

Humpback Whale Research Project, Bermuda

Andrew Stevenson



Number 11 Sargasso Sea Alliance Science Report Series

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The Sargasso Sea Alliance is led by the Bermuda Government and aims to promote international awareness of the importance of the Sargasso Sea and to mobilise support from a wide variety of national and international organisations, governments, donors and users for protection measures for the Sargasso Sea.

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The Secretariat of the Sargasso Sea Alliance is hosted by the Washington D.C. Office of the International Union for the Conservation of Nature (IUCN).

Website is **www.sargassoalliance.org**

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COVER PHOTO: Humpback whale (A. Stevenson).

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The Humpback Whale Research Foundation
Bermuda

Foreword

BETWEEN 2010 AND 2012 a large number of authors from seven different countries and 26 separate organisations developed a scientific case to establish the global importance of the Sargasso Sea. A summary of this international study was published in 2012 as the “Summary science and Supporting Evidence Case.” Nine reasons why the Sargasso Sea is important are identified in the summary. Compiling the science and evidence for this case was a significant undertaking and during that process a number of reports were specially commissioned by the Sargasso Sea Alliance to summarise our knowledge of various aspects of the Sargasso Sea.

This report is one of these commissioned reports. These are now being made available in the Sargasso Sea Alliance Science Series to provide further details of the research and evidence used in the compilation of the summary case. A full list of the reports in this series can be found in the inside back cover of this report. All of them can be downloaded from www.sargassoalliance.org.

Professor Howard Roe

Science Advisory Committee Chair
Sargasso Sea Alliance

Professor Dan Laffoley

Science Coordinator
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Humpback Whale Research Project

For the last five years I have been studying the humpbacks' pelagic migratory behaviour. The first phase of our research from Feb 2007 - Feb 2009 was piggybacked on the budget for my film "Where the Whales Sing". The second phase of my research 2010-2011 was piggy-backed on the budget I received to write a book: "Whale Song: Journeys into the Secret Lives of the North Atlantic humpbacks". This book will come out simultaneously in London and North America in September 2011.

While marine scientists know a lot about the humpbacks in their feeding and breeding grounds closer to shore, there is little information on the humpbacks' mid-ocean migratory behaviour. As a mid-ocean platform, Bermuda provides a unique window into the lives of the humpbacks. There are almost no other similar studies and the few that are out there are from coastal sites near to the breeding grounds and may not be typical of pelagic migration.

I have now spent over 1,000 hours on the waters around Bermuda observing the North Atlantic humpback whales each spring as they migrate past these islands. We have obtained 450 individual fluke IDs in Bermuda from 2007-2011. That is triple the total of 146 fluke IDs taken here in Bermuda by visiting scientists and local residents from 1968 to 2006. These fluke IDs obtained over the last five seasons have been carefully identified and sorted in our own catalogue and integrated with Allied Whale's North Atlantic Humpback Whale Catalogue and the Provincetown Centre for Coastal Studies. About a quarter of our fluke IDs have been matched to the larger North Atlantic Humpback Whale Catalogue and about a quarter are 'new' whales never sighted before. We have data sheets detailing every aspect of each trip and each whale sighting including: date, time, location, number of whales in a group, activity and any other observable patterns. This data has been cross-referenced on a spread sheet to facilitate intra-year and year-to-year comparisons.

We also have meticulously recorded the humpbacks on hydrophones and logged these recordings by cross-referencing to the daily data sheet.

I co-authored two poster presentations co-authored with College of the Atlantic for the biennial meeting of the Society of Marine Mammology in October 2009 in Quebec City, Canada based on these findings. These poster presentations are included in the www.whalesbermuda.com diary entry entitled 'Presentation to Biennial Meeting of the Society for Marine Mammology' dated 12th October, 2010.

Many of 'our' Bermuda whales have been re-sighted here during the same time period over more than one year. So far of our 450 individual whales identified in Bermuda, 45 have been re-sighted to Bermuda waters, an indication that the humpbacks maintain fidelity to their migratory routes. Working closely with the research group Allied Whale we are determining if there is a pattern to individual preferences or changes for the timing of their migration to ascertain possible class segregations defining their schedules. I will be co-authoring with Dr Peter Stevick another poster presentation to this effect at the next biennial meeting of the Society for Marine Mammology.

The table 'Bermuda-Bermuda Re-sightings by Year' reveals the Bermuda catalogue number, the year and dates the whales were sighted in Bermuda, the Allied Whale North Atlantic Catalogue number and the first year the whale was identified and the areas where the whale has been photographed. 'Our' Bermuda whales have been matched to photo IDs of the same whales along the US Eastern Seaboard, Gulf of Maine, Eastern Canada, Newfoundland, Labrador, Greenland and Iceland in the northern feeding grounds, and primarily Silver Bank, Dominican Republic in the breeding grounds. Many of these matches are to whales first photographed 35+ years ago. Some of these show long gaps of around 30 years from the first sighting to the second sighting in Bermuda. These long gaps in sightings suggest that these whales are not frequenting areas inhabited by humans, or at least by those humans who have cameras. Many of the whales identified in Bermuda have never been identified before, including whales that have been re-sighted in Bermuda over the last five seasons.

We have also recorded re-sightings intra-year. In the 2011 season we re-sighted two whales over an 8-day period. We have many sightings over six days, five days etc. Obviously the whales are not simply by-passing Bermuda. These re-sightings over several days are all the more remarkable given inconsistent observations over consecutive days due to inclement weather. The whales seem to come by our waters during their migration northwards in 'waves'. We see 30 – 50 whales in a day and the next day can find none. Gradually the numbers build up again. This cycle seems to coincide with the full moon and half-moon during the height of the migration but it would take more dedicated observation to ascertain whether this pattern is consistent.

Many of these humpback whales exhibit behaviour commensurate with foraging. There are certain hotspots

for these feeding whales and they include Sally Tuckers and the windward edges of Challenger Bank. Where the fishermen are, the whales are too, all accessing the denser food web on the up-wellings. Whales' feeding cycles tend to be 8 – 12 minutes between resurfacing. The feeding whales are generally in 140 feet of water on the Bermuda platform off Sally Tuckers, and the 180-foot edge of Challenger Bank. Fishermen report similar feeding behaviour on Argus Bank. A funnel-net thrown overboard in 2007 on an upwelling with some 20 whales in the vicinity produced a dense population of decapods, copepods, fish eggs and tiny fish within twenty seconds of towing. Bait-balls of small fish are often seen with whales underneath or nearby. Examination of the stomach contents of a tuna caught in the presence of humpback whales revealed one small sargassum triggerfish, which is usually associated with floating *Sargassum*, one lantern fish, and five bristle-mouth. The two latter, which are deep water species, could have been caught by the tuna diving, or at night when these fish come to the surface. There was also one small teuthoid squid and at least 30 red decapod shrimps, apparently all belonging to the same species. The whales are probably feeding on the same menu as the tuna.

We also have whales in Bermuda waters consistently from the last week of December through to the migration season beginning late March through to the end of April. We continue to observe whales into May and these seem to include young calves with mother and escort(s). The 'winter' whales remaining here in the Sargasso Sea through the winter from December to late March may be older females and younger females too old and too young to mate. Underwater video footage of these 'winter' whales confirms that some at least are indeed juvenile females. There are also probably males present based on the persistent observation of singing – if it is only the males doing the singing, as is the conventional wisdom. We have observed one very young calf in early January. This could be a calf born here because its mother did not make it down to the breeding/birthing grounds in the Caribbean in time, or it could be an indication of a re-colonization of Bermuda waters as both a breeding and birthing ground. This would make Bermuda the humpbacks' only mid-ocean breeding/birthing/feeding/migratory route anywhere.

Another pattern observed this year is the use of shallow water sand holes for the whales to groom themselves, presumably to rid themselves of whale lice (cyamids). This seems to be a consistent behaviour and may be another important reason for the humpbacks to visit Bermuda waters.

With 30% of the North Atlantic humpback whales having bite marks on their flukes, pectoral or dorsal fins incurred when they were calves, there is a very real incentive for females with calves to associate into large protective social units, mid-ocean, before heading north. By assembling into these larger social units they may be able to more safely pass through areas frequented by the orcas somewhere on their migratory route north of Bermuda.

A three-year study of the North Atlantic humpback whales revealed that there was a general melee of whales in the breeding grounds down in the Caribbean. In other words there was no rhyme or reason for a whale to be in a certain location at any point in time. Whale-watch tour operators up north recognise many of the humpbacks that return to the same bays indicating they do maintain site fidelity to their feeding grounds. Do the same whales meet up in their habitual feeding grounds or do the humpback whales assemble into loose social units on the mid-ocean seamounts before travelling together up north?

Based on observations over the past five years it seems the migrating humpbacks are aggregating into loose associations around singers, primarily on the crown of Challenger Bank. We have identified the same whales for several days around the crown of Challenger Bank. While there may be some surface activity similar to the breeding behaviour on the Silver Bank, the behaviour here doesn't seem so aggressive or robust. These whales coordinate their breathing and diving cycles and on occasion have been observed to move together in numbers of around seven or more in the direction of their northward migration past Sally Tuckers and along Bermuda's South Shore. In 2009 one of the females humpbacks with a calf satellite-tagged by a NOAA team on the Silver Bank migrated northwards 125 miles to the west of Bermuda, remained for some days on a smaller seamount to the northwest before returning southeast towards Bermuda. My own explanation for this behaviour is that she heard a singer she recognised and moved out of her direct line of migration to join it. These mid-ocean seamounts could therefore be important staging areas for the females with calves to associate with other whales moving to the same feeding grounds as a means of protection against orca attacks on their calves.

All in all, the mid-ocean habitat of the humpbacks seems to be very important to their survival. Bermuda is not simply a navigational waypoint for the migrating humpbacks as I was first told when I started observing them. This habitat, particularly the seamounts, serves multi-purposes for the humpbacks' well-being.

ANNEX 1. Log of Bermuda whales that have also been recorded in other areas

Table containing Bermuda sightings (up to 15/05/2011) by Andrew Stevenson matched with the 'North Atlantic Humpback Whale Catalogue' maintained by Allied Whale, College of the Atlantic. TOTAL: 107 matches from 449 FLUKE identifications = 23.8%. The 'BDA' column provides the catalogue number for the whale. NAHWC is the Allied Whale number. In some cases there is a name given to the whale, particularly by the Provincetown Centre for Coastal Studies (Dr Jooke Robbins). First year represents the first year the whale was identified. This date usually comes from the Allied Whale NAHWC. 'Area' is the areas where the whale has been identified. The codes for the northern feeding grounds are: R=Europe, E=Eastern Atlantic, I=Iceland, G=Greenland, N=Eastern Canada, M=Gulf of Maine. In the breeding grounds the codes are: U=US coast of Cape Cod, B=Bermuda, D=Dominican Republic, P=Puerto Rico, V=Virgin Bank, C=Cape Verde Islands.

BDA	NAHWC	NAME	FIRST YEAR	AREA	UPDATES - CORRECTIONS
0002	1135		1983	P D	
0006	6002		1997	B N	
0010	1061		1978	N D	
0012	8344		2002	M	
0014	1845		1978	D P N	
0016	5346		1985	D N	
0017	0789	Bandit	1988	M	
0018	5673		1989	D	
0027	3186		1980	N	
0029	7059	Vector	1991	N	
0030	HWC	Lapel			
0035	3558		1982	NV	
0036	2242		1982	P	
0037	0456	Duo	1985	M	
0039	1517	Harry Potter	1979	N D	
0041	7350		2004	EC	
0043	8363		2002	NS	
0046	8379		2003	D	
0047	2943		1984	D	
0052	0225	Navajo	1980	M	
0053	3455		1983	EC	#6109/retired
0064	7385		2002	EC	
0090	3209		1981	NB	
0100	8231		1998	NS	
0101	8806	Limbo	1998	M	
0103	8244	Nike	1999	M	
0104	2527		1977	D	
0110	3685		1990	N	
0119	2796		1983	D	
0123	0182	Icepick	1979	M	
0141	3399		1983	N	

continues

BDA	NAHWC	NAME	FIRST YEAR	AREA	UPDATES - CORRECTIONS
0144	6141		1995	N	
0145	2311		1993	D	
0146	8732	Pogo	2002	M	
0162	1418		1982	N	
0166	7602	RK0203	2003		
0173	8873	Glaze			
0180	0988	Blanco	1980	M	
0181	2913		1983	D	
0189	0246	Mask	1980	M	
0191	6133	RK0178	2008		
0219	p.dolk 05	RKPDH10	2005	N	
0223	0289	Toro	1979	M	
0224	1002		1979	N	
0235	5000		1984	D	
0236	2576		1980	D N	
0238	3027		1980	N	
0249	0637	Petroglyph	1990	M	
0254	8613		1992	Iceland	
0256	0612	Hail	2006	M	
263	2595		1980	D	
0267	1037		1978	N	
0270	5638		1989	TC	
0271	8337		2002	NS	
0273	8277	Ping	1999	M	
0286	5811	Brooch	1990	EC	
0290	5637		1989	D	
0292	2376		1984	P M	
0293	2467				
0301		Palmer Crary			
0302	0679	Stance	1987	M	
0313	2347	SPM0186	1983	PD	
0330	7522				
0344	7316		1999	N	
0352	Sn0030				
0357		Grouper PCCS		M	
0361	0049	Matrix	1981	P M	
0364	8124	Maelstrom	1992	M	
0368		SPM0197			
0397	0783	Canal	1988	M	
0409	3996		2006	N	

continues

BDA	NAHWC	NAME	FIRST YEAR	AREA	UPDATES - CORRECTIONS
0417	5614		1988	WI	
0426	3479		1983	EC	
0428	3152		1980	N	
0430	5296		1985	D	
0431	0638	Bulldog	1987	M	
0437	2129		1979	P	
0440	0523	Pendiente	1986	M	
0448	8193		1998	M	
499	4281		1989	G	
500	0670		1987	M	
511	8719		2005	M	
513	PCCS	Moonlight			
517	8655	Mascara	2004	M	
526	0362	Alphorn	1983	MD	
527	1824		1979	N	
528	4253	Sickle	1989	G	
530	7187		1984	N	
532	HWC	Empanage			
534	3126		1980	ND	
537	1443	Buzzard	1983	ND	
547	0667	Barb	1987	M	
552	HWC	Tsunami			
563	5672		1989	D	
570	7047		1991	N	
575	3864	Spotty	1993	N	
581	0551	Polarbear	1986	M	
583	8209	Pawprint	1988	N	
584	6042		1984	BDN	
589	7104	Orchidee	1993	N	
590	1911		1979	N	
607	2332	Nova	1983	PDM	
615	5135		1984	D	
616	7054		1991	N	
633	0453	Simian	1985	MD	
655	0599	Sweep	1986	M	
662	1231		1978	N	

ANNEX 2. Bermuda-Bermuda re-sightings of North Atlantic Humpback Whales by year (Updated to 5/15/2011)

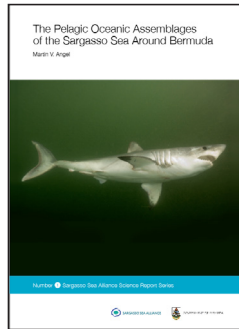
This table contains Bermuda-Bermuda re-sightings which are whales that have been re-sighted in Bermuda. This includes Allied Whale's archival record of some 146 whales identified from the 1960s to 2007. As the number of identities increases year on year so does re-sightings - in 2011 Bermuda observations matched 20% of the year's take with recent previous sightings. The BDA column is the Bermuda catalogue number for the whale, and then, moving horizontally, the year and the date of the sighting. In the last column is where the whale was re-sighted using the same codes as set out in Annex 1.

BDA	1970/80'S	1990'S	2006	2007	2008	2009	2010	2011	HWC	HWC YEAR/AREA
001				4/24				4/07	6090	2007 B
002				4/20 4/21 4/23			4/13	4/17	1135	1978 N
004				4/23		4/30	4/08 4/13		6094	2007 B
006	4/24/1977			4/21				4/07	6002	1977 B N
013				4/01			4/12		6091	2007 B
039			4/02		4/11	3/29	4/12	4/15 4/18	1517	1979 N D
043					4/11	4/19			8363	2002 M
047					4/20	4/05	4/19		2943	1984 D N B
052		4/13/1995			4/21				0225	1980 M P B
055					4/28			4/20 4/24 4/26	6110	2008 B
090	4/1985								3209	1981 NB
104	4/071986				3/27		3/21		2527	1977 V B D
158				4/13		4/02			6092	2007 B
160						4/02	4/07			
173						4/02	3/21		8873	
219						4/11	4/07 4/08		NFPD H10	2005
223				4/24		4/11			0289	1979 M D
224	4/20/1984					4/11			1002	1978 N B
225						4/11		4/13		
226						4/11		4/18		
237						4/14		4/14 4/17		

BDA	1970/80'S	1990'S	2006	2007	2008	2009	2010	2011	HWC	HWC YEAR/AREA
244						4/14		3/26	0765	1988 M
270						4/19	5/06		5638	1989 D
273						4/19	4/06		8277	1999 M
277						4/19	4/10			
292						4/26		3/21	2376	1984 PM WI
301						4/27 4/30	5/03		Palmer Crary	
302						4/29	4/06		0679	1987 M
308						4/30		4/15		
415							4/12	4/15		
426					4/20		4/12	4/17	3479	1983 N
448			2006 ?					3/28	1998	M
450				4/24				4/15		
496								3/19 3/20		
504								3/14 3/15		
512								3/15 3/20		
535								3/26 3/27		
563								3/30 4/04	5672	1989 D
567								4/04 4/07		
589								4/13 4/15 4/20	7104	1993 N
607								4/15 4/17	1983	PDM
651								4/20 4/24		

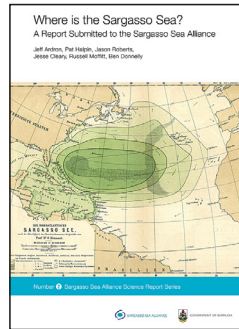
Sargasso Sea Alliance Science Series

The following is a list of the reports in the Sargasso Sea Alliance Science Series. All can be downloaded from www.sargassoalliance.org:



1

Angel, M.V. 2011. *The pelagic ocean assemblages of the Sargasso Sea around Bermuda.* Sargasso Sea Alliance Science Report Series, No 1, 25 pp.



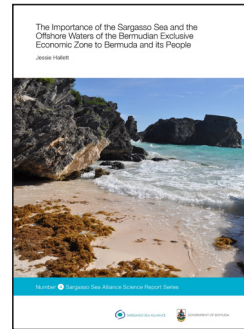
2

Ardron, J., Halpin, P., Roberts, J., Cleary, J., Moffitt, M. and J. Donnelly 2011. *Where is the Sargasso Sea?* Sargasso Sea Alliance Science Report Series, No 2, 24 pp.



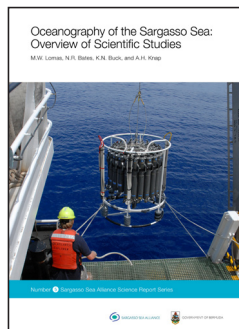
3

Gollock, M. 2011. *European eel briefing note for Sargasso Sea Alliance.* Sargasso Sea Alliance Science Report Series, No 3, 11 pp.



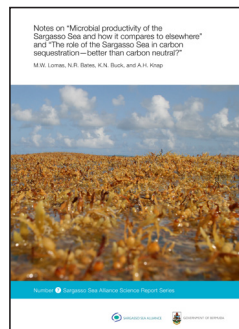
4

Hallett, J. 2011. *The importance of the Sargasso Sea and the offshore waters of the Bermudian Exclusive Economic Zone to Bermuda and its people.* Sargasso Sea Alliance Science Report Series, No 4, 18 pp.



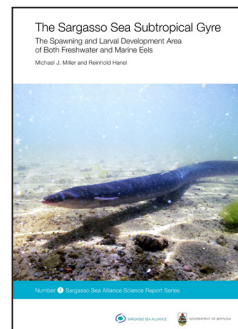
5

Lomas, M.W., Bates, N.R., Buck, K.N. and A.H. Knap. (eds) 2011a. *Oceanography of the Sargasso Sea: Overview of Scientific Studies.* Sargasso Sea Alliance Science Report Series, No 5, 64 pp.



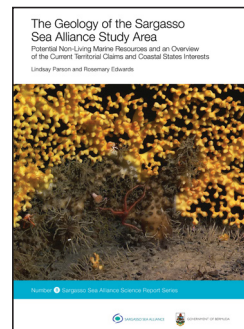
6

Lomas, M.W., Bates, N.R., Buck, K.N. and A.H. Knap. 2011b. *Notes on "Microbial productivity of the Sargasso Sea and how it compares to elsewhere" and "The role of the Sargasso Sea in carbon sequestration—better than carbon neutral?"* Sargasso Sea Alliance Science Report Series, No 6, 10 pp.



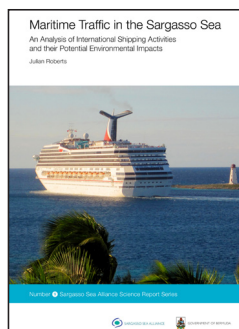
7

Miller, M.J. and R. Hanel. 2011. *The Sargasso Sea subtropical gyre: the spawning and larval development area of both freshwater and marine eels.* Sargasso Sea Alliance Science Report Series, No 7, 20 pp.



8

Parson, L. and R. Edwards 2011. *The geology of the Sargasso Sea Alliance Study Area, potential non-living marine resources and an overview of the current territorial claims and coastal states interests.* Sargasso Sea Alliance Science Report Series, No 8, 17 pp.



9

Roberts, J. 2011. *Maritime Traffic in the Sargasso Sea: An Analysis of International Shipping Activities and their Potential Environmental Impacts.* Sargasso Sea



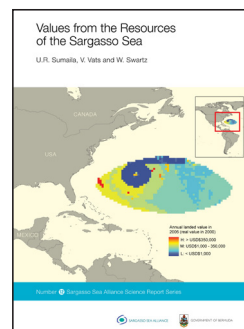
10

Siuda, A.N.S. 2011. *Summary of Sea Education Association long-term Sargasso Sea surface net data.* Sargasso Sea Alliance Science Report Series, No 10, 18 pp.



11

Stevenson, A. 2011. *Humpback Whale Research Project, Bermuda.* Sargasso Sea Alliance Science Report Series, No 11, 11 pp.



12

Sumaila, U. R., Vats, V., and W. Swartz. 2013. *Values from the resources of the Sargasso Sea.* Sargasso Sea Alliance Science Report Series, No 12, 24 pp.



Since the initial meetings the partnership around the Sargasso Sea Alliance has expanded. Led by the Government of Bermuda, the Alliance now includes the following organisations.

PARTNER	TYPE OF ORGANISATION
Department of Environmental Protection	Government of Bermuda
Department of Conservation Services	Government of Bermuda
Mission Blue / Sylvia Earle Alliance	Non-Governmental Organisation
International Union for the Conservation of Nature (IUCN) and its World Commission on Protected Areas	Multi-lateral Conservation Organisation
Marine Conservation Institute	Non-Governmental Organisation
Woods Hole Oceanographic Institution	Academic
Bermuda Institute for Ocean Sciences	Academic
Bermuda Underwater Exploration Institute	Non-Governmental Organisation
World Wildlife Fund International	Non-Governmental Organisation
Atlantic Conservation Partnership	Non-Governmental Organisation