

Historical review of dolphin bounty hunting in Italy with a focus on the period 1927–37

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ABSTRACT

Dolphins were first formally considered as a ‘pest’ species in the Mediterranean Sea in the late 19th century as they frequently disrupted fishing activities. Numerous fishing organisations/syndicates requested permission to hunt dolphins and the killing of dolphins was allowed by a number of national laws. This paper provides an overview of the hunting of dolphins in Italy across 14 Italian Maritime Compartments, mainly from 1927–1937. It summarises governmental measures implemented, numbers of individuals killed and their monetary value in accordance with the bounty system; official records reveal over 7,200 dolphins (species not specified) killed during the 11-year period and approximately 400,000 Italian Liras (\approx 355,000 EUR in today’s money) was paid out. In addition to the bounty, the meat was either consumed or sold, making dolphin hunting a profitable activity. The lack of information on species identity and the size of dolphin populations around the Italian coast at that time make it difficult to estimate the population level impact of ‘bounty fishing’, but it is possible that it had a significant impact.

KEYWORDS: DIRECT CAPTURE; DOLPHINS; HISTORICAL DATA; MANAGEMENT PROCEDURES; MEDITERRANEAN

INTRODUCTION

Dolphins were often celebrated in early cultures and even considered to be messengers of the gods in some parts of the world (e.g. see references in Catton, 1995). In the fishing world, the presence of dolphins was often seen as a good omen (Brunelli, 1932; Donati and Pasini, 1997; 1999; Faber, 1883) and there are many stories of collaboration between fishers and dolphins even as far back as Pliny the Elder who described ‘cooperative fishing’ of mullets by humans and dolphins along the Mediterranean French coast. Similar associations have been reported in other parts of the Mediterranean, such as the Güllük Gulf, Turkey and Spain (see Orams, 1997 for a review). In recent times, there have been examples of cooperative fishing between dolphins and indigenous communities, both in coastal ocean and river sites (Zappes *et al.*, 2011).

In parts of the Mediterranean (e.g. the Gulf of Naples), the short-beaked common dolphin (*Delphinus delphis* L., 1758) incidentally ‘assisted’ fishing operations where observations of the dolphins herding and then feeding on anchovies and sardines provided a signal for the setting of purse seines. However, the relationship between dolphins and fishers was/is not always perceived as positive by the latter. For example, in the Gulf of Naples, striped (*Stenella coeruleoalba* Meyen, 1833) and bottlenose dolphins (*Tursiops truncatus* Montagu, 1821) often appeared attracted to fishing operations as a convenient source of food, damaging gear (especially trammel and gillnets) and allowing the fish to escape or damaging the fish and reducing their value. Dolphin presence could lead to the abandonment of fishing for the day for fear of damage to the nets as lacerated nets took time to repair and meant further loss of hours at sea (Bearzi, 2002; Notarbartolo di Sciara and

Bearzi, 2002). In addition, dolphins were perceived as direct competitors for resources (Bearzi *et al.*, 2010). Lauriano *et al.* (2004) discuss ongoing problems with bottlenose dolphins in an artisanal fishery in Sardinia.

In many areas, including parts of the Mediterranean, by the end of the 19th century the actual or perceived damage to fishing caused by dolphins led to calls for them to be treated as a ‘pest’ and culled; in certain areas and periods, this led to support for the killing of dolphins and even the establishment of incentives (bounties) by national and/or regional authorities. The first record of a monetary reward for killing a dolphin in the Adriatic Sea dates back to 1872 (Crnkovic, 1958), whilst from as early as 1865, the French Government offered 25 Francs for each dolphin killed (Duguay *et al.*, 1983; Perrier, 1889).

Such encouragement was also present in Italy for a long period of time. Indeed, Italian law on the ‘Rules of the Maritime Fishery’ (n.963/1965) still permitted the use of harpoon guns on cetaceans for ‘recreational’ fishing activities, and a Ministerial Decree (31 December 1979) continued to allow the killing of dolphins under special authorisation by the Ministry of Merchant Marine. A ban on dolphin capture and the full protection of cetaceans, marine turtles and sturgeons was implemented in 1980, after a Decree of the Ministry of Merchant Marine (Cagnolaro *et al.*, 1983), following Italy’s adherence to CITES (the Convention on International Trade in Endangered Species of Wild Fauna and Flora) on 31 December 1979.

This paper summarises the available information on dolphin bounty hunting in Italy with a focus on official records available for the period 1927–37 for the 14 *Compartimenti Marittimi* hereafter *Compartimenti* (see Fig.1).

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Fig. 1. Distribution of the Compartimenti around the Italian Peninsula.

MATERIALS AND METHODS

Information regarding the actions taken to control dolphin populations was obtained from the Reports of the Italian Ministry of Agriculture, Industry and Commerce (1903; 1905) and a literature review incorporating Faber (1883), Perrier (1889), Brusina (1889), Barone (1895), Ninni (1901), Issel (1903), Del Rosso (1905), Levi-Morenos (1905), Brunelli (1932), Maggioli (1941), Cirillo (1942) and Lopez (1948).

Data concerning the landings (in terms of number of caught dolphins) and the respective economic value (in terms of bounties paid by the authorities) were extracted from the Reports of the Italian Ministry of the National Economy (1927–37) and the Central Institute of Statistics. These data (Table 1) are available for the 14 Compartimenti shown in Fig. 1: Genoa (Liguria); Leghorn (Tuscany); Anzio (Latium); Naples (Campania); Reggio (Calabria); Catania and Palermo (Sicily); Cagliari (Sardinia); Bari (Apulia); Ancona (Marche); Chioggia and Venice (Veneto); Trieste (Venezia Giulia); and Kvarner Gulf (Istrian Peninsula).

Data regarding the number of catches in the Kvarner Gulf (Croatia) from 1914–1925 were reported by D’Ancona (1926).

Data from 1946–1980 regarding the Chioggia Compartimento were obtained from the database of Padua University (<https://chioggia.biologia.unipd.it/banche-dati/banca-dati-del-pescato/1945-oggi/>). These data were

expressed in tonnes per year rather than individuals. For bottlenose dolphins, Sharir *et al.* (2011) evaluated for Spanish, French and Israel specimens, average lengths of 313, 317 and 272cm respectively. Using the ratio between length and weight proposed by Ridgway and Fenner (1982), ranging from 0.58 to 0.65kg/cm, the estimated average weight of bottlenose dolphins ranges from 163 to 190kg. On the other hand, the weight of an adult striped dolphin ranges from 70 to 90kg (Di Meglio *et al.*, 1996). Unfortunately, no data were available about the species composition of the killed dolphins in the Chioggia Compartimento but, whilst recognising the considerable uncertainty, we believe it is reasonable to assume an average weight per dolphin of 150kg

RESULTS

Bounty hunting

The disruptive actions of dolphins including taking fish from nets and causing severe damage to fishing gear, affecting income and sustenance, provoked widespread anger and discontent in fishing communities; dolphins were regarded as ‘evil animals’ that prevented fishers from obtaining sufficient income and sustenance (Issel, 1903). In Italy, several systematic ‘culls’ of dolphins were organised (Bearzi *et al.*, 2004). The animosity towards dolphins was tremendous, mainly in the Adriatic Sea, until at least the early 1960s, when, as discussed below, perceptions began to

Table 1
Data of annual total landed specimens (*n*) and bounties paid in Italian Lira (*L*).
The values in parenthesis are the numbers of killed pregnant females reported.

Comp.		1927	1928	1929	1930	1931	1932	1933	1934	1935	1936	1937	Total
Genoa	<i>n</i>	13	27	27	34(1)	20(2)	35(2)	36	49	37(2)	33(1)	36(1)	347(9)
	<i>L</i>	650	1,350	1,500	1,750	1,100	1,850	1,800	2,000	1,950	1,700	1,850	1,7500
Leghorn	<i>n</i>	18	32(1)	40(2)	22(2)	33(1)	36	42(2)	42(3)	30(1)	44(4)	47(5)	386(21)
	<i>L</i>	900	1,650	2,100	1,200	1,700	1,800	2,200	2,200	1,550	2,400	2,600	20,300
Anzio	<i>n</i>	16(3)	18(2)	25(3)	18(1)	13	23(3)	39(4)	98(3)	72(2)	30	35	387(21)
	<i>L</i>	950	1,000	1,400	950	650	1,300	2,150	5,050	3,700	1,500	1,750	20,400
Naples	<i>n</i>	18(4)	23(2)	18	6(1)	7	9(2)	53(4)	41(2)	49(2)	43(3)	49(4)	316(24)
	<i>L</i>	1,100	1,250	900	350	400	2,250	2,850	2,150	2,550	2,300	2,650	18,750
Reggio C.	<i>n</i>	15(5)	13(2)	18(3)	12(5)	11(1)	18(2)	23(3)	26(1)	23	20(2)	22(3)	201(27)
	<i>L</i>	1,000	750	1,050	850	600	1,000	1,300	1,350	1,150	1,100	1,250	11,400
Catania	<i>n</i>	46(2)	54(6)	54(1)	58(2)	47(1)	48	84(5)	90(7)	32(4)	35(6)	33(7)	581(41)
	<i>L</i>	2,400	3,000	2,750	3,000	2,400	2,400	4,450	4,850	1,800	2,050	2,000	31,100
Palermo	<i>n</i>	42(1)	119(6)	51(5)	87(2)	85(5)	74(6)	117(9)	102(10)	123(10)	199(14)	138(10)	1,137(78)
	<i>L</i>	2,150	6,250	2,800	4,450	4,500	4,000	6,300	5,600	6,650	10,650	7,400	60,750
Cagliari	<i>n</i>	14(1)	32	26(6)	56(1)	49(2)	52(4)	51(2)	64(5)	36(3)	43(3)	50(5)	473(32)
	<i>L</i>	750	1,600	1,600	2,850	2,550	2,800	2,650	3,450	1,950	2,300	2,750	25,250
Bari	<i>n</i>	14(1)	10	17	16(3)	22(1)	30	33(1)	35	46(1)	49(3)	54(5)	326(15)
	<i>L</i>	750	500	850	950	1,150	1,500	1,700	1,750	2,350	2,600	2,950	17,050
Ancona	<i>n</i>	75(8)	76(1)	91(2)	106(2)	107(2)	108(3)	113(3)	112(3)	142(5)	141(8)	204(16)	1,275(55)
	<i>L</i>	4,150	3,850	4,650	5,400	5,450	5,550	5,800	5,850	7,350	7,460	11,000	66,510
Chioggia*	<i>n</i>	30	32	60	82	46	72	98	82	86	86	104	778
	<i>L</i>	1,500	1,600	3,000	4,100	2,300	3,600	4,900	4,200	4,300	4,300	5,200	39,000
Venice	<i>n</i>	15(2)	16(1)	30(2)	41(2)	23(1)	36(1)	49(4)	42(3)	43(4)	43(7)	52(6)	390(33)
	<i>L</i>	850	850	1,600	2,150	1,200	1,850	2,650	2,250	2,350	2,500	2,900	21,150
Trieste	<i>n</i>	8	11(2)	7(2)	12(0)	3(0)	31(2)	28(3)	22(2)	24(5)	19(2)	23(4)	188(22)
	<i>L</i>	400	650	450	600	150	1,650	1,550	1,200	1,450	1,050	1,350	10,500
Kvarner	<i>n</i>	10(1)	37(4)	156(5)	36	47	124(6)	73(5)	103(2)	98(3)	81(1)	79(1)	844(28)
	<i>L</i>	550	2,050	8,050	1,850	2,350	2,350	3,900	5,250	5,050	4,100	4,000	39,500
Total	<i>n</i>	306(28)	473(27)	589(31)	563(22)	497(16)	665(31)	794(45)	865(43)	799(42)	812(54)	859(67)	7,629(406)
	<i>L</i>	18,100	26,350	32,700	30,450	26,500	33,900	44,200	47,150	44,150	46,010	49,650	399,160

*No foetal data available for Chioggia.

change (Bearzi, 2002; Cuculic, 1960; Marelic, 1961; Northridge and Hofman, 1999; Peksider-Srica, 1931).

As early as 1868, Mr. Merello, mayor of Portofino (the name of this village derives from the latin *portus delphini*, meaning dolphin harbour) claimed that the number of dolphins in the Gulf of Genoa had increased so much as to threaten the fishing economy of the region and in particular that the cost of repairing damaged nets absorbed almost all economic gain. He asked the Government for a reward of 10 Italian Liras (\approx 47 EUR in today's money) for every dolphin killed, although it was not approved. Similarly, in 1880, the mayors of the villages of the Western Ligurian Riviera offered a prize for whoever made an economic and easy-to-use weapon for hunting dolphins; a bomb gun developed by Alexander Henry of Edinburgh sold for 15 pounds (\approx 1900 EUR in today's money). In 1889, the Government's Fisheries Consultative Commission approved, for the first time, the requests of fishing organisations for financial support (bounties) for each dolphin killed and authorised the experimental use of bomb guns.

The 'dolphin management' problem escalated in 1904 when David Levi-Morenos from the Lega Navale of Venice, reported on the damages declared by the fishermen for the Compartimenti of Venice and Ancona, calculable in 'several thousand' Italian Liras (Levi-Morenos, 1905). The Levi-Morenos report also described the many methods used

around Europe to kill dolphins, including the use of light sources to attract dolphins to make them easier to kill, the use of dynamite, torpedoes, spear-harpoons, other armed throwing weapons (e.g. bolases) and forced stranding techniques (Levi-Morenos, 1905). A strong debate ensued in the Fisheries Consultative Commission, since not all the experts present were in agreement with the report and some doubted the veracity of the fishermen's testimonies, considering them to be exaggerated. The Fisheries Consultative Commission postponed a decision on a proposal to distribute rifles on loan to fishing syndicates and to encourage recreational dolphin hunting to limit populations. However, in 1904 a law was passed called 'Provisions in favour of fishing and fishermen' (n. 378, 11 July 1904), that promised a reward to every fisherman (provided that he was a member of a syndicate) who killed a dolphin and provided proof. In addition, the Government granted each syndicate an initial grant of 30,000 Italian Liras and an annual contribution of 10,000 Italian Liras to assist their fishing operations.

The request for rifles was reiterated and refused again in 1913 when the Sindacato Peschereccio Ligure-Sardo (Ligurian-Sardinian Fishery Syndicate) in Genoa decided to ask the Italian government not only for bounties, but also for rifles to be distributed to the fishing syndicates (Cattaneo-Vietti and Bava, 2009; Pellerano, 2014; Poggi, 1986).

Despite this request for rifles being refused, the syndicate continued a dolphin hunting programme and indeed supplied the Natural History Museum of Genoa with 29 common dolphin and 16 bottlenose dolphin specimens between 1914 and 1917 (Cagnolaro *et al.*, 2012; Poggi, 1986; 2014).

During the era of the National Fascist Party in Italy (1922–1943), animosity towards dolphins increased, encouraged by a series of propaganda articles in which ‘the dolphin’ was identified as an enemy of the national fishing heritage (Cirillo, 1942). Following a decree by the Ministry of the National Economy (26 December 1928) formally published in the *Gazzetta Ufficiale* (n. 22, 26 January 1929), for the period 1928–38 a 50 Lira bounty increased to 100 Lira if a pregnant female ($\approx 45\text{--}90$ EUR in today’s money) was to be provided to any Italian citizen who killed a dolphin, if confirmed by the local maritime authorities. During the Second World War, the Ministry of Finance allocated 40,000 Italian Liras ($\approx 26,000$ EUR in today’s money) for culling campaigns; which ceased at the end of 1942 (Cirillo, 1942). Although the provision of bounties ceased, some dolphins continued to be hunted legally until 1980 and Italy’s adherence to CITES (Bearzi *et al.*, 2004) as noted above.

Landings

Annual data for the officially reported total numbers of landed dolphins and the amount paid in bounties (by Compartimenti) from 1927 to 1937, are reported in Table 1 and summarised over the whole period in Table 2. Over the full period, a total of 7,629 dolphins were reported killed, increasing from 306 in 1927 to 859 in 1937 (the peak year was actually 1934 with a catch of 865). The average (by Compartimenti) increased from 23.8 (SD 18.6) in 1927 to 66.1 (SD 51.0) in 1937 (Fig. 2). Over the same period, the total bounty paid increased from 18,100 in 1927 to 49,650 Italian Liras in 1937 (although during this time the value of the Lira had decreased by around 27%).

There was considerable variation in reported catches amongst Compartimenti (see Fig. 3), with the highest reported total catches from Ancona in the Adriatic Sea (1,275 with 55 foetuses) and Palermo in the Tyrrhenian Sea (1,137 with 78 foetuses) with annual average catches of 115.9 (SD 36.4) and 103.4 (SD 43.8), respectively. Reported catches

increased in both of these areas over the period, with the highest values of 204 for Ancona in 1937 and 199 for Palermo in 1936.

As noted above, additional data (although only based upon weights) were found for Chioggia for the period 1946 to 1960. In this period, the estimated captures, although with a certain degree of uncertainty related to the assumption about the average weight of the specimens, showed a collapse, reaching 2.7 ± 0.5 dolphins per year. This was due to the suspension of rewards and probably the non-mandatory catch reporting.

After the Second World War, the Kvarner Gulf Compartimento in the northeastern Adriatic remained active. Crnkovic (1958) asserted that the coastal populations of bottlenose and short-beaked common dolphins comprised thousands of individuals and about 600 dolphins (species unknown) were reported killed although no bounties were paid after 1960 (Marelic, 1961). D’Ancona (1926) had reported high catches (around 222 with considerable annual variation) for the decade 1914–1925.

In Italy, no data on dolphin landings are available in the Reports of the Central Statistical Institute after 1980, the year when the absolute ban on dolphin hunting was issued, but a few illegal catches continued for a short time, e.g. Bearzi *et al.* (2004).

DISCUSSION AND CONCLUSIONS

In the period 1927–37, along the Italian coast, over 7,200 dolphins were reported killed. In addition to this value, we have to consider the undocumented number of wounded animals that sank and died later. In the same period, 400,000 Italian Liras were distributed to fishers as rewards, equivalent now to 355,000 EUR, about 40–50 EUR for each dolphin. Considering that the meat could be consumed both at the family level or sold on the market, mainly as ‘musciamme’⁴, this kind of hunting could be profitable (Stanzani and Piermarocchi, 1992).

⁴Until the early 1980s, fishing communities and families prepared dolphin meat as ‘musciamme’, from the Arabic word *mušammà* which means dry and hard. The meat was salted in a 20–25% solution for 15 days, left to dry naturally and then sold in the fish markets as a product of high gastronomic and economic value (Pellegrino and Tortonese, 1982; Cagnolaro *et al.*, 1983).

Table 2
Summary of catch and foetal data for the total period (1927–37) by Compartimenti.

Comp.	Catch	% of total	Annual average	SD	Foetuses	% foetuses
Genoa	347	4.5	31.55	9.6	9	2.6
Leghorn	386	5.1	35.09	9.6	21	5.4
Anzio	387	5.1	35.18	26.56	21	5.4
Naples	316	4.1	28.73	18.5	24	7.6
Reggio	201	2.6	18.27	5.00	27	13.4
Catania	581	7.6	52.82	19.1	41	7.1
Palermo	1,137	14.9	103.36	43.8	78	6.9
Cagliari	473	6.2	43.00	14.6	32	6.8
Bari	326	4.3	29.64	15.2	15	4.6
Ancona	1,275	16.7	115.91	36.4	55	4.3
Chioggia	778	10.2	70.73	25.4	0	n/a
Venice	390	5.1	35.45	12.7	33	8.5
Trieste	188	2.5	17.09	9.3	22	11.7
Kvarner	844	11.1	76.73	42.7	28	3.3
Total	7,629	100.0	693.55	197.2	9	5.9*

*The percentage of foetuses for the total is based upon a total catch of 6,851, i.e. excluding the 778 catch for Chioggia for which there are no foetal data available.

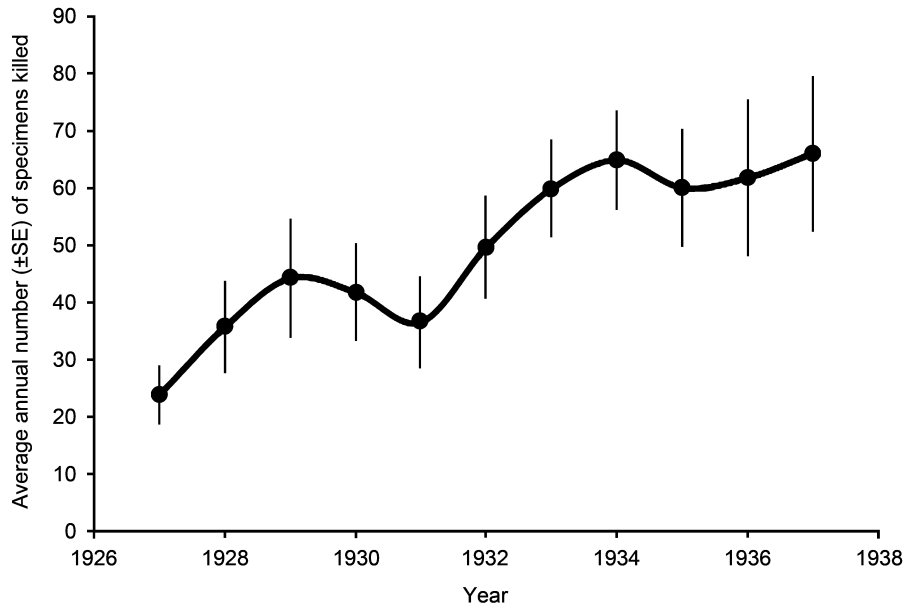


Fig. 2. Average annual number (± SE) of specimens killed (1926–1938).

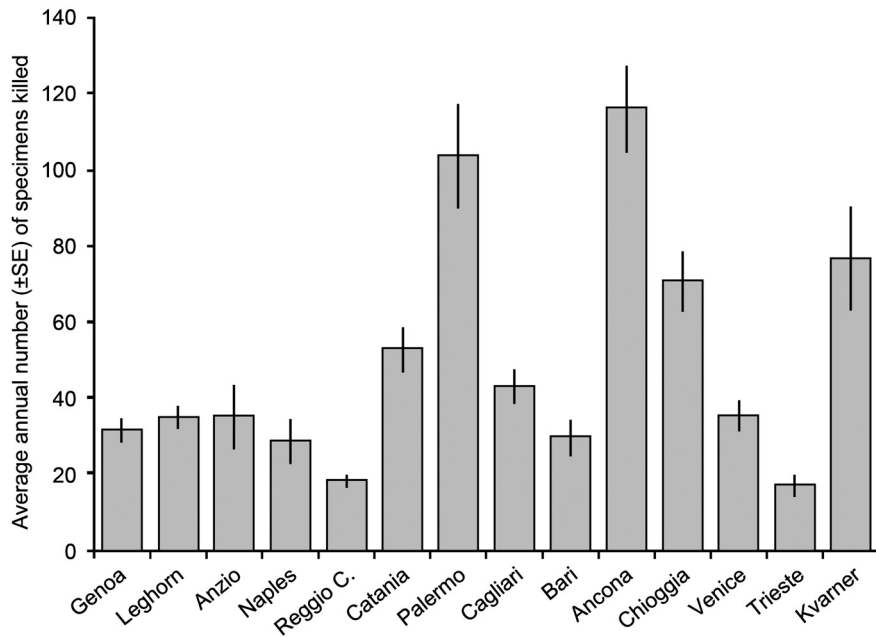


Fig. 3. Average number (± SE) of specimens killed in each considered Compartimenti in the decade 1927–1937.

The data presented here are valuable but it must be recognised that there are a number of uncertainties surrounding the official data from 1927–33 that it is not possible to fully answer (but that would need to be taken into account in any attempt to use them in a population assessment), including:

- (1) the reliability of the reported data, even in terms of total numbers landed is not clear – e.g. given the financial considerations scenarios could be envisaged in which the numbers were inflated (collaboration amongst fishers and officials to obtain maximum financial gain);
- (2) the locations of the catches (as opposed to the landings) are unknown;
- (3) the numbers do not include animals that were injured and later died but were not able to be brought to shore and

thus reported – the number of such animals is unknown but may be quite high;

- (4) the reported data are not broken down by species or sex;
- (5) the foetal data will almost certainly be an underestimate given the difficulties of identifying small foetuses; and
- (6) as the data are not broken down by sex then the proper comparison (pregnant females to total adult females) cannot be made – the comparison in this paper simply shows the percentage of total reported animals (which will include males and immatures) that had a reported foetus.

With respect to species identity, present knowledge of the behaviour and distribution of dolphins in the ‘study’ area,

suggests that the most frequently caught species was the bottlenose dolphin, probably followed by the common dolphin; striped dolphins are usually found further from the coast and so are probably the least represented. The bottlenose dolphin is the most common cetacean of the Italian continental shelf (Bearzi and Ferretti, 2000; Gnone *et al.*, 2011; Ninni, 1901; Notarbartolo di Sciara *et al.*, 1993) and is the species which commonly displays opportunistic behaviour, taking fish from nets and fish farms (Di Natale and Notarbartolo di Sciara, 1994; Diaz Lopez, 2007a; 2007b; Lauriano *et al.*, 2004; Quero *et al.*, 2000).

Fortuna *et al.* (2018) produced density maps of bottlenose dolphins in the Adriatic Sea from systematic surveys showing summer concentrations in the North (that would coincide roughly with Chioggia, Venice, Trieste and Kvarnar), in the centre (that would be roughly at the same latitude as Ancona) and the South (that would include Bari). Estimates of abundance based upon combined data from aerial surveys in 2010 and 2013 were 2,600 (CI 2,200–2,900) in the North, 1,100 (CI 800–1,500) in the central area and 1,800 (CI 1,300–1,800) in the South. For comparative purposes, for the 1927–37 period, total reported catches were 2,200 (annual average 200 or around 13% of the present abundance) for the northern area, 1,275 (average 116 or around 11%) for the central area and 326 (average 30 or around 2%) for the southern area. Given the uncertainties referred to above it is not possible to draw any conclusions on likely impact of catches at that time. However, if all or most of the hunted animals were bottlenose dolphins and present-day abundance reflects past abundance, then this would probably have had an adverse effect at the sub-population level for the northern and central regions given the fertility rate for adult females in the eastern Ligurian Sea of around 0.3–0.4 estimated by Rossi *et al.* (2017) with a calf mortality rate of around 0.25.

It is believed that common dolphins, which are now almost absent from the Adriatic, were once relatively abundant there (e.g. see Bearzi *et al.*, 2004). It is not impossible that this is related at least in part to bounty hunting.

Similar contemporary data to those for bottlenose dolphins in the Adriatic do not yet exist for the Ionian and Tyrrhenian Seas for either of the most likely hunted species, the bottlenose and common dolphins. However, Gnone *et al.* (2011), estimated the Ligurian ‘eastern sub-population’ of the bottlenose dolphin at about 510–552 individuals in 2006 and Lauriano *et al.* (2010) estimated about 884–1,023 individuals for the total Pelagos Sanctuary. The relevant Compartimenti are Genoa and Leghorn where the total catches for the 1927–37 period were 733 (annual average around 66 that could represent between 6–13% of the present total abundance). Following the logic applied to the Adriatic Sea, if all or most of the hunted animals were bottlenose dolphins and present-day abundance reflects past abundance then this would probably have had an adverse effect at the population level given by Rossi *et al.* (2017).

Panigada *et al.* (2011; 2017) developed density maps and abundance estimates for striped dolphins based upon aerial surveys undertaken seasonally (except autumn) from 2009–14 (although not all areas in all seasons). The estimated

abundance (over 95,000; 92,900–120,300 95% CI) was thus high compared to the hunting levels in the 1927–37 period, even if they were all striped dolphins.

In summary, hunting dolphins for food, pleasure or to eliminate a competitor for fishing was a relatively common and legal practice even until 1980 in Italy. Hunting was encouraged by the authorities and fuelled by substantial bounties prior to the Second World War as these cetaceans were considered enemies of the national fishing heritage (Cirillo, 1942; Maggioli, 1941). As is the case elsewhere in the world, opinions on dolphins have changed since the 1970s and today dolphins are fully protected and generally popular (although perhaps still less so in some fishing communities). They are considered key species in raising public awareness about the importance of environmental conservation and are seen as important bioindicators of the health of marine and coastal ecosystems (Notarbartolo di Sciara, 2002).

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REFERENCES

- Barone, G. 1895. Modificazioni delle abitudini del delfino comune (*Delphinus delphis*) osservate in Liguria e prodotte dal generalizzarsi della pesca intensiva. *Neptunia* 10: 156–64. [In Italian].
- Bearzi, G. 2002. Interactions between cetaceans and fisheries in the Mediterranean Sea. In: Notarbartolo di Sciara, G. (eds). *Cetaceans of the Mediterranean and Black Seas: state of knowledge and conservation strategies*. A report to the ACCOBAMS Secretariat, Monaco, February 2002.
- Bearzi, G. and Ferretti, S. 2000. Rare report of a bottlenose dolphin foraging in the Venice Lagoon, Italy. *European Research on Cetaceans* 14: 110–114.
- Bearzi, G., Agazzi, S., Gonzalvo, J., Bonizzoni, S., Costa, M. and Petroselli, A. 2010. Biomass removal by dolphins and fisheries in a Mediterranean Sea coastal area: do dolphins have an ecological impact on fisheries. *Aquat. Conserv. Marine and Freshwater Ecosystems* 20(5): 549–59.
- Bearzi, G., Holcer, D. and Notarbartolo di Sciara, G. 2004. The role of historical dolphin takes and habitat degradation in shaping the present status of northern Adriatic cetaceans. *Aquat. Cons. Marine and Freshwater Ecosystems* 14: 363–79.
- Brunelli, G. 1932. Biologia industriale dei delfinidi. *Bollettino di Pesca, Piscicoltura e Idrobiologia* 3: 343–59. [In Italian].
- Brusina, S. 1889. Mammals of the Adriatic Sea. *Rad Jazu* 95: 79–177. [In Croatian].
- Cagnolaro, L., Di Natale, A. and Notarbartolo-di-Sciara, G. 1983. *Cetacei. Guide per il riconoscimento delle specie animali delle acque lagunari e costiere italiane*. Vol. 9. AQ/1/224. Consiglio Nazionale delle Ricerche, Roma, 183pp. [In Italian].
- Cagnolaro, L., Podesta, M., Affronte, M., Agnelli, P., Cancelli, F., Capanna, E., Carlini, R., Cataldini, G., Cozzi, B., Insacco, G., Maio, N., Marsili, L., Nicolosi, P., Olivieri, V., Poggi, R., Renieri, T. and Wurtz, M. 2012. Collections of extant cetaceans in Italian museums and other scientific institutions. A comparative review. *Nat. Hist. Sci.* 153(2): 145–202.
- Cattaneo-Vietti, R. and Bava, S. 2009. *La tonnellata e la pesca tradizionale a Camogli*. Le Mani, Recco. 143pp. [In Italian].
- Catton, C. 1995. *Dolphins*. Boxtree, London. 160pp.
- Cirillo, S. 1942. La caccia ai delfini. *La Pesca italiana* 3(4). [In Italian].
- Crnkovic, D. 1958. The dolphin problem. *Morsko Ribarstvo* 10: 12–14. [In Croatian].
- Cuculic, N. 1960. Five-year research programme to advance marine fisheries. *Morsko Ribarstvo* 12: 84–86. [In Croatian].

- D'Ancona, U. 1926. Dell'influenza della stasi peschereccia del periodo 1914–18 sul patrimonio ittico dell'Alto Adriatico. *Memorie R. Comitato Talassografico Italiano* 126: 1–92. [In Italian].
- Del Rosso, F. 1905. *Pesche e peschiere antiche e moderne nell'Etruria marittima*. Piaggi, Florence. [In Italian].
- Di-Méglio, N., Romero-Alvarez, R. and Collet, A. 1996. Growth comparison in striped dolphins, *Stenella coeruleoalba*, from the Atlantic and Mediterranean coasts of France. *Aquatic Mammals* 22(1): 11–21.
- Di Natale, A. and Notarbartolo di Sciarra, G. 1994. A review of the passive fishing nets and trap fisheries in the Mediterranean Sea and of the cetacean bycatch. *Rep. Int. Whal. Commn (special issue)* 15: 189–202.
- Diaz Lopez, B. 2007a. Bottlenose dolphin depredation on aquaculture and gillnets along the north-eastern coast of Sardinia. ACCOBAMS-MiPAAF workshop, Rome, 10–11 September 2007. DOI: 10.13140/RG.2.2.35822.61766
- Diaz Lopez, B. 2007b. The pressures of aquaculture and gillnets fisheries on coastal bottlenose dolphins off Sardinia. ACCOBAMS-MiPAAF workshop, Rome, 10–11 September 2007. DOI: 10.13140/RG.2.2.35822.61766
- Donati, A. and Pasini, P. 1999. *La pesca, realtà e simbolo fra tardo Antico e Medioevo*. Vol. II. Leonardo Arte Publ. 167pp. [In Italian].
- Donati, A., and Pasini P. 1997. *Pesca e pescatori nell'antichità*. I. Leonardo Arte Publ. 1–179. [In Italian]
- Duguay, R., Besson, J., Casinos, A., di Natale, A., Filella, S., Raduan, A., Raga, J. and Viale, D. 1983. L'impact des activités humaines sur les cétacés de la Méditerranée occidentale. *Rapp. Comm. Int. Mer Médit.* 28(5): 219–22. [In French].
- Faber, G.L. 1883. *The Fisheries of the Adriatic and the Fish Thereof: A Report of the Austro-Hungarian Sea-fisheries, with a Detailed Description of the Marine Fauna of the Adriatic Gulf*. B. Quaritch. 292pp.
- Mannocci, L., Roberts, J. J., Halpin, P. N., Authier, M., Boisseau, O., Bradai, M. N., Cañadas, A., Chicote, C., David, L., Di-Méglio, L., Fortuna, C.M., Frantzis, A., Gazo, M., Genov, T., Hammond, P.S., Holcer, D., Kaschner, K., Kerem, D., Lauriano, G., Lewis, T., Notarbartolo di Sciarra, G., Panigada, S., Raga J.A., Scheinin, A., Ridoux, V., Vella, A., Vella, J. 2018. Assessing cetacean surveys throughout the Mediterranean Sea: a gap analysis in environmental space. *Scientific Reports* 8(1), 3126.
- Gnone, G., Bellingeri, M., Dhermain, F., Dupraz, F., Nuti, S., Bedocchi, D., Moulins, A., Rosso, M., Alessi, J., McCrear, R.S., Azzellino, A., Airolidi, S., Portunato, N., Laran, S., David, L., Di Meglio, N., Bonelli, P., Montesi, G., Trucchi, R., Fossa, F. and Wurtz, M. 2011. Distribution, abundance, and movements of the bottlenose dolphin (*Tursiops truncatus*) in the Pelagos Sanctuary MPA (north-west Mediterranean Sea). *Aquat. Conserv. Marine and Freshwater Ecosystems* 21(4): 372–88.
- Issel, A. 1903. Uso della dinamite contro orate e delfini. *Atti della Commissione Consultiva per la Pesca. Sessione dicembre 1899*. Annals of the Ministry of Agriculture, Industry and Commerce, Rome. [In Italian].
- Lauriano, G., Fortuna, C.M., Moltedo, G. and Notarbartolo di Sciarra, G. 2004. Interactions between common bottlenose dolphins (*Tursiops truncatus*) and the artisanal fisher in Asinara Island National Park (Sardinia): assessment of catch damage and economic loss. *J. Cetacean Res. Manage.* 6(2): 165–73.
- Lauriano, G., Panigada, S., Cannari, R. and Zeichen, M.M. 2010. Abundance estimate of striped dolphins (*Stenella coeruleoalba*) in the Pelagos sanctuary (NW Mediterranean) by means of line transect surveys. *J. Cetacean Res. Manage.* 11(3): 279–84.
- Levi-Morenos, D. 1905. Mezzi per la difesa dei Delfini. *Atti della Commissione Consultiva per la Pesca. Sessione dicembre 1904*. *Annals of the Ministry of Agriculture, Industry and Commerce*, Rome. [In Italian].
- Lopez, A. 1948. Storie di mare: il delfino. *La Pesca italiana. Edizioni Olimpia* 9(5–6). [In Italian].
- Maggioli, U. 1941. Il delfino é un nemico del patrimonio ittico nazionale. *La Pesca italiana. Edizioni Olimpia* 2(5). [In Italian].
- Marelic, D. 1961. Results of the work for the advancement of marine fisheries in 1961. *Morsko Ribarstvo* 3(5–7). [In Croatian].
- Ministry of Agriculture, Industry and Commerce. 1903. *Atti della Commissione Consultiva per la Pesca. Sessione dicembre 1899*. [In Italian].
- Ministry of Agriculture, Industry and Commerce. 1905. *Atti della Commissione Consultiva per la Pesca. Sessione dicembre 1904*. [In Italian].
- Ministry of the National Economy. 1927–37. *Premi per la cattura dei delfini. Nuovi Annali dell'Agricoltura*. Rome. [In Italian].
- Ninni, E. 1901. Sulle catture di alcuni Cetacei nel Mare Adriatico ed in particolare sul *Delphinus tursio* (Fabr.). *Neptunia* 8: 67–78. [In Italian].
- Northridge, S.P. and Hofman, R.J. 1999. Marine mammal interactions with fisheries. pp. 99–119. In: Twiss, J.R., Jr. and Reeves, R.R. (eds). *Conservation and Management of Marine Mammals*. Smithsonian Institution Press, Washington and London. 576pp.
- Notarbartolo di Sciarra, G. 2002. *Cetaceans of the Mediterranean and Black Seas: state of knowledge and conservation strategies*. A report to the ACCOBAMS Secretariat, Monaco, February 2002. [Available at: <http://www.accobams.org>].
- Notarbartolo di Sciarra, G. and Bearzi, G. 2002. Cetacean direct killing and live capture in the Mediterranean Sea. Section 5, 4. In: Notarbartolo di Sciarra, G. (eds). *Cetaceans of the Mediterranean and Black Seas: state of knowledge and conservation strategies*. A report to the ACCOBAMS Secretariat, Monaco, February 2002.
- Notarbartolo di Sciarra, G., Venturino, M.C., Zanardelli, M., Bearzi, G., Borsani, F.J. and Cavalloni, B. 1993. Cetaceans in the central Mediterranean Sea: distribution and sighting frequencies. *Bollettino della Società Zoologica Italiana* 60: 131–8.
- Orams, M.B. 1997. Historical accounts of human-dolphin interaction and recent developments in wild dolphin based tourism in Australasia. *Tourism Manage.* 18(5): 317–26.
- Panigada, S., Lauriano, G., Burt, L., Pierantonio, N. and Donovan, G. 2011. Monitoring winter and summer abundance of Cetaceans in the Pelagos Sanctuary (Northwestern Mediterranean Sea) through aerial surveys. *PLoS One* 6(7): e22878.
- Panigada, S., Lauriano, G., Donovan, G., Pierantonio, N., Cañadas, A., Vázquez, J.A. and Burt, L. 2017. Estimating cetacean density and abundance in the Central and Western Mediterranean Sea through aerial surveys: Implications for management. *Deep Sea Research Part II: Topical Studies in Oceanography* 141: 41–58.
- Peksidar-Srica, V. 1931. On the dolphin and its hunting. *Lovacko Ribarski Vjesnik* 40: 409–15. [In Croatian].
- Pellegrino, C. and Tortonese, E. 1982. *Pesci marini e prodotti alimentari derivati*. Edagricole. 152pp. [In Italian].
- Pellerano, A. 2014. Il Laboratorio Marino e la Società Ligure-Sarda per la protezione della pesca. *Boll. Mus. Ist. Biol. Univ. Genova* 76(2): 1–107. [In Italian].
- Perrier, E. 1889. Rapport adressé au Ministre de la Marine au nome du Comité des peches maritimes. *Journal officiels Paris*. [In French].
- Poggi, R. 1986. I Delphinidae fatti pervenire al Museo di Genova tra il 1914 e il 1917 dal Sindacato Peschereccio Ligure-Sardo (Mammalia, Cetacea). *Ann. Mus. St. Nat. G. Doria* 86: 1–11. [In Italian].
- Poggi, R. 2014. I Cetacei del Museo Civico di Storia Naturale 'Giacomo Doria' di Genova. *Museol. Scient. Mem.* 12: 117–52. [In Italian].
- Quero, M.E., Chiofalo, G., Datta, S., Di Natale, A., Dremlere, P.Y. and Goodson, D. 2000. Interaction between dolphins and artisanal gillnet fishery: methods of fishery damage and sampling. *European Research on Cetaceans [Abstracts]* 14: 48–54.
- Ridgway, S.H. and Fenner, C.A. 1982. Weight-length relationships of wild-caught and captive Atlantic bottlenose dolphins. *Journal of the American Veterinary Medical Association* 181(11): 1310–1315.
- Rossi, A., Scordamaglia, E., Bellingeri, M., Gnone, G., Nuti, S., Salvio, F., Manfredi, P. and Santangelo, G. 2017. Demography of the bottlenose dolphin *Tursiops truncatus* (Mammalia: Delphinidae) in the Eastern Ligurian Sea (NW Mediterranean): quantification of female reproductive parameters. *Eur. Zool. J.* 84(1): 294–302.
- Sharir, Y., Kerem, D. and Spanier, E. 2011. Small size in the common bottlenose dolphin *Tursiops truncatus* in the eastern Mediterranean: a possible case of Levantine nanism. *Mar. Ecol. Prog. Ser.* 438: 241–251.
- Stanzani, A.L. and Piermarocchi, C. 1992. Cattura di alcuni individui di *Pseudorca crassidens* (Owen, 1846) in Adriatico. *Atti della Società italiana di Scienze naturali e del Museo civico di Storia Naturale di Milan* 133: 85–95. [In Italian].
- Zappes, C.A., Andriolo, A., Simões-Lopes, P.C. and Di Benedetto, A.P.M. 2011. Human-dolphin (*Tursiops truncatus* Montagu, 1821) cooperative fishery and its influence on cast net fishing activities in Barra de Imbé/Tramandaí, Southern Brazil. *Ocean Coast. Manage.* 54(5): 427–32.