Table 2). For example, "fish abound along the coast" was coded as abundant, while "enormous quantities of" was coded extremely abundant. Coding can be repeated independently by several researchers in order to reduce subjectivity.

Each anecdote was assigned to the functional group being described (marine mammals, seabirds, turtles, fish, invertebrates, seaweed, algae, others). Scientific names of the species, when mentioned or footnoted, and biological information (for instance, size, feeding and spawning behavior), were recorded. If the anecdote described several groups of species in one sentence, separate records were entered to account for each functional group mentioned, including the name of species when specified. Each anecdote was linked to the following information:

- the "sampling station", that is, the coordinates, time of arrival and departure, the country, and local names of the "station";
- the expedition details;
- the source and online links to the entire text, if available;
- the specimen accession number, if identified, and online links to the website of the museum that holds the specimen, if available.

The abundance anecdotes were separated by functional groups and arranged chronologically. Observations for each functional group were further subdivided into time periods with similar number of observations and plotted on the chronological axis at the value corresponding to the mean of the years with observations. The total number of observations per coding level was obtained for each time period (represented by its mean year). This permitted the plotting of

the "perceived" abundance (in percent; by coding level) of each functional group over time.

To test the plausibility of the resulting time series trends, estimates of extracted biomass or numbers of individuals killed were obtained from independent sources.[19]

RESULTS

DESCRIPTIVE NATURAL HISTORY

THE NARRATIVES INCLUDED in this study provided us with a view of the natural history of the Falkland Islands from the time of their sightings by the Spanish and Portuguese sailors and subsequent inclusion as "*Insule 7 delle pulzelle*," on the first map to bear the name of *America* by Martin Waldseemüller in 1507.[20]

Observations by privateering explorations, those of Captain John Davys of the *Desire*, or the second privateering expedition of Thomas Cavendish in 1591-1593, for instance, were cartographic and described how these ships replenished supplies, with scarce mention of the natural resources they encountered in these islands.[21] Most of the earlier narratives mention that the Falklands were "barren," providing little or no wood and no access to freshwater. However, seabirds and seals were observed as "extremely abundant"—expectedly so since these animals are easily seen. Sebald de Weert, vice-admiral of a Dutch fleet on board the *Blijde Boodschap*, wrote: "They here saw vast numbers of those birds called 'plongeons' or divers, because they dive into the water to catch fish.[22] They killed there ten or fourteen of them with sticks, and might have killed as many as would have served the whole fleet, but would not lose the opportunity of a fair wind."[23] The Englishman William Dampier on board a buccaneer's ship in 1684, wrote that "January 28th we made the Isles of Sebald de Weert ... where we found foul rocky Ground, and the Islands barren, and destitute of trees, but some Dildo-bushes growing near the Sea-side. We saw the same day vast shoals of small red Lobsters, no bigger than one's Finger."[24]

The first recorded landing was not until January 28, 1690, when the British captain, John Strong, anchored at Bold Cove, Port Howard where he wrote that "this land doth show like a great many Islands ... there is several keys that lye along shore. Wee sent our boat on Shoar to one of them and they brought on board abundance of Pengwins and other fowl and Seals." Strong named the islands after the Viscount of Falkland, one of the owners of his ship, the *Welfare*.[25]

At the end of the seventeenth century, French seafarers, quietly establishing an extensive trade with South America, used the islands as their base. They called the islands *Îles Malouines*, after St. Malo, a city in northwestern France.[26] French activity in the southern seas led to the establishment of a French colony at Fort St. Louis (named after the ship *St. Louis*, commanded by Jacques Gouin de Beauchêne, which landed there in 1698).[27] The colony was established in the East Falkland by Louise-Antoine Comte de Bougainville.[28] Bougainville's stay (1763-1764) and successive voyages (1766) to the Falkland Islands provided not only detailed descriptions of aquatic and terrestrial life, but also of their abundance.[29]

The French relinquished the islands to the Spanish in 1767, and from then on the islands were known by the Spanish version of their French name, the *Malvinas*. In the early 1830s, a successful colony of "cowboys," the "gauchos," was exporting dried beef and salted fish to Brazil and wool to London.[30] However, the British reclaimed the islands in the 1840s, renaming them the Falklands, and the population of gauchos was replaced by settlers from England.[31] This era marks the beginning of the exploitation of terrestrial and aquatic resources, though American sealers had been harvesting the seal populations around the islands since the late 1700s.[32]

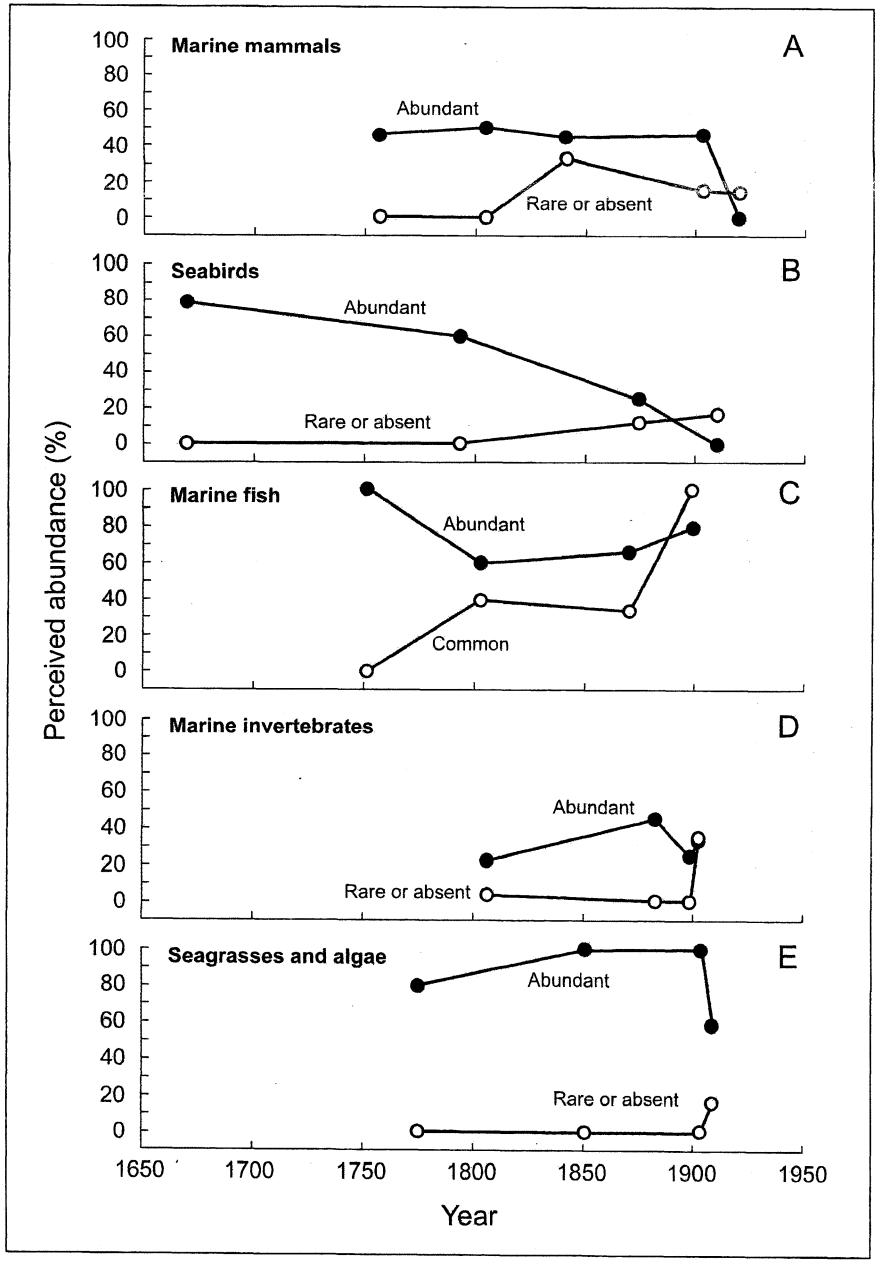
Charles Darwin's visits to the islands in 1833 aboard the *Beagle* and again in 1834 provided a rich collection of specimens along with notes, from Captain Robert Fitzroy, Syms Covington (Darwin's assistant) and Darwin himself, describing the islands' natural resources.[33] Darwin at first found the islands "desolate," being "universally covered by a brown wiry grass, which grows on the peat ... & excepting snipes & rabbits, scarcely any animals."[34] Covington, on the other hand, found "low Bushes with red berrrys [sic] which are very good eating" and "enormous numbers of Bullocks Horses & Pigs ... Rabbits, wild geese & Ducks ... & most excellent Snipe Shooting in the Marshy ground & Long grass, which the Island in general is very little else."[35] Darwin later on found that the islands were not desolate after all. They had "an immense quantity & number of kinds of organic beings which are intimately connected with the Kelp ... the infinite number of small fish which live amongst the leaves ... Crustacea of every order swarm, ... Encrusting Corallines & Aztias are excessively numerous ... The number of compound & simple Ascidia is a very observable fact ... Heurobranchus is common: but Trochus & petalliform shells abound on all leaves." Darwin believed that these islands will "become a very important halting place" with "fine harbors, plenty of fresh water & good beef."[36] Darwin also expressed concern that, as the islands became colonized, certain rare, endemic, and exploited species (such as the Falkland fox—the "warrah") would "be ranked among those species which have perished from the face of the earth."[37]

TIME SERIES TRENDS OF PERCEIVED ABUNDANCE

OF THE MANY references available on voyages to the Falkland Islands, we limited our data gathering to the narratives in English and French available to us through the University of British Columbia Library. We screened seven thousand pages to identify 194 pages that contained useful anecdotes for marine organisms.

For these, we extracted about five hundred observations on terrestrial, aquatic, and marine organisms for the Falkland Islands from the various publications we examined from the 1590s to the 1920s. However, only 390 records were of marine organisms and of those only 353 were usable: marine mammals (15.9 percent), seabirds (14.2 percent), fish (5.7 percent), invertebrates (30 percent), algae and sea grass (5.9 percent). Occurrences of marine organisms, where no indication of abundance was mentioned, were inferred from 28.3 percent of these usable observations. The rest were observations for which no date and/or year was mentioned and thus not suitable for our methodology.

Figure 1. Perceived Abundances of Marine Organisms in Percent of Total Number of Observations per Chronological Group.



Created by Rachel Atanacio.

A: marine mammals, i.e., whales, dolphins and seals, n=56 from 7 narratives (2,639 pages of text perused) from 1690 to 1924. B: seabirds, mostly penguins, n=50 from 9 narratives (2,621 pages) from 1598 to 1911. C: fishes, mostly pelagics, n=20 from 9 narratives (2,090 pages) from 1696 to1911. D: invertebrates, mostly mollusks, n=106 from 7 narratives (1,771 pages) from 1703 to 1988. E: algae and seagrass, n=21 from 5 narratives (1,335 pages) from 1690 to 1911.

Of the five functional groups considered here, only marine mammals, seabirds, and invertebrates could be analyzed. The other groups were not as viable because of the paucity of records.

The plots of relative abundance over time showed that, for marine mammals and seabirds, the number of observations that classified organisms as "extremely abundant" and "abundant" decreased over time. Conversely, the number of observations that classified them as "rare" and "absent" increased (Figures 1a and 1b). Note that, even with a limited number of observations, the same relative trends were observed for fishes and marine plants (see Figures 1c and 1e). Figure 1d, however, shows the opposite trend for invertebrates).

EXOGENOUS IMPACTS ON MARINE MAMMALS

SEALING IN THE FALKLANDS started with de Bougainville's French colony in Port Louis in 1775. The first fur seal cargo was exported from the South Atlantic to Canton, China, in 1784.[38] In the late 1700s, the fur seal population in the Falklands experienced withdrawals averaging two thousand to four thousand seals per ship per voyage.[39] Given the estimate of 102 sealing vessels operating in the area and the average seal withdrawals given above, the number of fur seals, *Arctocephalus australis*, caught in the region would have amounted to more than 300,000 per voyage. The extraction of fur seals increased by 71 percent from 1775 to 1793 and continued at an average of 10 percent per year to 1821.[40] Fur seal skins and whale oil having increased in value, Louis Vernet (then governor of the Falkland Islands and its dependencies) invited immigrants from the Americas to establish agricultural businesses and to engage in whaling in the islands.[41] Fourteen years later, the once prodigiously numerous seals were being "foolishly annihilated."[42] By 1919, the fur seal population in Beauchêne Island was locally extirpated.[43] Sea lions, *Otaria flavescens*, suffered a similar fate with a 7 percent rate of extraction per year from 1928 to 1952.[44] Associated sealing activities led to the extirpation of elephant seals, *Mirounga leonina*, from the Falklands in 1871.[45]

Whaling, which began surreptitiously in the early 1700s (fur sealers switched to whaling when whales were found), flourished in the mid 1800s with as much as six hundred sailboats plying the southern seas. This was undoubtedly a result of the invitation extended by Louis Vernet to American whalers. Whaling diminished steadily with the decrease in the price of whale oil during the second half of the nineteenth century.[46] However, the introduction of the explosive harpoon gun by Svend Foyn in 1866 led to more efficient whaling and in 1904, the first whaling company, Compañia Argentina de Pesca, was established in Buenos Aires. This company exploited South Georgian waters and, by 1915, the Falkland Islands and its dependencies held the most important fishery of whales in the world.[47] It had twenty-one whaling companies, six coastal and two floating processing stations and a seasonal production of 430,000 barrels of whale oil.[48] The species of whales harvested in and around the Falkland Islands were primarily Fin whale, *Balaenoptera physalus,* and Sei whale, *B. borealis.* Given that a twenty-meter Fin whale gave fifty barrels of oil and a ten meter Sei whale gave about twenty-five barrels, we estimate a maximum of about 9,000 whales killed per year.[49]

Table 3. Some Records on the Exploitation of Marine Mammals and Penguins.

Year	Extracted	Abundance	Area	Organism/Item
1766	900		Falkland Islands	Elephant seals[50]
1775	13,000		Falkland Islands	Fur seals (skins)[51]
1791		102	Southern Oceans	Sailboats[52]
1793	361,900		South Seas	Fur seals (skins) [50]
1821	202,500		South Seas	Fur seals (skins) [50]
1850		600	South Seas	Sailboats[53]
1865	2,250,000		Stanley, East Falklands	Rockhopper and Gentoo penguins[50]
1871		0	Falkland Islands	Elephant seals[50]
1881		40	Stanley, East Falklands	Sailboats[54]
1904		1	Falkland Islands	Steamers[53]
1912	430,000		Falkland Islands	*Balaenoptera musculus* oil barrels[53]
1915		21	Falkland Islands and dependencies	Steamers[53]
1919		11	Beauchêne Island, Falklands	remaining Fur seals[55]
1933	39,700		Albermarle Sation, West Falklands	Sea lions[56]
1971		5,000	Falkland Islands	recovering Elephant seals[50]
1994		20,000	Falkland Islands	recovering Fur seals[50]

TIME SERIES TRENDS AND EXOGENOUS IMPACTS ON MARINE ANIMALS

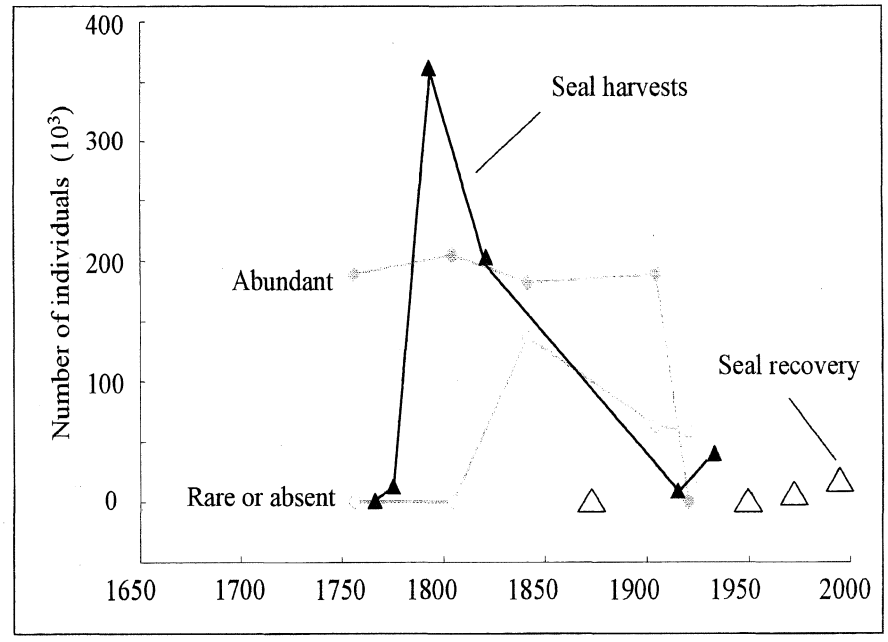
BECAUSE MOST SOURCES on extractive activities in the Falkland Islands dealt with marine mammals, we were only able to validate the time series of perceived abundance for this group. The data on seals (fur and elephant) and sea lions (Table 3) plotted in Figure 2 corroborate the decrease in relative abundance of marine mammals suggested in Figure 1a. In view of these results, we can conclude that our methodology validates the usefulness of anecdotes as data sources for marine mammal biodiversity trends.

Note, however, that the decreasing trends demonstrated in Figures 1a-1c were not replicated for invertebrates (Figure 1d). The explanation that comes to mind is that the large and mobile marine mammals, seabirds, and large pelagic fishes were far more visible to explorers and voyagers than the usually smaller and sessile invertebrates. The increase in perceived abundance toward the mid 1800s may be an artefact resulting from the more thorough scientific expeditions, which sampled all groups of marine organisms. However, we could argue that by this period, the populations of larger, more profitable resources had declined and the colony's need to identify other sources of profit generated further explorations of their coastlines, leading to the higher "visibility" of populations of molluscs and crustaceans that before were used only for local subsistence.[57]

CONCLUSION

IN HIS CONTRIBUTION on the "shifting baseline syndrome of fisheries," Daniel Pauly defined anecdotes as earlier knowledge, extracted from the historical and

Figure 2. Perceived Abundance of Marine Mammals (%) in the Falkland Islands.



Created by authors.

Here, the perceived abundance of marine mammals (from Figure 1a) is overlaid with the total number of extracted seals (fur and elephant seals and sea lions; see Table 3) and the number of recovering seal populations (fur and elephant seals only; see also Table 3).

anthropological literature.[58] He defended the importance of such observations in shifting the baseline of knowledge in marine fisheries beyond the start of industrialized fisheries, and he proposed that fisheries managers and policy makers develop frameworks to incorporate knowledge from the past two hundred years or more into contemporary attempts at ecosystem-based fisheries management. Moreover, the use of historical information in establishing the major impact of overfishing on marine ecosystems was convincingly demonstrated by Jackson, et al., using data spanning 125,000 years of ecological records.[59]

Our study suggests that qualitative data can be standardized and transformed to a semi-quantitative format for time series trends analyses and may have the potential to be used in validating trends obtained from ecosystem models—Ecosim and Ecospace, analyses of trophic levels or archeo- and paleoecological studies.[60] The challenge to reacquire such data remains to be met, however, and we believe that continuing to populate the database used in this study and extending its coverage to more geographical areas will facilitate future analyses of this genre.[61] This will give a new life to the often forgotten stacks of documents hidden in the various rare book collections in museums, libraries, and private collections around the world. Environmental historians are well positioned to take advantage of these resources in the ongoing efforts to reconstruct the history of the marine world.

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NOTES

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1. R. Kerr, "Voyage of Sebald de Weert to the South Sea and the Straits of Magellan in 1598," in *A General History and Collection of Voyages and Travels, Arranged in Systematic Order: Forming a Complete History of the Origin and Progress of Navigation, Discovery and Commerce, by Sea and Land, from the Earliest Ages to the Present Time*, 18 vols. (Edinburgh: W. Blackwood, 1824), 2: 130-48.
2. V. F. Boyson, *The Falkland Islands: With Notes on the Natural History by Rupert Vallentin* (Oxford: Oxford University Press, 1924), 30-31.
3. J. Callender, *Voyages to the Terra Australis, or Southern Hemisphere, during the Sixteenth, Seventeenth, and Eighteenth Centuries. Containing an Account of the Manners of the People, the Productions of the Countries ...* , 3 vols. (Amsterdam: N. Israel, 1967), 3: 1-4.
4. Boyson, *The Falkland Islands*, 26-27.
5. A. J. Pernetty, *The History of a Voyage to the Malouine (or Falkland) Islands Made in 1763 and 1764 under the Command of M. de Bougainville, in Order to Form a Settlement There: and of Two Voyages to the Streights of Magellan, with an Account of the Patagonians* (trans. from Dom Pernetty's historical journal written in French) (London: printed for W. Goldsmith and D. Steel, 1773).
6. Louise-Antoine de Bougainville, *Voyage autour du monde par la frégate du Roi la Boudeuse et la flute l'Étoile: en 1766, 1767, 1768 & 1769* (Paris: Gallimard, 1982).
7. B. M. Gough, "American Sealers, the United States Navy, and the Falklands 1830-32," *Polar Record* 28 (1992): 219-28.
8. Patrick Armstrong, *Darwin's Desolate Islands: A Naturalist in the Falklands, 1833 and 1834* (Chippenham: Picton Publishing Ltd., 1992), 147; R. D. Keynes, ed., *Charles Darwin's Zoology Notes & Specimen Lists from H.M.S. Beagle* (Cambridge: Cambridge University Press, 2000), 430.
9. H. N. Moseley, *Notes by a Naturalist on the Voyage of H.M.S. "Challenger." An Account of Observations Made during the Voyage of the H.M.S. "Challenger" Round the World in the Years 1872-1876 under the Command of Capt. Sir G. S. Nares, R.N., K.C.B., F.R.S., and Capt. F. T. Thomson* (London: R.N. John Murray Publishers Ltd., 1892).
10. Boyson, *The Falkland Islands*, 288-361.
11. **1725-1797**: Boyson, *The Falkland Islands*, 63, 75, 80, 219, 236-37; **1839**: M. É. Charton, "Îles Malouines ou Falklands," *Le Magasin Pittoresque* 16 (1848): 266-67; **1856**: P. V. A. Malte-Brun, " Les îles Malouines ou Falkland," *Nouvelles annales des voyages, de la Géographie, de l'Historie et de l'Archéologie* 150 (1856): 240-41; **1861**: A. Dechambre, "Malouines," *Dictionnaire Encyclopédique des Sciences Médicales*, 2nd ed. (Paris: Place de l'école de Médecine, 1871), 4:351-53; **1801-1893**: Boyson, *The Falkland Islands*, 83, 92, 106, 124, 219-20, 222, 231, 235-36, 238-39, 240-41, 287-88, 293, 296; **1903-1924**: Boyson, *The Falkland Islands*, 222, 224-27, 231, 242-43; **1909-1918**: J. Nippgen, "Amérique," *La Géographie* 36 (Paris : Société de Géographie, 1921): 370-76.
12. Pernetty, *The History of a Voyage to the Malouine*, 190.
13. Bougainville, *Voyage autour du monde*, 98.
14. G. A. Boulenger, "A List of the Fishes Collected by Mr. Rupert Vallentin in the Falkland Islands. With Notes by the Collector," *Annals and Magazine of Natural History* 7 (1900): 53-54.
15. Boyson, *The Falkland Islands*, 336.
16. Charton, "Îles Malouines ou Falklands," 266.
17. Callender, *Voyages to the Terra Australis*, 63.
18. Boyson, *The Falkland Islands*, 297.
19. Kerr, "Voyage of Sebald de Weert," 130-48; Boyson, *The Falkland Islands*, 26-27, 30-31, 288-361; Callender, *Voyages to the Terra Australis*, 3: 1-4, 63; Pernetty, *The History of a Voyage to the Malouine;* Bougainville, *Voyage autour du monde;* Gough, "American Sealers"; Armstrong, *Darwin's Desolate Islands*, 147; Keynes, ed., *Charles Darwin's Zoology Notes & Specimen Lists*, 430; Moseley, *Notes by a Naturalist on the Voyage of H.M.S. "Challenger,"* 540; **1725-1797**: Boyson, *The Falkland Islands*, 63, 75, 80, 219, 236-37; **1839**: Charton, "Iles Malouines ou Falklands," 266-67; **1856**: Malte-Brun, "Les îles Malouines ou Falkland," 240-41; **1861**: Dechambre, "Malouines," 351-53; **1801-1893**: Boyson, *The Falkland Islands*, 83, 92, 106, 124, 219-20, 222, 231, 235-36, 238-39, 240-41, 287-88, 293, 296; **1903-1924**: Boyson, *The Falkland Islands*, 222, 224-27, 231, 242-43; **1909-1918**: J. Nippgen, "Amérique," 370-76 ; Pernetty, *The History of a Voyage to the Malouine*, 190; Boulenger, "A List," 53-54; Charton, "Iles Malouines ou Falklands," 266.
20. J. Haeber, "U.S. Buys Oldest Map Marked 'America,'" *National Geographic News*, June 19, 2003 (www.news.nationalgeographic.com).
21. P. J. Pepper, "Port Desire and the Discovery of the Falklands," *Falkland Islands Newsletter*, March 2001 (www.falklands.info/history/histarticle19.html).
22. Probably penguins, given that they were on Penguin Island at the time of observation; however, this also could refer to diving petrels.
23. Five ships at one hundred men each would have amounted to five hundred mouths to feed. Kerr's 1824 interpretation of Sebald de Weert's observations upon arriving at Penguin Isle on April 6, 1599; Kerr, "Voyage of Sebald de Weert to the South Sea," 133.
24. Boyson, *The Falkland Islands*, 27, identifies this as a shrimp, *Munida surugosus*, "much liked by whales and penguins." The genus *Munida* belongs to the decapod family of squat lobsters, *Galatheidae*, and the species occurring in the Falklands is *Munida subrugosa*, with benthic adults but planktonic larvae; see F. Tapella, et al., "Reproductive Biology of the Crab *Munida Subrugosa* (*Decapoda: Anomura: Galatheidae*) in the Beagle Channel, Argentina," *Journal of the Marine Biological Association* 82 (2002): 589-95. However, the swarming description might refer to what

is now termed as "lobster krill" (usually *Munida gregaria*, but also other species of *Munida*) occurring in the diets of sea lions, *Otaria flavescens*–see D. Thompson, et al., "Foraging Behaviour and Diet of Lactating Female Southern Sea Lions (*Otaria Flavescens*) in the Falkland Islands," *Journal of Zoology* 246 (1998): 135-46; and in penguins–see A. Clauzen, and P. Klemens, "Winter Diet and Foraging Range of Gentoo Penguins (*Pygoscelis papua*) from Kidney Cove, Falkland Islands," *Polar Biology* 26 (2003): 26, 32-40.

25. Boyson, *The Falkland Islands*, 31; Pepper, "Port Desire and the Discovery of the Falklands."
26. Daniel Pauly, *Darwin's Fishes: An Encyclopedia of Ichthyology, Ecology and Evolution* (Cambridge: Cambridge University Press, 2004), 75.
27. É. Taillemite, *Sur des mers inconnues. Bougainville, Cook, Laperouse* (Paris: Découvertes Gallimard, 1997).
28. Pernetty, *The History of a Voyage to the Malouine.*
29. Bougainville, *Voyage autour du monde*; Pernetty, *The History of a Voyage to the Malouine.*
30. A timeline is available at www.falklands.info.
31. M. Cawkell, *The History of the Falkland Islands* (Oswestry, England: Anthony Nelson Ltd., 2001).
32. See section on exogenous impacts.
33. Pauly, *Darwin's Fishes*, 75.
34. Armstrong, *Darwin's Desolate Islands*, 22-25.
35. Ibid.
36. Letter to Caroline Darwin, April 6, 1834; cited in Armstrong, *Darwin's Desolate Islands*, 100-103.
37. Charles Darwin, *Journal of Researchers into the Geology and Natural History of the Various Countries Visited by H.M.S. Beagle, under the Command of Captain FitzRoy, R.N. from 1832 to 1836* (London: Henry Colburn, 1839), 248-51.
38. R. J. Hofman and W. N. Bonner, "Conservation and Protection of Marine Mammals: Past, Present and Future," *Marine Mammal Science* 1 (1985): 109-27; W. N. Bonner, "The Fur Seal of Georgia," *British Antarctic Survey*, Report No. 56 (London: British Antarctic Survey, 1968), 81.
39. A. G. E. Jones, "Fur Sealing in the Falkland Islands in the 1820s and 1830s," *Falkland Islands Journal* 6 (1992): 39-47.
40. H. R. Mill, *The Siege of the South Pole* (New York: Frederick A. Stokes Co., 1905), cited by Glyn Roberts, "History of World Fur Sealing," accessed September 2005 at http://www.fahan.tas.edu.au/macquarie_island/infohut/sealing.htm; See Table 3.
41. Announcement that appeared in the *National Gazette* of Philadelphia, August 10, 1830; Bianchi B. du Bocage, Sueur-Merlin Coraboeuf, Warden et cie. "Îles des Falklands," *Bulletin de la Société de Géographie* 16 (Paris 1831): 272.
42. M. V. de Saint-Martin, "Notice sur le progrès des découvertes géographiques pendant l'année 1844: Les îles Falklands," *Nouvelles annales des voyages et des sciences géographiques* 1 (Paris 1845) :228-30. See also Charton, "Îles Malouines ou Falklands," 266.
43. I. J. Strange, *The Bird Man* (London: Gordon Cremonesi, 1976).
44. D. Rodriguez and R. Bastida, "Four Hundred Years in the History of Pinniped Colonies around Mar del Plata, Argentina," *Aquatic Conservation: Marine and Freshwater Ecosystems* 8 (1998): 721-35.
45. P. H. Armstrong, "Human Impact on the Falkland Islands Environment," *The Environmentalist* 14 (1994): 215-31.
46. A. Stevenson, "Les pêcheries de baleines des îles Falkland et de leurs dépendances," *Revue générales des Sciences pures et appliquées* 26 (1915): 181-86.
47. Th. E. Salvesen, "The Whale Fisheries of the Falkland Islands and Dependencies," in *Report of the Scientific Results of the Scottish National Antarctic Expedition*, (Edinburg: Scottish Oceanographical Laboratory, 1914), 4:475-86.
48. Stevenson, "Les pêcheries de baleines des îles Falkland."
49. Ibid.; Armstrong, "Human Impact on the Falkland Islands Environment"; Bonner, "The Fur Seal of South Georgia"; Mill, *The Siege of the South Pole*; Stevenson, "Les pêcheries de baleines des îles Falkland"; "Notices sur les colonies anglaises : possesions d'Amérique. Les îles Falklands," *Revue Maritime et Coloniale* 68 (Paris 1881): 220-28; Strange, *The Bird Man*; I. J. Strange, *The Falkland Islands*, 3rd ed. (London: David and Charles, Newton Abbot, 1983).
50. Armstrong, "Human Impact on the Falkland Islands Environment."
51. Bonner, "The Fur Seal of South Georgia."
52. Mill, *The Siege of the South Pole.*
53. Stevenson, "Les pêcheries de baleines des îles Falkland."
54. "Notices sur les colonies anglaises," 220-28.
55. Strange, *The Bird Man.*
56. Strange, *The Falkland Islands.*
57. Charton, "Îles Malouines ou Falklands," 266. See also Armstrong, "Human Impact on the Falkland Islands Environment."
58. Daniel Pauly, "Anecdotes and the Shifting Baseline of Fisheries," *Tree* 10 (1995): 430.
59. J. B. C. Jackson, et al., "Historical Overfishing and the Recent Collapse of Coastal Ecosystems," *Science* 293 (2001): 629-38.
60. T. J. Pitcher, "Fisheries Managed to Rebuild Ecosystems? Reconstructing the Past to Salvage the Future," *Ecological Applications* 11 (2001): 601-17; A. Morales and E. Roselló, "Fishing Down the Food Web in Iberian Prehistory? A New Look at the Fishes from Cueva de Nerja (Málaga, Spain)," in *Petits animaux et sociétés humaines du complément alimentaire aux ressources utilitaires. 24th rencontres internationales d'archéologie et d'histoires d'Antibes*, ed. J.-P. Brugal, J. Desse (Antibes: Editions APDCA, 2004), 111-23 ; R. S. Steneck, J. Vavrinec, and A. V. Leland, "Accelerating Trophic-level Dysfunction in Kelp Forest Ecosystems of the Western North Atlantic," *Ecosystems* 7 (2004): 323-32; J. M. Pandolfi, et al., "Global Trajectories of the Long-term Decline of Coral Reef Ecosystems," *Science* 301 (2003): 955-58; J. B. C. Jackson and K. G. Johnson, "Measuring Past Biodiversity," *Science* 293 (2001): 2401-04.
61. D. Zeller, R. Froese, and D. Pauly, "On Losing and Recovering Fisheries and Marine Science Data," *Marine Policy* 29 (2005): 69-73.