

## Great Cormorant *Phalacrocorax carbo* in Europe. Population Development 1970 - 2014

# How many Cormorants in Europe ?

- **Breeding Pairs**

*(countries + Europe, based on a synopsis of published data)*

- **Total Population**

*(estimate based on a simplified age-cohort model)*

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## *Foreword*

Data on Cormorant Breeding Population exist for most countries in Europe. However, there is no actual publication which provides a satisfactory overview of year by year population trends, which is indispensable for any rational discussion on cormorants.

**This EAA-documentation provides a comprehensive data-set with the number of Cormorant Breeding Pairs, year by year covering the period from 1970 to 2014.**

It is a compilation from a multitude of ornithological publications, with 'cautious' interpolations where published data are lacking.

Actually, the main outcome is just a compilation of numbers of breeding pairs per year per country. However, this enables a multitude of analyses and provides a clear insight into the development of cormorant breeding population, both country by country and for Europe as a whole.

Based on these data on breeding population we have also tried an estimate of the Total Cormorant Population (including juveniles / non-breeders).

The documentation focuses on quantitative information, on numbers and diagrams, without interpretation or too much verbal comments. However, more differentiated explanations can be provided on request.

Analysis, in general, is restricted to "Core Europe", which means all European countries except Ukraine (where data are fragmentary), Moldavia and mainland Russia, where data are fragmentary. (However, in contrast to the previous editions, Russian parts on the Baltic and Belarus.)

This documentation will be updated whenever relevant new information is available. So please mind the version number / publication date. The latest issue always can be found on EAA-website [www.eaa-europe.org](http://www.eaa-europe.org).

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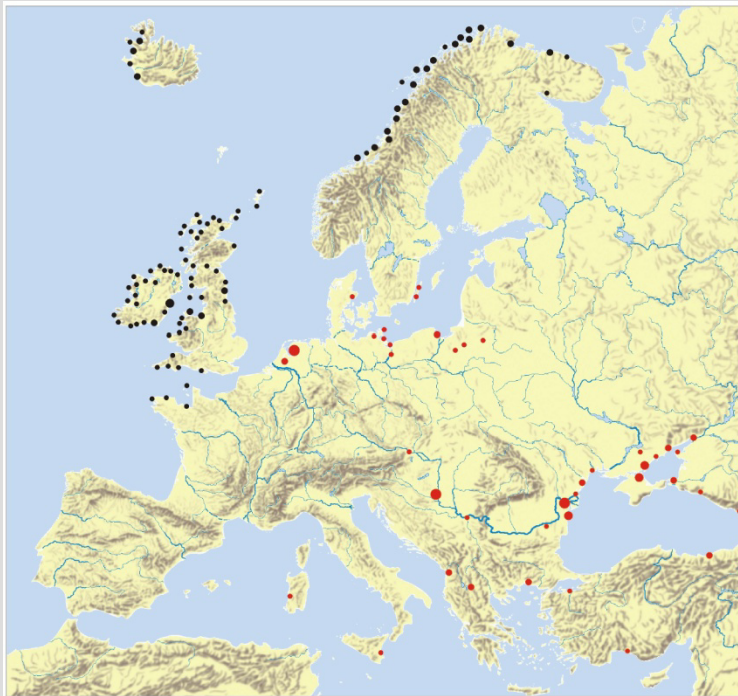
*Appendix I: Sources for Maps of Cormorant Colonies Europe*

*Appendix II: Sources for Breeding Population / Breeding Pairs*

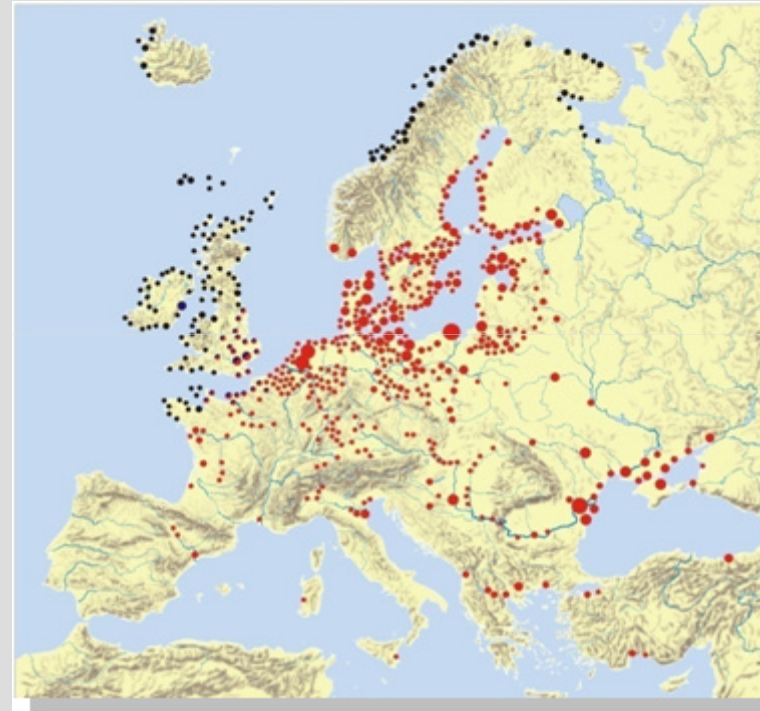
# A1: Regional Distribution of Breeding Colonies

Maps are based on a multitude of sources - see list in appendix

1965/70



2007/08

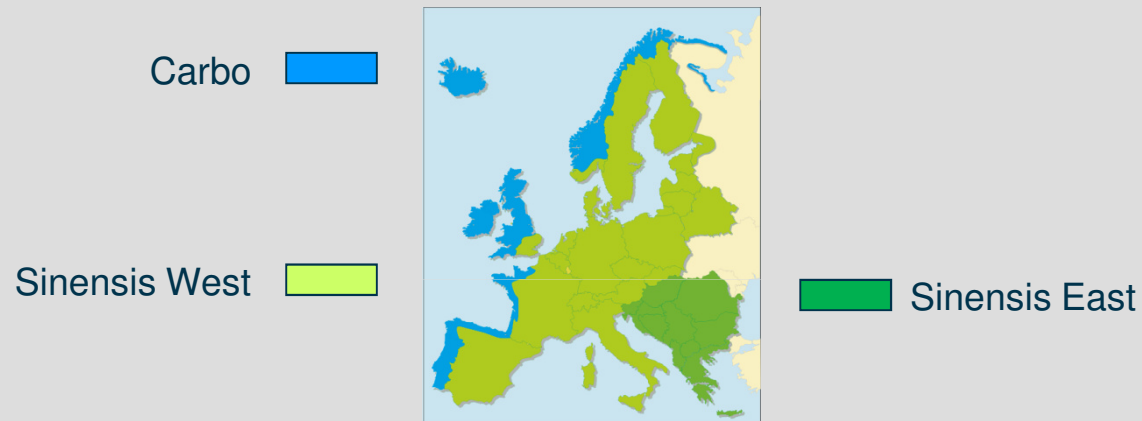


- *Ph. carbo carbo* ⇒ stays within same regional range
- *Ph. carbo sinensis* ⇒ massive expansion between 1990 and 2008  
(since then the range stayed relatively stable in the north, but expanded significantly in Spain, where until 2012 the birds founded about 15 new colonies)

## A2: Subspecies and Sub-Populations

Geographical Scope: Core Europe (excluding Ukraine, mainland Russia\* and Moldova)

- Carbo-subspecies (often called “atlantic race”) lives mainly along the coastal areas of western Europe (*Portugal and Spain up to now have no Carbo breeding colonies, but are traditional wintering countries*).

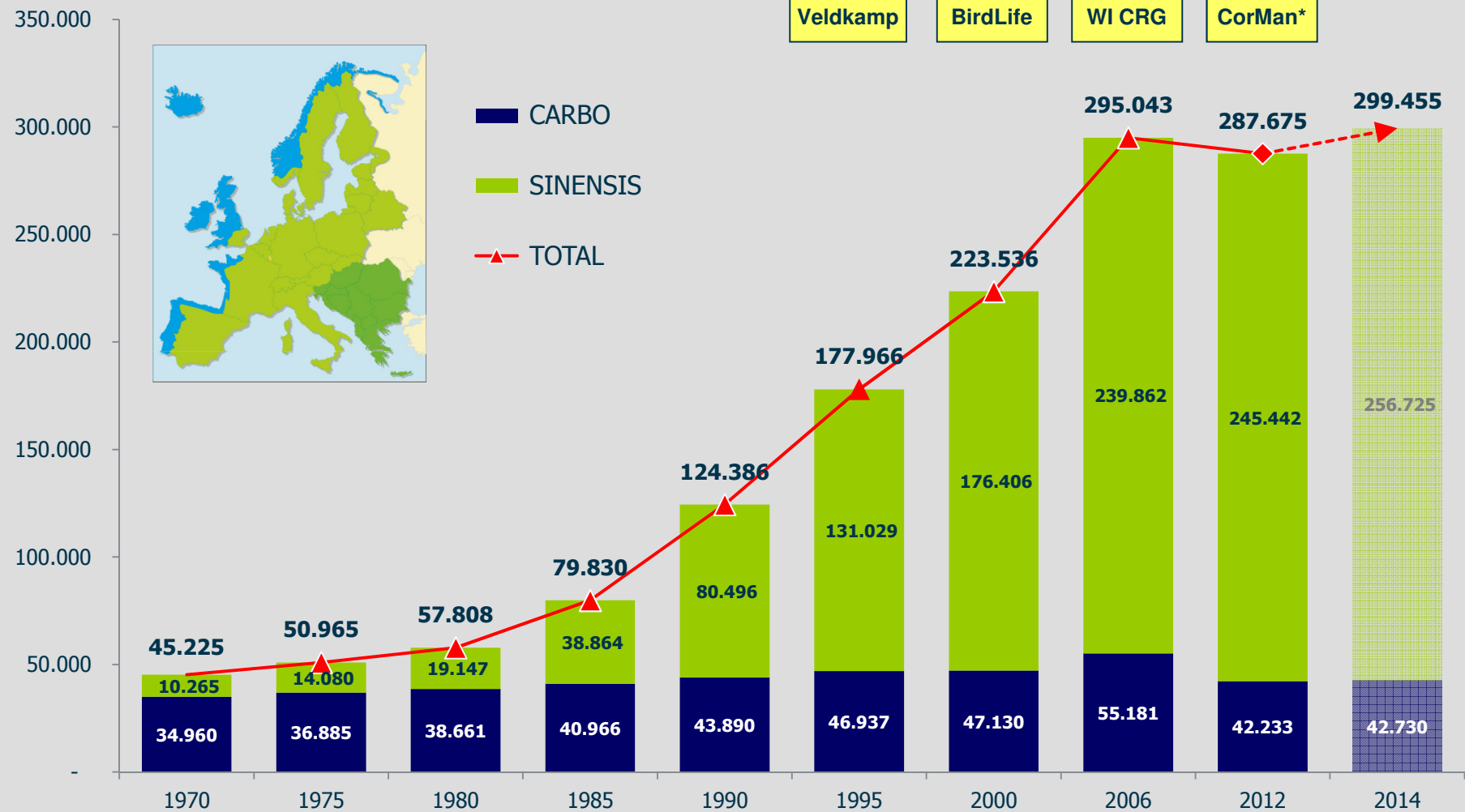


- Within the Sinensis-cormorant two separate sub-populations can be distinguished
  - Sinensis East: centered around Black Sea and Danube delta, extending upstream along the Danube
  - Sinensis West: historically centered in NL, DK, Sweden and Baltic coast of Germany and Poland, then expanding throughout western and central Europe
- Historically, the subspecies and sub-populations were sharply separated. Presently, due to the spectacular expansion of the cormorant population, it has become more difficult to draw a clear border. However, despite possible overlaps the following analysis still maintains this distinction

\*) Ukraine and the European part of Russia holds a large number of breeding cormorants (see Part C), but data are fragmentary and their migration routes do not, or only marginally, touch EU-territory, so they are treated separately. However, Russian colonies on the Baltic (around Kaliningrad and Gulf of Finland) are also relevant for the EU, so these regions are included in “Core Europe”.

## A3: Development of Breeding Population (Pairs) on European Scale

Geographical scope: "Core Europe" (including Belarus and Baltic parts of Russia, but excluding Ukraine & Moldova)

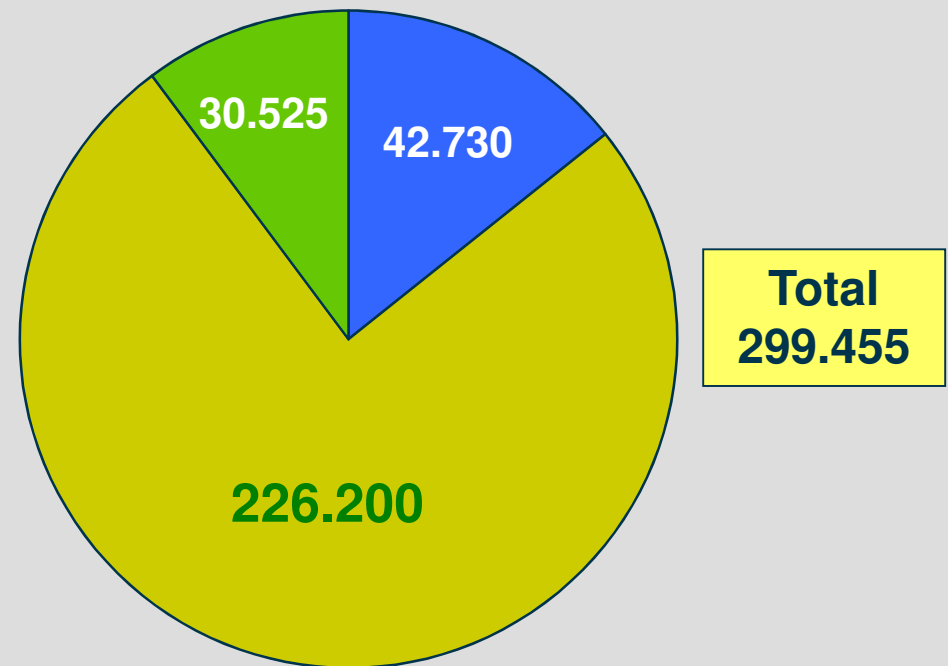


## A4. Breeding Pairs: Carbo vs Sinensis West vs Sinensis East - Status 2014\*

Basis: Core Europe – including Baltic areas of Russia & Belarus\*\*, excluding Ukraine and Moldova



### Breeding Pairs 2014



■ Carbo   ■ Sinensis West\*\*   ■ Sinensis East

\*) Source EU-CorMan Census 2012 plus trend-extrapolations and actualised counts for A, CH, DK, NL and SF,

\*\*\*) As a change to the previous issues now Baltic Russia (Kaliningrad, Gulf of Finland) and Belarus have been included



## A4.1.Tables Breeding Pairs (1)

published data  
interpolated

Year	Norway	Iceland & Faroes*	UK carbo	Ireland	France (coastal)	Russia North Carbo*	SUM CARBO	Netherlands	Denmark	Germany	Poland	Sweden	Norway sinensis	Estonia	Finland	Lithuania	Latvia	Russia Baltic	Belarus	Sum West & Baltic
1970	20.000	3.210	6.400	2.100	1.200	2.050	34.960	2.060	600	1.035	1.000	295	-	-	-	-	-	-	-	4.990
1971	20.500	3.510	6.450	2.200	1.100	2.223	35.983	2.200	902	950	1.000	320	-	-	-	-	-	-	-	5.372
1972	20.000	3.210	6.350	2.370	1.050	2.343	35.323	2.550	950	1.000	1.100	350	-	-	-	-	-	-	-	5.950
1973	19.500	3.410	6.400	2.530	1.100	2.464	35.404	3.300	980	1.050	1.300	390	-	-	-	-	-	-	-	7.020
1974	19.500	3.210	6.500	2.700	1.280	2.584	35.774	3.090	1.020	1.000	1.330	430	-	-	-	-	-	-	-	6.870
1975	20.000	3.510	6.550	2.870	1.250	2.705	36.885	3.950	940	1.000	1.360	337	-	-	-	-	-	-	-	7.587
1976	20.500	3.210	6.650	3.060	1.300	2.825	37.545	3.070	1.160	920	1.380	520	-	-	-	-	-	-	-	7.050
1977	21.000	3.310	6.750	3.270	1.380	2.946	38.656	4.400	1.250	950	1.380	575	-	-	-	-	-	-	-	8.555
1978	21.000	3.710	6.800	3.480	1.350	3.066	39.406	4.470	1.375	970	1.350	630	-	-	-	-	-	-	-	8.795
1979	20.500	3.210	6.950	3.710	1.400	3.187	38.957	4.590	1.697	980	1.350	700	-	-	-	-	-	-	-	9.317
1980	20.000	3.010	7.000	3.960	1.400	3.291	38.661	5.494	2.037	979	1.390	767	-	-	-	-	-	-	-	10.667
1981	19.500	2.810	6.992	4.220	1.450	3.395	38.367	7.028	2.791	1.245	1.470	940	-	-	-	-	-	-	-	13.474
1982	20.000	2.810	7.025	4.500	1.440	3.499	39.274	7.226	3.713	1.476	1.500	1.090	-	-	-	-	-	-	-	15.005
1983	20.500	2.910	7.060	4.650	1.460	3.603	40.183	8.497	4.944	1.632	1.894	1.281	-	1	-	-	-	-	-	18.249
1984	21.000	2.610	7.070	4.800	1.500	3.707	40.687	10.505	6.272	1.925	2.261	1.355	-	5	-	0	-	0	-	22.323
1985	21.000	2.610	7.070	4.955	1.520	3.811	40.966	10.752	7.585	2.289	2.057	1.830	-	9	-	1	-	30	-	24.553
1986	22.000	2.710	7.005	4.955	1.550	3.915	42.135	12.621	9.503	2.655	3.716	1.861	-	21	-	10	-	80	-	30.467
1987	23.000	2.910	6.980	4.717	1.580	3.942	43.129	12.291	12.188	2.886	4.423	2.472	-	22	-	25	-	150	0	34.457
1988	24.000	2.810	7.060	4.717	1.600	4.123	44.310	13.642	14.116	4.615	5.130	3.450	-	36	-	45	0	260	8	41.302
1989	24.200	3.010	7.100	5.000	1.630	4.227	45.167	14.936	18.901	5.559	6.100	4.800	-	76	-	55	16	370	30	50.843
1990	23.500	2.810	7.136	5.200	1.690	3.554	43.890	18.528	23.557	5.750	6.600	5.500	-	139	-	100	25	540	60	60.799
1991	23.800	2.560	7.270	5.350	1.720	3.113	43.813	19.232	29.141	7.430	7.300	6.600	-	262	-	170	34	700	120	70.989
1992	24.000	2.610	7.550	5.500	1.800	3.767	45.227	20.894	33.560	9.428	8.260	9.400	-	484	-	300	60	1.100	180	83.666
1993	23.800	2.710	7.780	5.250	1.750	3.114	44.404	20.535	36.396	11.270	9.150	11.500	-	940	-	450	150	1.600	300	92.291
1994	24.000	2.810	8.020	5.000	1.750	2.464	44.044	14.700	37.600	14.510	10.100	13.600	-	1.425	-	700	160	2.250	450	95.495
1995	27.000	2.210	8.013	4.700	1.900	3.114	46.937	16.800	38.300	15.043	11.000	15.400	0	2.380	0	1.000	205	2.680	850	103.658
1996	24.200	2.410	8.300	4.900	1.900	2.884	44.594	18.500	40.200	14.260	11.850	17.500	25	2.368	10	2.000	250	3.100	1.050	111.113
1997	24.350	2.860	8.310	5.000	1.909	3.116	45.545	17.400	36.200	16.440	12.740	20.000	45	3.227	24	2.200	310	3.850	1.300	113.736
1998	24.650	2.760	8.338	4.800	1.911	3.269	45.728	19.800	39.000	15.920	13.500	22.400	150	3.898	50	2.500	370	4.800	1.370	123.758
1999	24.800	3.010	8.480	4.550	1.913	3.416	46.169	18.400	39.100	16.800	14.100	25.000	270	4.901	122	2.500	430	5.550	1.440	128.613
2000	25.150	3.260	8.884	4.550	1.750	3.536	47.130	19.950	41.000	18.400	15.000	26.000	500	5.836	161	2.700	500	6.300	1.500	137.847
2001	25.000	3.210	8.830	5.000	1.900	3.810	47.750	20.400	39.100	20.252	16.600	27.200	620	6.330	336	3.000	520	7.250	1.700	143.308
2002	25.800	3.160	8.900	5.200	2.000	3.953	49.013	22.050	40.800	20.031	18.000	29.000	800	8.094	699	3.130	520	8.200	1.850	153.174
2003	26.900	3.260	9.010	5.000	2.122	4.008	50.300	22.700	37.100	20.858	19.700	32.500	980	8.401	1.626	3.250	480	9.200	2.050	158.845
2004	28.000	3.210	9.360	4.800	2.000	4.128	51.498	23.325	39.200	23.059	21.400	36.500	1.080	9.529	2.910	3.360	520	10.350	2.300	173.533
2005	29.500	3.160	10.143	4.600	2.000	4.271	53.674	22.050	39.800	22.758	23.400	40.500	1.250	9.969	4.621	3.650	550	12.150	2.600	183.298
2006	30.051	4.144	10.000	4.495	1.969	4.522	55.181	23.476	38.014	23.505	25.731	44.000	1.338	12.300	5.770	3.692	500	12.314	2.700	193.340
2007	27.608	4.410	9.500	4.500	2.000	4.051	52.069	21.000	35.100	23.080	26.300	43.400	1.500	12.513	8.922	3.300	720	12.650	2.820	191.305
2008	25.667	4.810	9.200	4.500	1.950	4.161	50.288	21.200	33.500	25.100	26.700	42.800	1.650	13.356	12.677	4.300	1.000	12.900	2.890	198.073
2009	23.878	5.010	8.700	4.500	1.938	4.326	48.352	23.500	32.850	23.100	26.900	42.000	1.770	13.700	16.007	4.180	1.250	12.000	2.980	200.237
2010	21.968	5.260	8.200	4.500	1.950	4.435	46.313	24.250	28.015	22.700	27.100	41.500	1.900	13.200	14.419	4.190	1.800	11.700	3.090	193.864
2011	20.430	4.964	7.800	4.500	1.980	4.489	44.163	21.950	25.189	19.495	26.900	41.000	2.180	12.930	17.712	4.200	2.500	11.300	3.140	188.496
2012	19.000	4.782	7.405	4.400	2.046	4.600	42.233	23.556	27.237	22.550	26.600	40.598	2.500	13.000	17.258	3.200	3.106	10.905	3.250	193.760
2013	19.000	4.710	7.400	4.500	2.050	5.040	42.700	24.500	24.586	22.600	26.300	40.700	2.900	13.050	18.540	3.000	3.500	11.200	3.500	194.376
2014	19.000	4.690	7.400	4.500	2.050	5.090	42.730	25.200	30.503	22.500	26.600	41.000	3.300	13.070	20.350	2.800	3.800	10.900	3.650	203.673



## A4.2 Tables Breeding Pairs (2)

published data  
interpolated

Year	UK inland (sinensis)	France (inland)	Sum Belgium	Austria	Hungary	Czech Rep.	Slovakia	Switzer- land	Italy	Spain sinensis	Sum Cont Mid & South	Sum ex- Yugosl.	Romania	Bulgaria	Greece	Sum Sinesis East	SUM ALL SINENSIS	SUM CARBO	CORMS TOTAL
1970	-	-	-	8	280	-	-	-	25	0	313	628	3.465	319	550	4.962	10.265	34.960	45.225
1971	-	-	-	7	289	-	-	-	20	0	316	629	3.530	321	560	5.040	10.728	35.983	46.711
1972	-	-	-	0	249	-	-	-	22	0	271	641	3.590	323	600	5.154	11.375	35.323	46.698
1973	-	-	-	0	350	-	-	-	15	0	365	663	3.660	326	645	5.294	12.679	35.404	48.083
1974	-	-	-	0	650	-	-	-	30	0	680	664	3.725	328	690	5.407	12.957	35.774	48.731
1975	-	-	-	0	900	-	-	-	33	0	933	700	3.790	330	740	5.560	14.080	36.885	50.965
1976	-	-	-	0	1.120	-	-	-	40	0	1.160	787	3.860	332	790	5.769	13.979	37.545	51.524
1977	-	-	-	0	1.240	-	-	-	52	0	1.292	867	3.930	334	850	5.981	15.828	38.656	54.484
1978	-	-	-	0	1.360	-	-	-	58	0	1.418	978	4.000	337	910	6.225	16.438	39.406	55.844
1979	-	-	-	0	1.500	-	-	-	63	0	1.563	1.083	4.075	339	980	6.477	17.357	38.957	56.314
1980	-	-	-	0	1.650	-	-	-	70	0	1.720	1.200	4.150	360	1.050	6.760	19.147	38.661	57.808
1981	9	8	-	0	1.760	-	-	-	70	0	1.847	1.369	4.605	375	1.130	7.479	22.800	38.367	61.167
1982	25	12	-	0	1.890	32	-	-	75	0	2.034	1.547	5.110	390	1.210	8.257	25.296	39.274	64.570
1983	50	20	-	0	2.500	52	-	-	100	0	2.722	1.728	5.670	410	1.300	9.108	30.079	40.183	70.262
1984	85	30	-	0	2.700	80	-	-	120	0	3.015	1.890	6.290	440	1.390	10.010	35.348	40.687	76.035
1985	125	36	-	0	3.000	120	-	-	130	0	3.411	1.960	6.980	470	1.490	10.900	38.864	40.966	79.830
1986	170	40	-	0	2.700	246	-	-	150	0	3.306	2.055	7.742	500	1.600	11.897	45.670	42.135	87.805
1987	210	45	-	0	2.550	453	-	-	175	0	3.433	2.175	8.590	550	1.715	13.030	50.920	43.129	94.049
1988	250	50	-	4	2.400	460	40	-	200	0	3.404	2.287	9.210	610	1.840	13.947	58.653	44.310	102.963
1989	300	120	-	0	2.350	613	-	-	215	0	3.598	2.379	9.875	680	1.970	14.904	69.345	45.167	114.512
1990	356	210	-	0	2.300	671	-	-	250	0	3.787	2.455	10.590	750	2.115	15.910	80.496	43.890	124.386
1991	400	350	-	0	2.150	670	30	-	280	0	3.880	2.522	11.350	1.000	2.270	17.142	92.011	43.813	135.824
1992	460	420	20	0	2.180	470	55	-	325	1	3.931	2.570	12.170	1.000	2.430	18.170	105.767	45.227	150.994
1993	526	600	51	0	2.050	380	100	-	370	0	4.077	2.619	13.050	1.200	2.610	19.479	115.847	44.404	160.251
1994	760	850	195	0	1.950	320	155	-	427	0	4.657	2.679	13.990	1.225	2.800	20.694	120.846	44.044	164.890
1995	1.113	1.180	272	0	1.800	265	195	-	493	0	5.318	2.803	15.000	1.250	3.000	22.053	131.029	46.937	177.966
1996	1.250	1.280	280	0	1.750	250	215	-	560	0	5.585	3.018	15.940	1.450	3.150	23.558	140.256	44.594	184.850
1997	1.340	1.425	520	0	1.900	245	230	-	630	0	6.290	3.416	16.940	1.700	3.300	25.356	145.382	45.545	190.927
1998	1.450	1.450	580	0	2.100	220	240	-	710	2	6.752	3.760	17.928	1.950	3.460	27.098	157.608	45.728	203.336
1999	1.550	1.474	750	0	2.350	205	250	-	795	10	7.384	4.600	18.461	2.200	3.630	28.891	164.888	46.169	211.057
2000	1.660	1.600	1.000	0	2.650	190	240	-	880	25	8.245	5.139	18.825	2.350	4.000	30.314	176.406	47.130	223.536
2001	1.780	1.800	1.050	5	2.900	200	220	2	950	35	8.942	5.422	19.137	2.500	4.195	31.254	183.504	47.750	231.254
2002	1.890	2.250	1.230	33	3.000	215	180	7	1.030	60	9.895	5.740	20.000	2.600	4.300	32.640	195.709	49.013	244.722
2003	1.980	2.807	1.306	65	3.300	230	150	23	1.120	90	11.071	5.480	20.000	2.500	4.350	32.330	202.246	50.300	252.546
2004	2.150	3.200	1.450	89	3.500	250	125	53	1.200	140	12.157	5.520	20.000	2.300	4.450	32.270	217.960	51.498	269.458
2005	2.204	3.700	1.519	115	3.500	265	115	117	1.350	230	13.115	5.570	20.000	2.200	4.500	32.270	228.683	53.674	282.357
2006	2.184	4.094	1.648	178	3.200	288	104	214	2.142	350	14.402	5.690	19.700	2.080	4.650	32.120	239.862	55.181	295.043
2007	2.220	4.500	1.700	210	3.500	300	105	350	2.400	532	15.817	5.720	19.455	2.250	5.100	32.525	239.647	52.069	291.716
2008	2.300	5.000	1.787	235	3.600	336	105	440	2.700	700	17.203	5.761	19.000	2.450	5.600	32.811	248.087	50.288	298.375
2009	2.400	5.220	1.740	125	3.400	350	100	547	2.820	900	17.602	5.635	18.500	2.640	5.900	32.675	250.514	48.352	298.866
2010	2.500	5.600	1.645	175	3.200	312	100	560	2.970	1.120	18.182	5.430	17.500	2.650	6.250	31.830	243.876	46.313	290.189
2011	2.600	5.800	1.553	85	3.000	295	100	796	3.170	1.350	18.749	5.304	16.800	2.730	6.600	31.434	238.679	44.163	282.842
2012	2.809	6.620	1.615	65	2.661	297	99	1.037	3.914	1.605	20.722	5.207	16.000	2.775	6.978	30.960	245.442	42.233	287.675
2013	2.800	6.680	1.620	114	2.500	266	100	1.233	4.500	1.750	21.563	5.341	15.000	2.800	7.200	30.341	246.280	42.700	288.980
2014	2.800	6.700	1.620	138	2.480	285	100	1.504	5.000	1.900	22.527	5.375	15.000	2.850	7.300	30.525	256.725	42.730	299.455

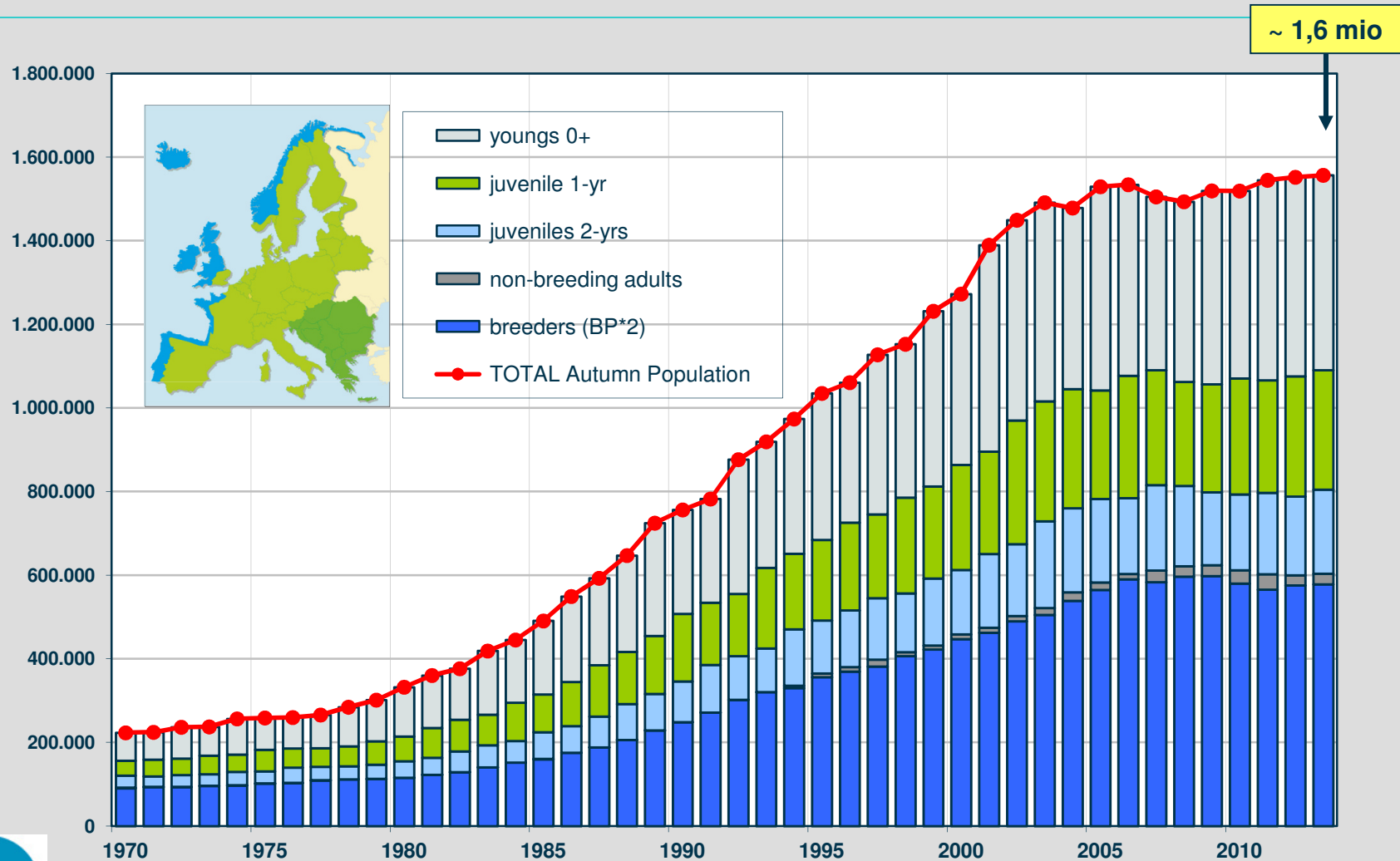
## A5: Estimate of Total Cormorant Population

### A5-1: Methodological Remarks

- Cormorants start breeding with 3 - 5 years, so breeding pairs represent only a part the total population
- A direct count of the non-breeding birds is not feasible. However, if the development of Breeding Pairs is known (% of increase/decrease) then the size of the non-breeding population can be estimated by using observed mortality- and fertility rates.
  - in case of stable number of breeding pairs the number of first-time breeders must be equal the mortality of last year's breeders
  - and in case of an increasing breeding population the number of first time breeders must be adequately more (*to balance the mortality of adult birds + to make up for the increase*)
- Consequently, the percentage of non-breeding juveniles will be relatively higher when the population grows and relatively lower in case of stable or shrinking populations.
- The following estimates are based on a calculation model with the following simplified assumptions:
  - Cormorants start breeding with 3 years, almost all (> 95%) adults do effectively breed
  - Normative mortality (as suggested by ornithological sources). Sinensis: 1st winter 40%, 2<sup>nd</sup> and 3<sup>rd</sup> winter 30%, after 3<sup>rd</sup> year 20%. Carbo: 1st winter 36%, then 26% and after 3<sup>rd</sup> year 13%.
  - average fertility may vary in a range between 1,5 - 1,9 fledged youngs per nest
- With these parameter values the model delivered a good fit with the development of breeding pairs
- Under these assumptions the total population (carbo + sinensis) per summer 2014 was estimated at ca. 1.595.000 cormorants in core Europe (about 195.000 carbo and 1.400.000 sinensis)
- However, it must be reminded that number of non-breeders and consequently the total population could be significantly higher if there is a higher percentage of adult non-breeders.

## A5-2. Estimate Total Cormorant Population in Core Europe - 1970 -2014

Total Cormorant Population (Carbo + Sinensis, Breeders + Non-Breeders) - Estimate F. Kohl (ÖKF/EAA)\*



\*) Estimates based on following simplified assumptions: Cormorants start breeding with 3 years, average fertility and mortality rates as suggested by Wetlands International CRG and other ornithological sources. Details see previous page 'Methodological Remarks'.

## A6: Total Cormorant Population incl. East-East Europe 2014

Basis: Whole Europe – including inland Russia, Ukraine & Moldova



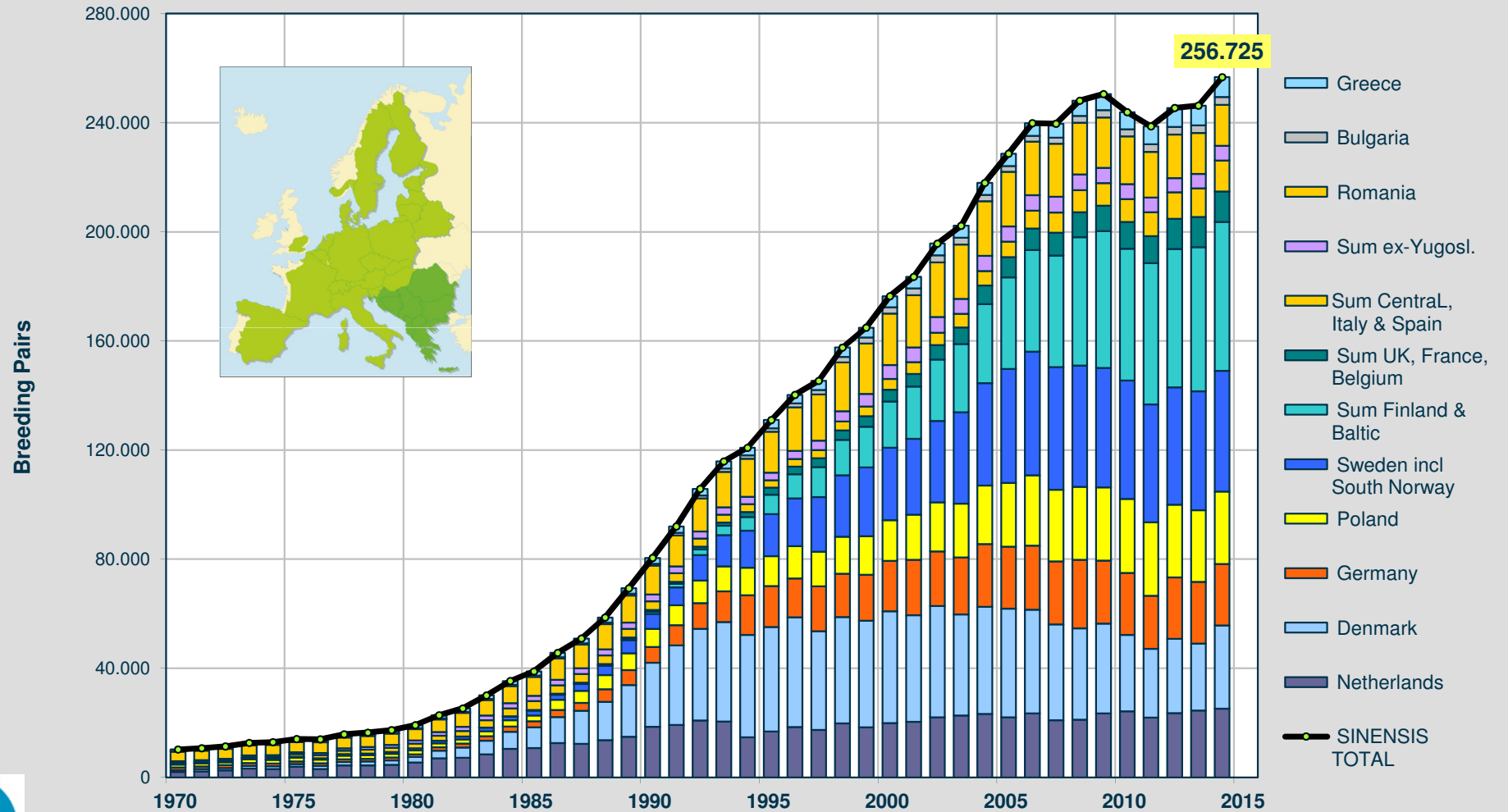
- While there are quite reliable counting data for Core Continental Europe, the data basis for the East-Eastern part is fragmentary.
- For 2012 the CorMan census reports 46.500 pairs in Ukraina. The census also two limited areas of inland Russia (Azov Sea 20.000, Volga Delta 28.000 pairs). Assuming an additional 20-30.000 pairs in uncovered Russian wetlands one could expect an actual breeding population of around 125.000 pairs in whole East-Eastern Europe. However, any such estimate must be viewed cautiously.

Cormorant Population Europe 2014	Breeding Pairs	Expansion Factor	Individuals (Summer)
Sum Core Europe	<b>299.455</b>	~5,3	<b>1.595.400</b>
Sinensis East-East*	<b>125.000</b>	~5,3	<b>663.000</b>
<b>Sum Cormorants Total Europe</b>	<b>424.455</b>		<b>2.258.400</b>

- Looking at whole European continent, in 2014 there were about 452.000 breeding pairs of the Great Cormorant.
- The total population (breeders + non-breeders) per summer 2014 amounted to about 2,2 - 2,3 million individual birds.

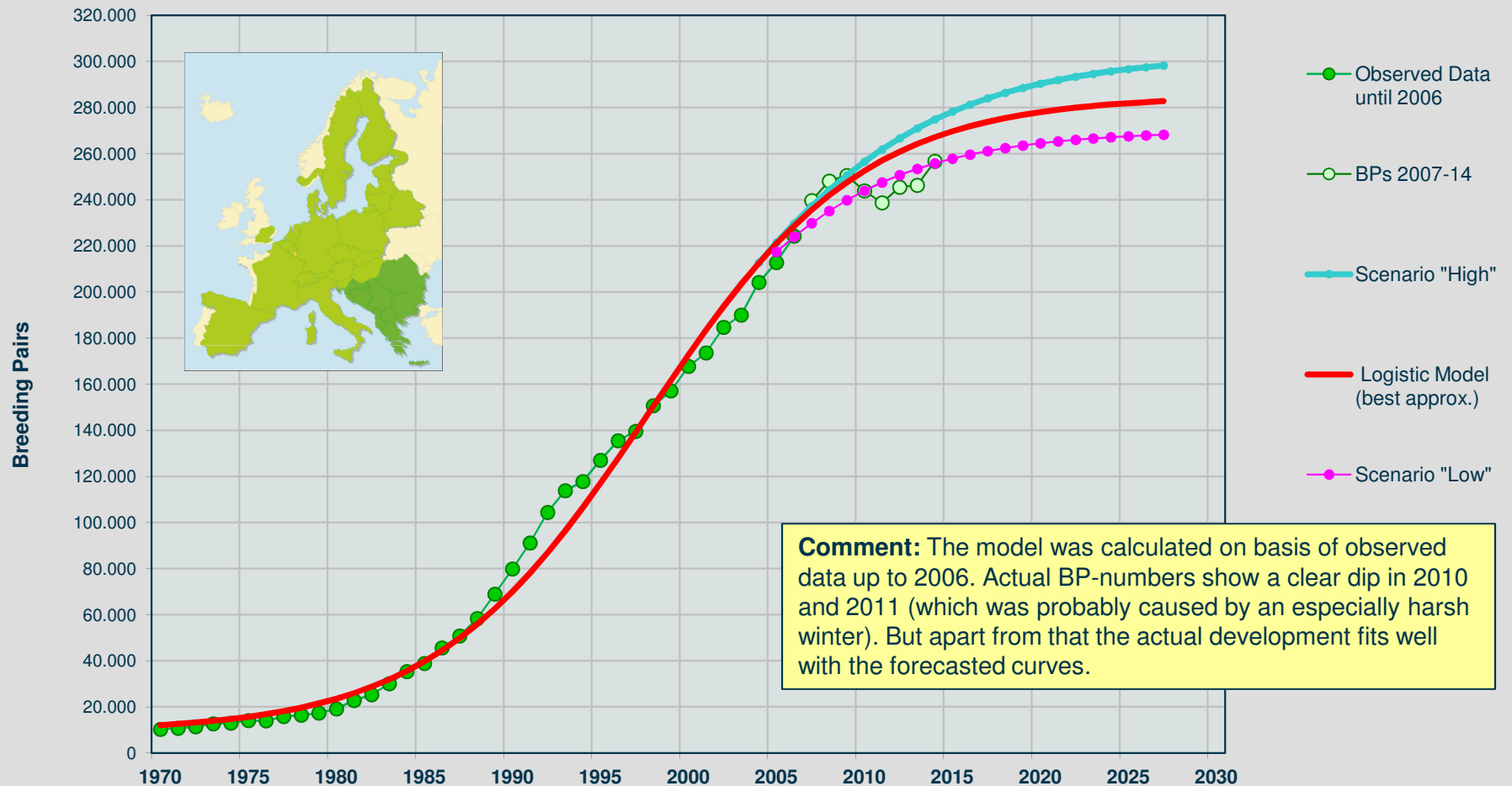
\*) Sources: BirdLife Factsheet Cormorants (2004) estimates for Ukraine 65 - 75.000, for Russia 35 – 65.000, for Moldova about 500 breeding pairs. Bregnballe (2011) reports that the WI-CRG census counted about 68.000, Nemtzov (2008) reports that 71.000 pairs were counted in the Black Sea area and estimates additional several thousands in inland areas. In 2012 the CorMan census covered whole Ukraina and reports 46.500 pairs – obviously a clearly declining trend. CorMan census also counted two limited inland areas in Russia (Azov Sea 20.000 and Volga Delta 28.123 pairs).

# A7-1. Overview Diagram Sinensis: Breeding Pairs 1970-2014



## A7-2. Logistic Model Breeding Population Sinensis: Scenarios high - low

Basis: Sinensis Total (West + East) in Core Europe. Assumption: No serious population management measures



Logistic Function  $\Rightarrow \Rightarrow$  BP in year  $t = a + (b-a)/(1+\text{Exp}(-(t-c)/d))$  "Best Approximation" with  $a=9.210$ ,  $b=285.000$ ,  $c=28,7$ ,  $d=6,1$



## ***Content Part B + C***

### **Part A: Overview charts**

### **Part B: More details on Breeding Population in Core Europe**

- B1: Background . Objectives. Methodological remarks
- B2. Overview Diagram: Development of Breeding Population on European Scale
- B3: Development of Breeding Population - Individual Countries
  - *Sinensis* DK, NL, D, PL and Sweden
  - *Sinensis* in Finland & Balticum
  - *Sinensis* West in UK, France and Belgium
  - *Sinensis* Central Europe (Hungary, Austria, CZ, Slovakia, Switzerland)
  - *Sinensis* in Italy and Spain
  - *Sinensis* East (Romania, ex-Yug, Bulgaria, Greece)
- B4. Overview *Sinensis*: Breeding Pairs – shifting regional distribution
- B5. Development of *Carbo carbo* ("atlantic race") – Individual countries
- B6. Breeding Pairs - Relative importance of *Carbo* vs. *Sinensis*

### **Part C: Cormorants in East-East Europe (Russia, Ukraine & Moldova)**

***Appendix I: Sources for Maps of Cormorant Colonies Europe***

***Appendix II: Sources for Breeding Population / Breeding Pairs***

## Part B: More details on Breeding Population

### B.1. Background and Objectives

Data on Cormorant Breeding Population exist for most countries in Europe. But only few publications have attempted to give figures for Europe as a whole.

- Development until 1995: Veldkamp (1996) "A first step towards a European management plan"\*\*\* contains a comprehensive compilation of numbers and trends for all European breeding countries, authoritative but naturally not up-to-date..
- Status per 1998-2002: BirdLife Cormorant Fact Sheet (published 2004)\*\*\* shows a table with breeding population for all European countries. However, there are no figures for previous years.
- Status per 2006: Leaflet by Wetlands International CRG (published 2008)\*\*\* provides the overall results of the pan-European Breeding Pair Census 2006. The final report (published 2011) provided counting results (breeding pair numbers) xy individual countries.
- Status per 2012. In context of the EU-project CorMan a complete census in all European countries was attempted. The final report (2014)\*\*\* covers 32 countries plus several selected breeding regions in Russia..

The last two publications provide important and authoritative figures. However, they did not integrate the numerous additional national data for in-between years and they did not try to show the development and population trends – which is essential for any rational discussion about the cormorant issue.

**That is why this EAA-documentation was compiled: To provide a comprehensive, easy to read data set on the development of cormorant population, year by year, both on European and country level.**

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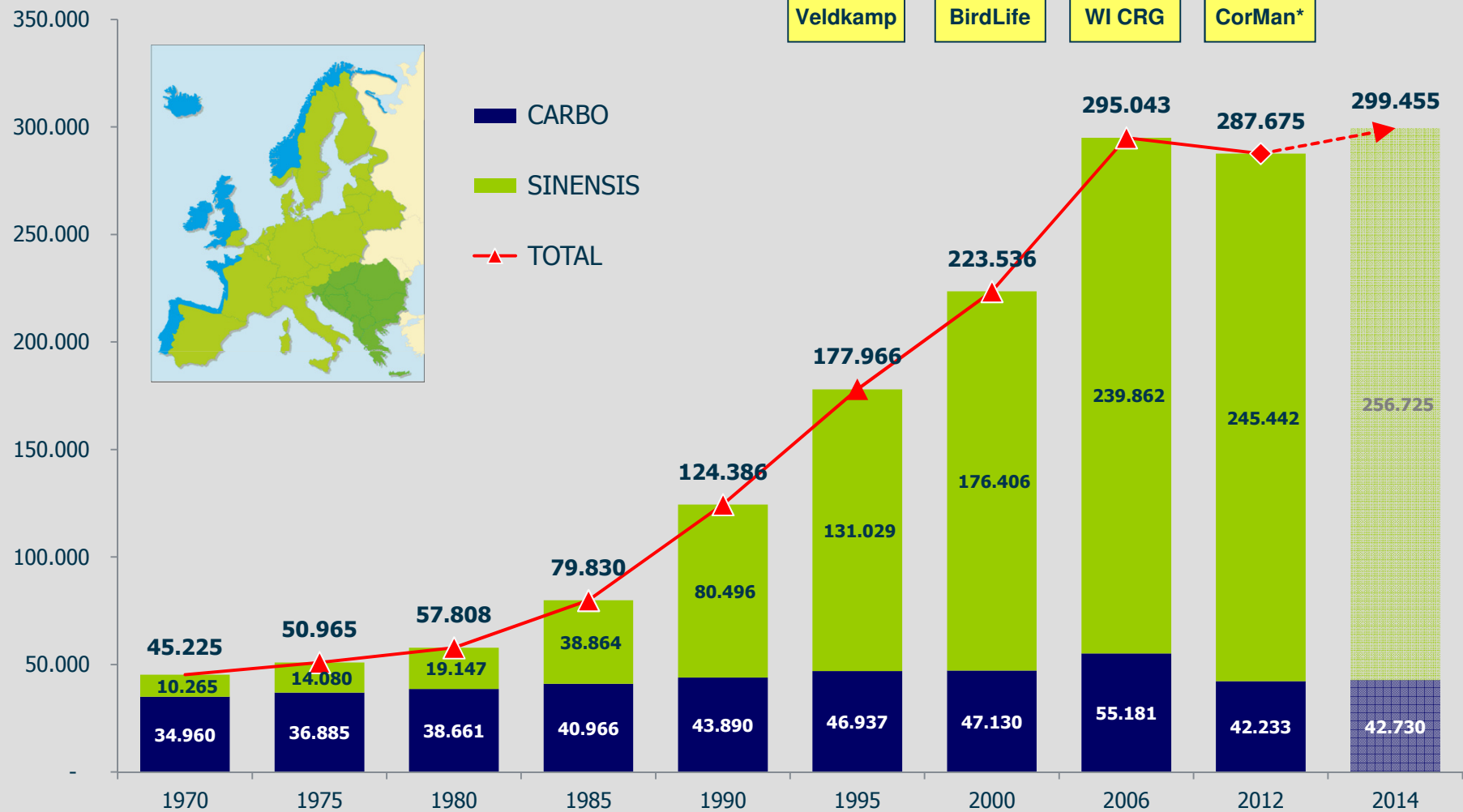
\*\*\*) Full citations see Appendix II, Sources for Breeding Population

## B.2. Breeding Population - Methodological remarks

- Cormorants start breeding with 3 - 5 years, so breeding pairs represent only a part the total population - however, the trends are closely correlated. (*For size of total cormorant population see extra chapter*)
- As a rule, number of breeding pairs is assessed by physical counting in breeding colonies (number of AONs = Apparently Occupied Nests), and counting is done by ornithologists and/or experienced bird watchers. Counting methodology as prescribed by WI Cormorant Research Group for Census 2006 is excellent (*⇒ though there's no guarantee of perfect implementation in all cases, results deserve high trust*)
- In general, the reliability of published counting data is good. However, counting errors can't be excluded - e. g. due to incomplete knowledge of colonies, time-shifted breeding, counting problems in badly accessible areas like Danube-Delta. As most possible counting errors would result in underreporting, published figures must be regarded as minima - but nevertheless can be regarded as "hard data".
- Data for the following charts were compiled from a broad spectrum of ornithological sources (*list of sources see appendix, details per case available from EAA*). Each figure was put into a databank, along with its source. If different BP-figures are given in different publications, those were taken which better fit the trend.
- In case of 'gaps' in a country the missing BP-numbers were estimated / extrapolated from the trend.
- The country-specific diagrams show "counted data" and "interpolated numbers" in different colours – dark blue for “published” and grey for “interpolated/estimated” figures. This is a good indicator for the reliability of the data for each individual country.
- **Generally, data quality is good to very good in western and central Europe, while information is thinner for Balkan region (especially countries of ex-Yugoslavia and Romania).**

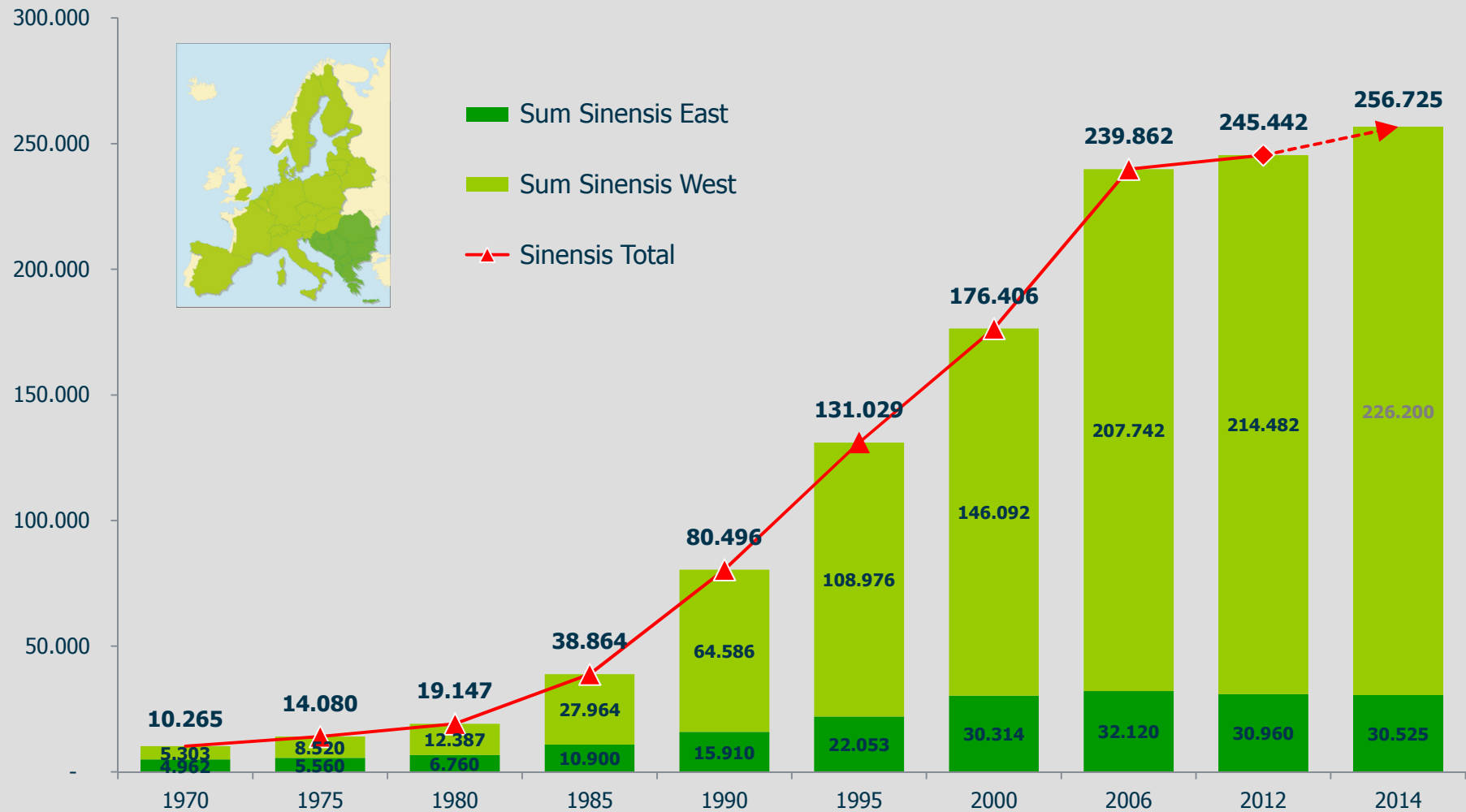
## B1: Development of Breeding Population (Pairs) on European Scale

Geographical scope: "Core Europe" (including Belarus and Baltic parts of Russia, but excluding Ukraine & Moldova)



## B2: Breeding Population - Sinensis East + Sinensis West

Geographical scope: "Core Europe" (including Belarus and Baltic parts of Russia, but excluding Ukraine & Moldova)



## B2a: Breeding Population Sinensis East vs Sinensis West - Table

Numbers relate to "Core Europe" = all countries except Russia, Belarus, Ukraine & Moldova\*\*\*

Breeding Pairs	1970	1975	1980	1985	1990	1995 Veldkamp	2000 BirdLife	2006 (WI CRG)	Increase 1970-2006
sinensis west	5.268	8.608	12.387	27.969	63.986	105.446	138.317	190.054	<b>36 times</b>
sinensis east	4.964	5.560	6.750	10.869	15.755	22.250	30.525	42.257	<b>9 times</b>
<b>Sum Sinensis</b>	<b>10.232</b>	<b>14.168</b>	<b>19.137</b>	<b>38.838</b>	<b>79.741</b>	<b>127.696</b>	<b>168.842</b>	<b>232.311</b>	<b>23 times</b>

Sinensis West



Sinensis East



- Both sub-populations of the Sinensis cormorant grew steeply since 1970
- But expansion of the western sub-population was even extremely higher than in Eastern parts of Europe (Romania, countries of ex-Yugoslavia, Bulgaria and Greece)



## B3: Development of Breeding Population - Individual Countries



### Introductory remarks:

- The following charts show the development of Cormorant breeding population country by country
- The colour of the columns indicates for each year whether the BP-number is from a published source or whether it is an interpolation
  - **dark blue** ⇒ published / actually counted numbers
  - **light grey** ⇒ interpolation / trend estimate
- This enables an instant assessment of "data quality" in a certain country
  - ⇒ if most columns are "dark blue" (= published / counted data), high reliability can be assumed
  - As charts will show, in many countries cormorant breeding pairs are counted year by year
- Main objective of these charts is the visualization of quantitative trends - so diagrams mostly are without verbal commentary and without numbers except for selected years (*Tables with concrete numbers per year can be found in Part A. Overall Figures & Trends*)

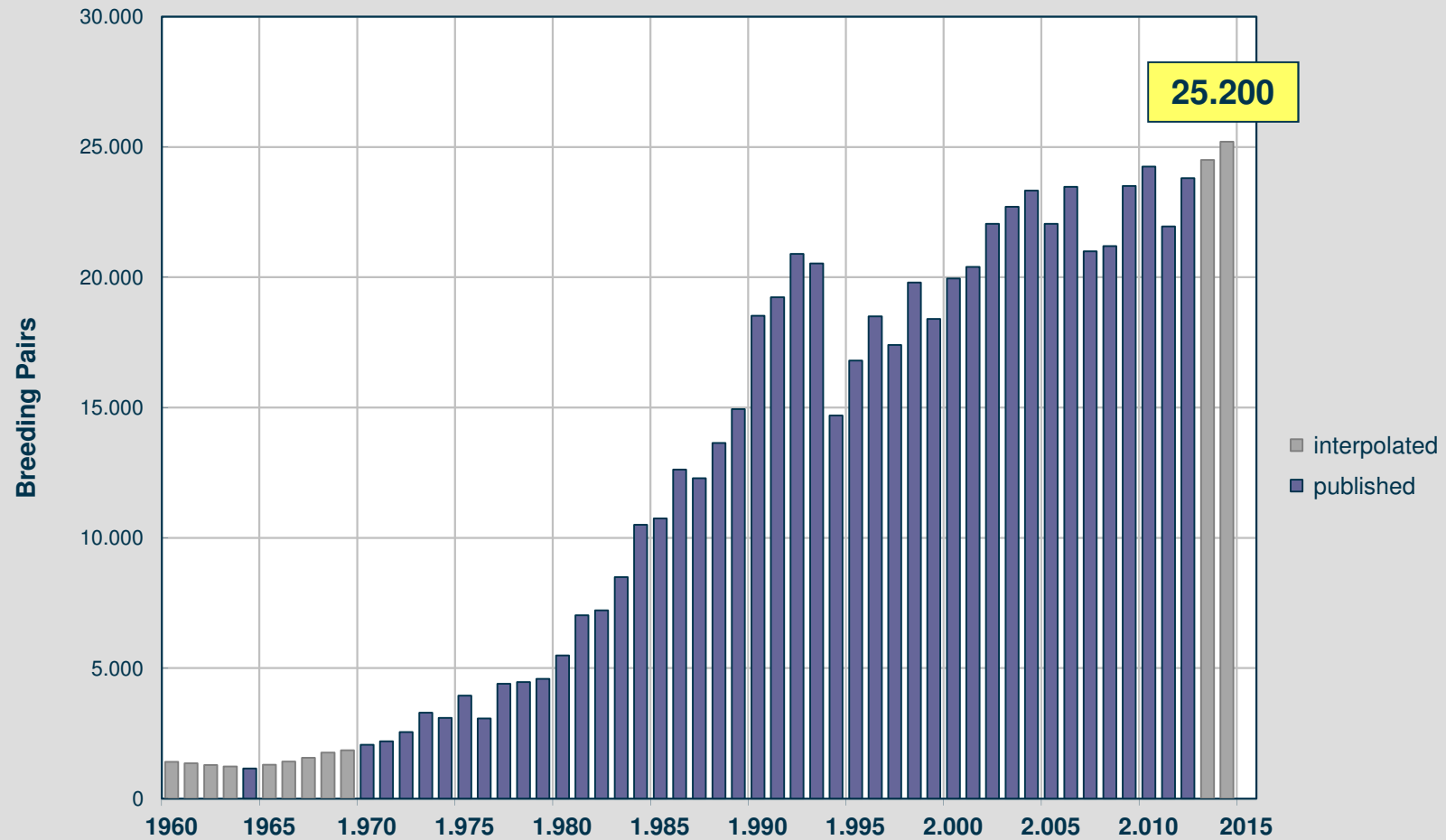
## B3-1. Development of Sinensis West in DK, NL, D, PL and Sweden



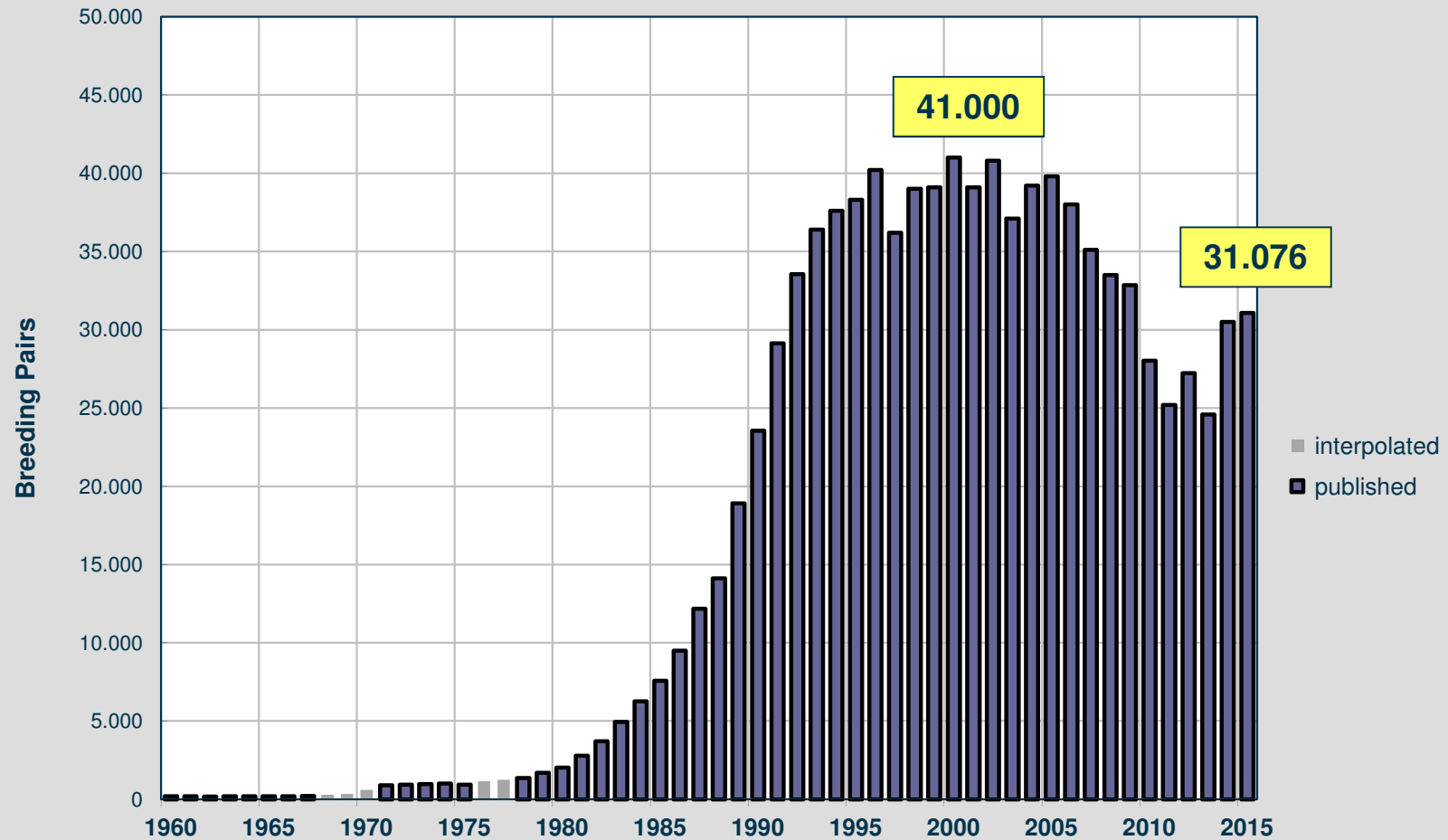
- Population growth of the Sinensis-Cormorant started in The Netherlands, followed by Denmark, which in 1989 overtook the NL as holding the highest numbers of cormorants.
- After a period of exponential growth in the 1980ies and early 1990ies the development in NL and DK started to stagnate.
- However, this was more than compensated by the development in neighbouring Germany, Poland and Sweden, where Cormorant breeding population showed enormous growth until the most recent years.
- **In 1993, these 5 countries held 77% of the total Sinensis-population in Core Europe**
- Since 1996 some Sinensis cormorants (probably immigrating from neighbouring regions in Sweden) started to breed on the southern coast of Norway. Numbers are steeply expanding in recent years.
- However, due to a decrease in Denmark and the enormous increase of cormorants in Finland and Baltic states, the region has lost relative importance. But actually (2014) it still counts for approximately 58% of all Core-Europe sinensis cormorants.

Remarkable: Quality of population data in this area is exceptionally good: In NL, DK and Germany data are from systematic year-by-year counts, also in Sweden and Poland actual counting is done in quite regular intervals of 4 to 5 years.

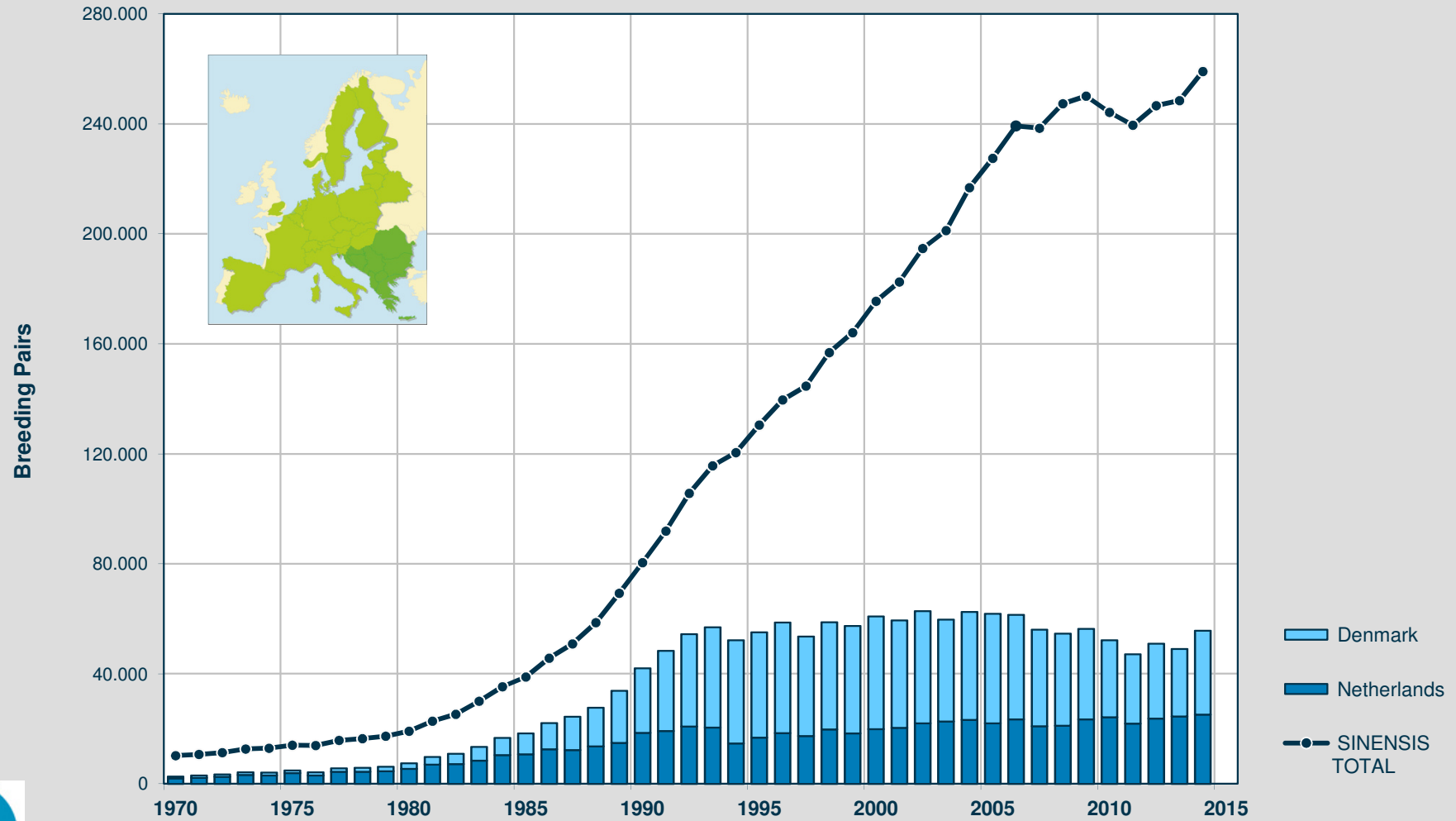
## Cormorant Breeding Pairs - NETHERLANDS



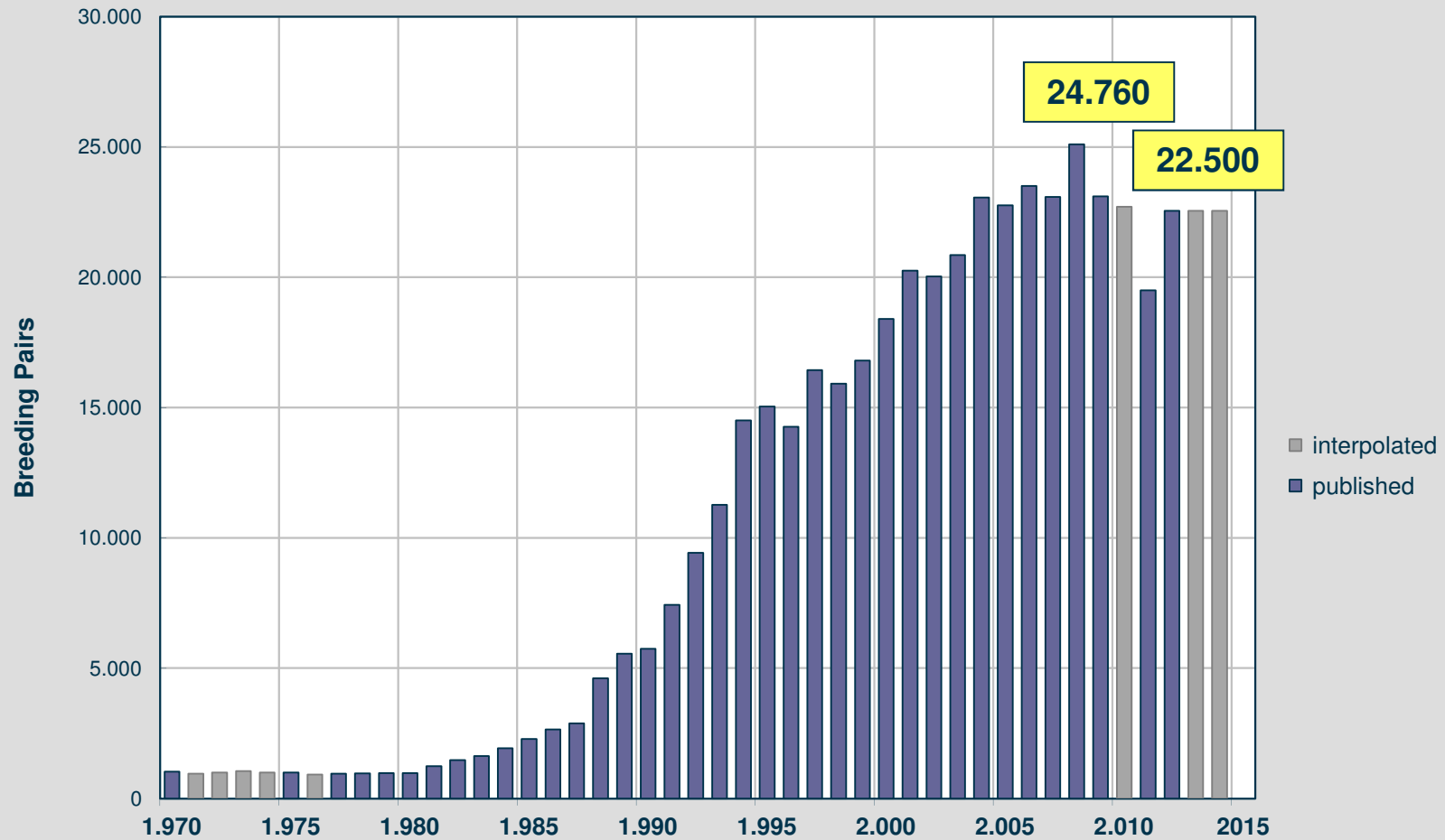
## Cormorant Breeding Pairs - DENMARK



## B3-1a. Sinensis West - Country Groups (1)

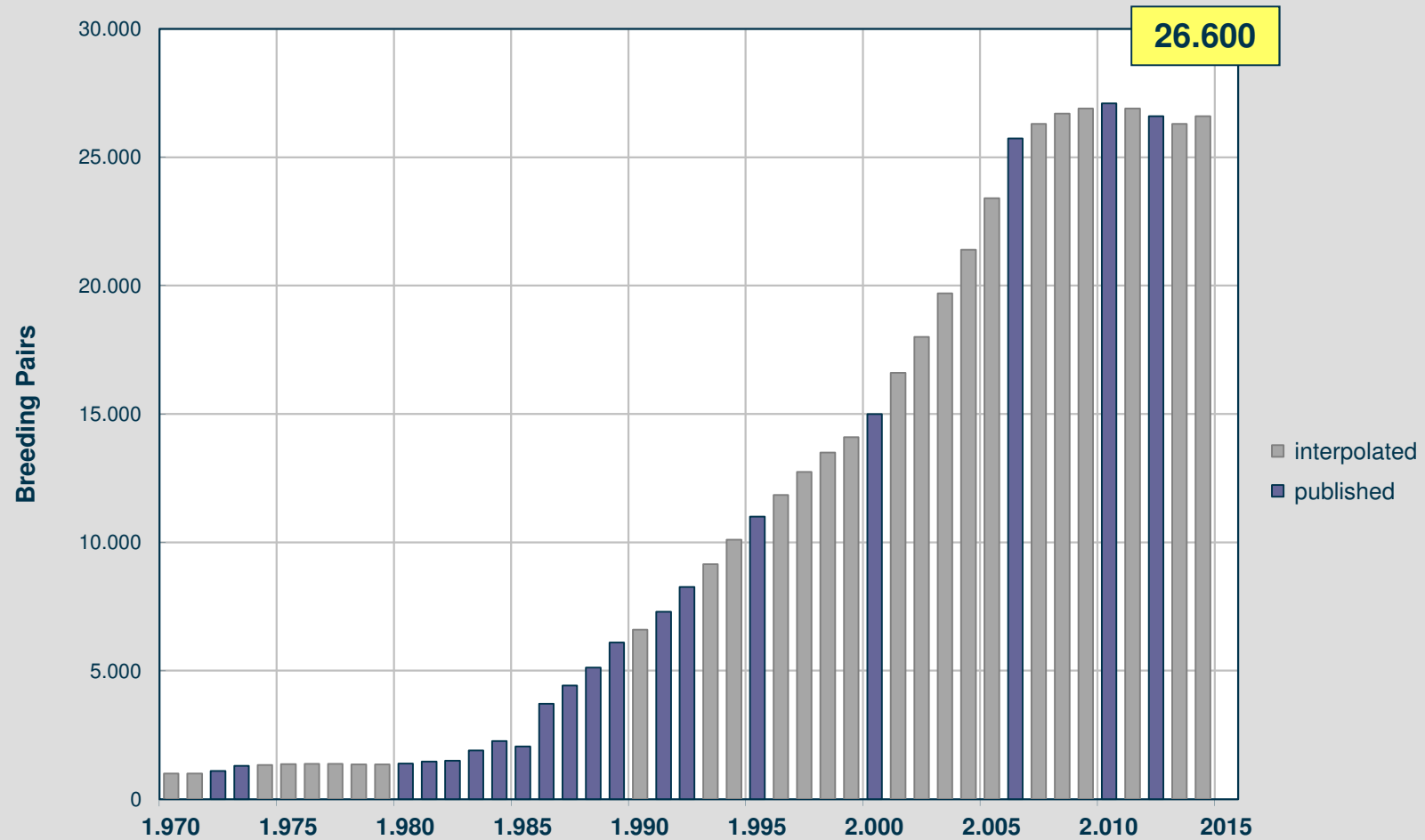


## Cormorant Breeding Pairs - GERMANY

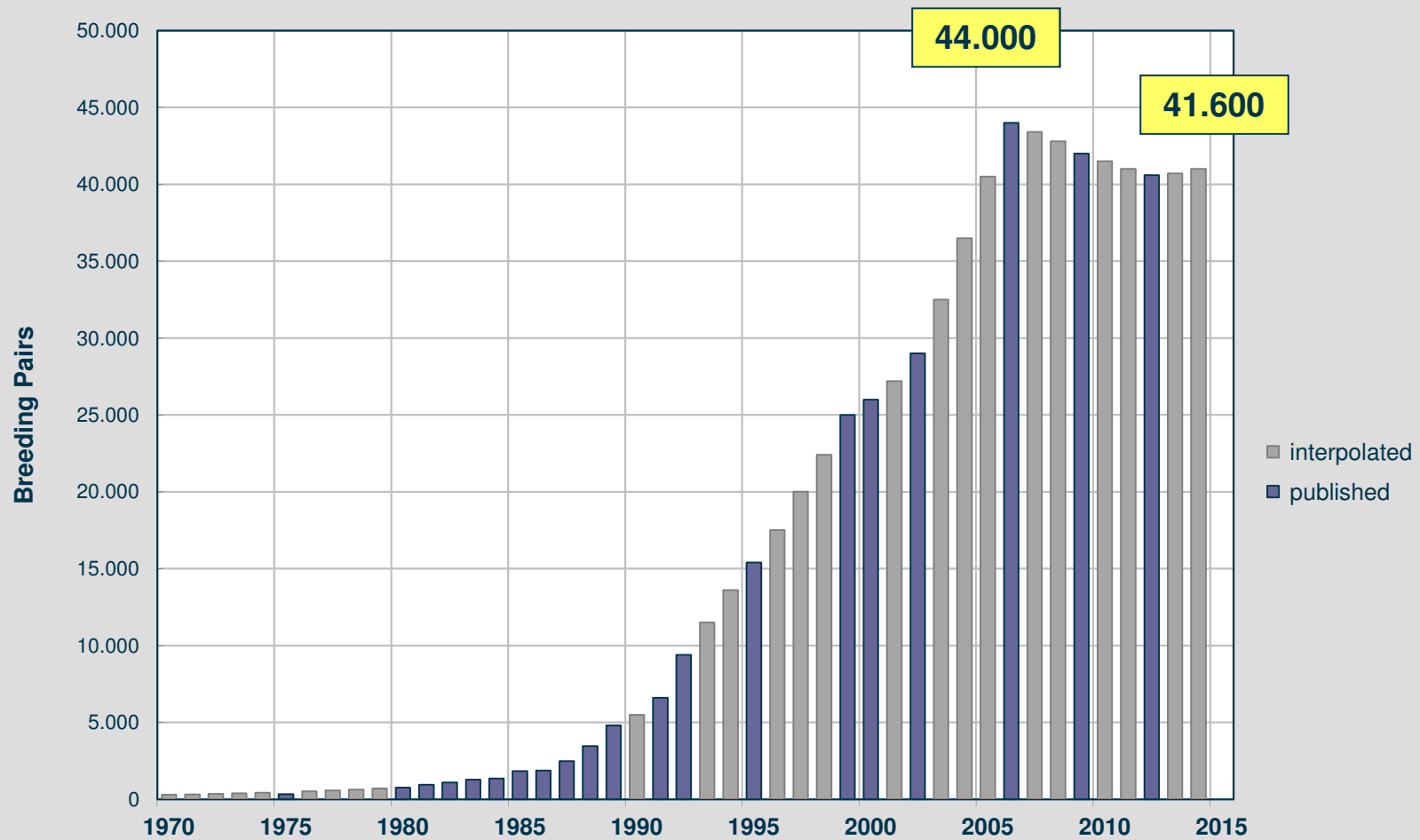




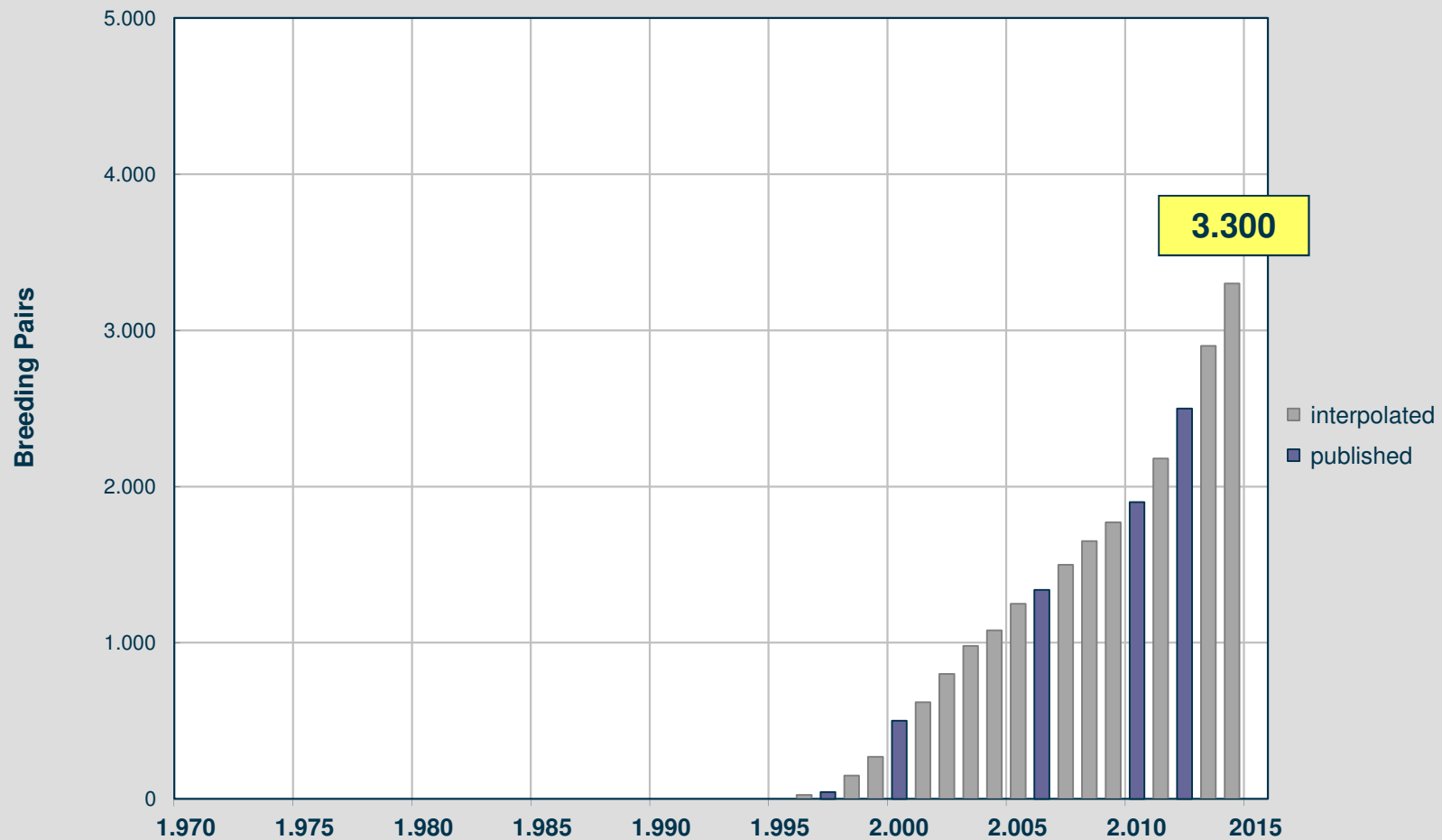
## Cormorant Breeding Pairs - POLAND



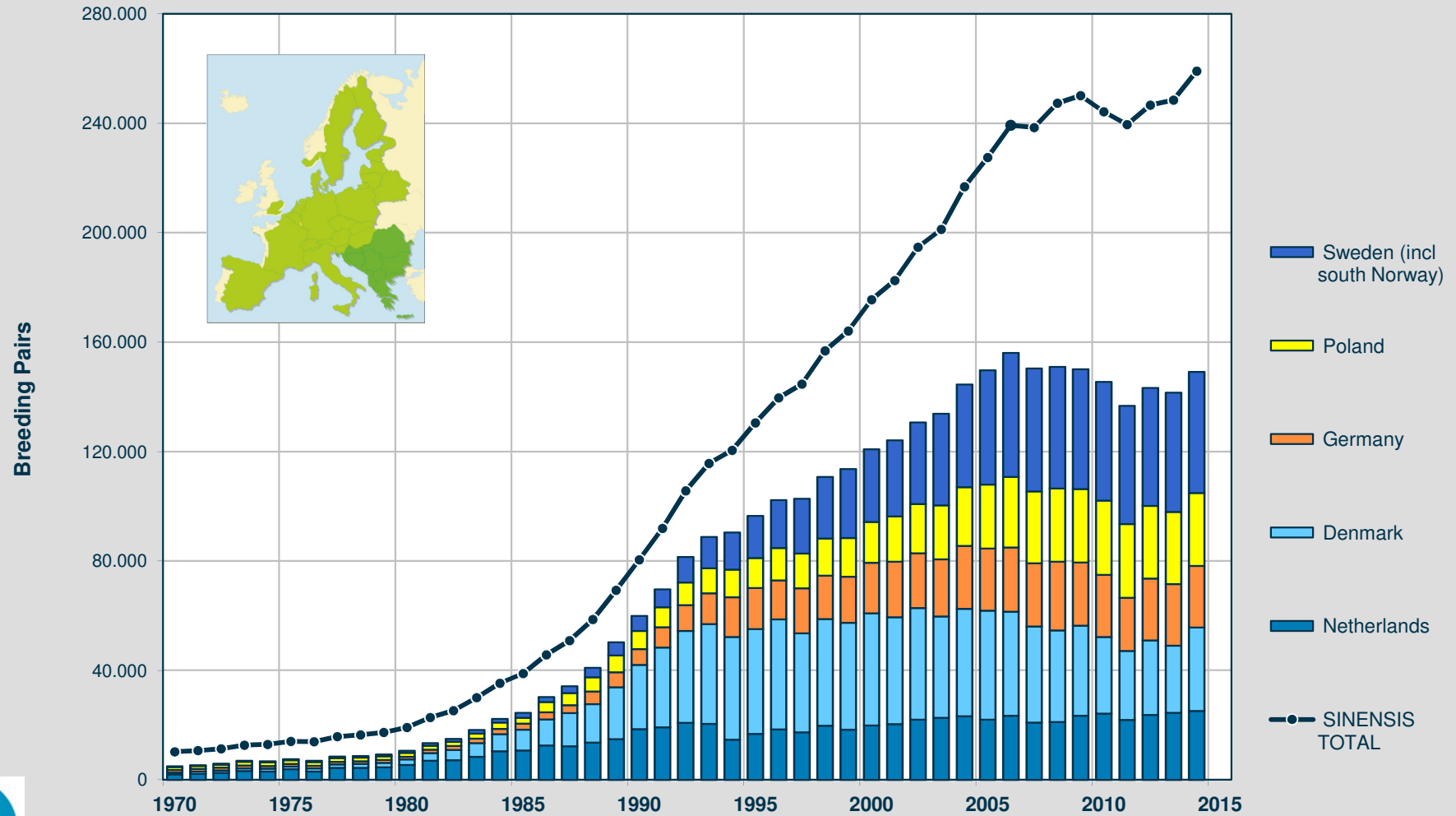
## Cormorant Breeding Pairs - SWEDEN



## Cormorant Breeding Pairs – NORWAY Sinensis



## B3-1b. Breeding Pairs Sinensis West - Country Groups (1+2)

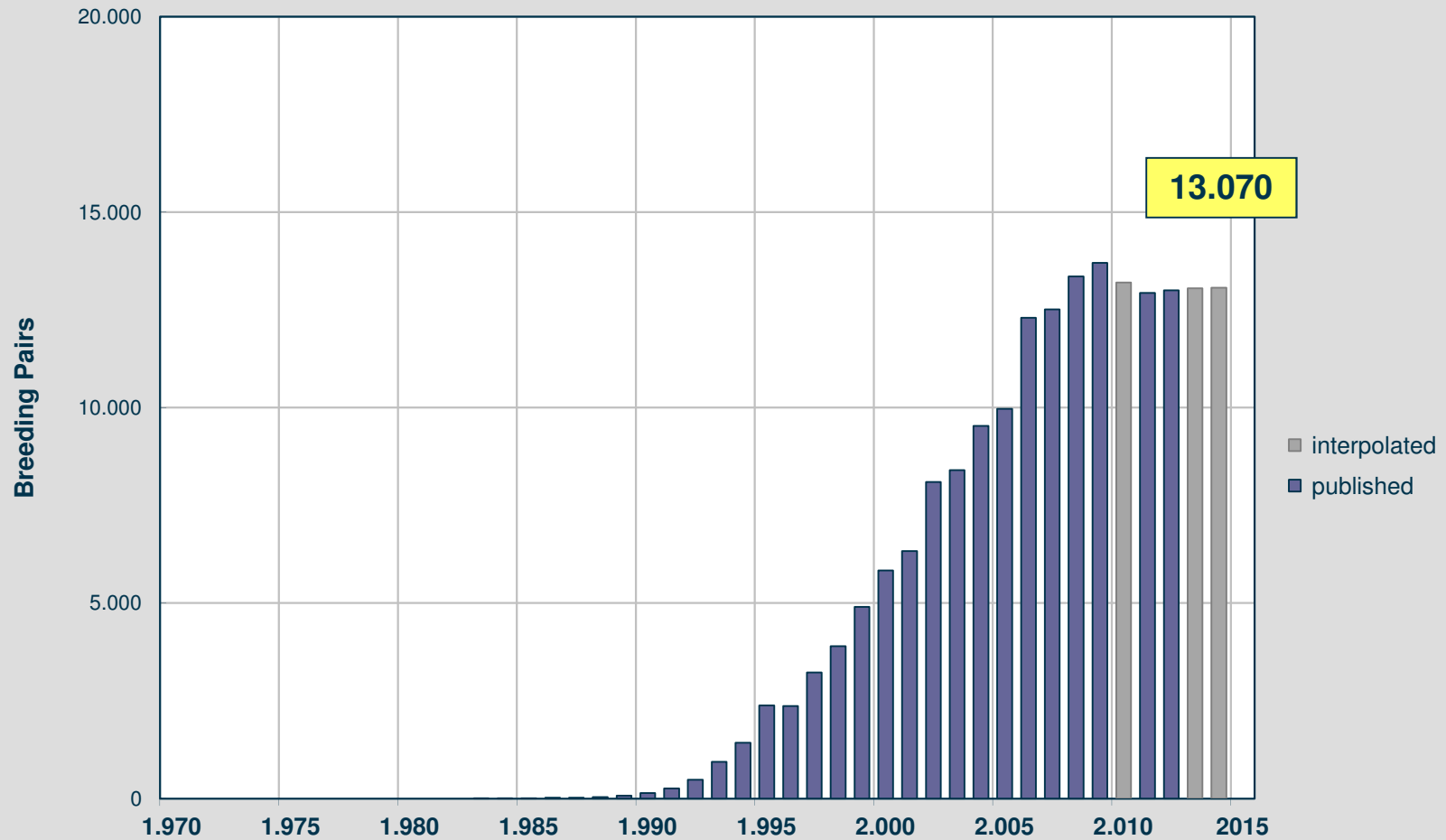


## B3-2. Development of *Sinensis* West in Finland & Balticum

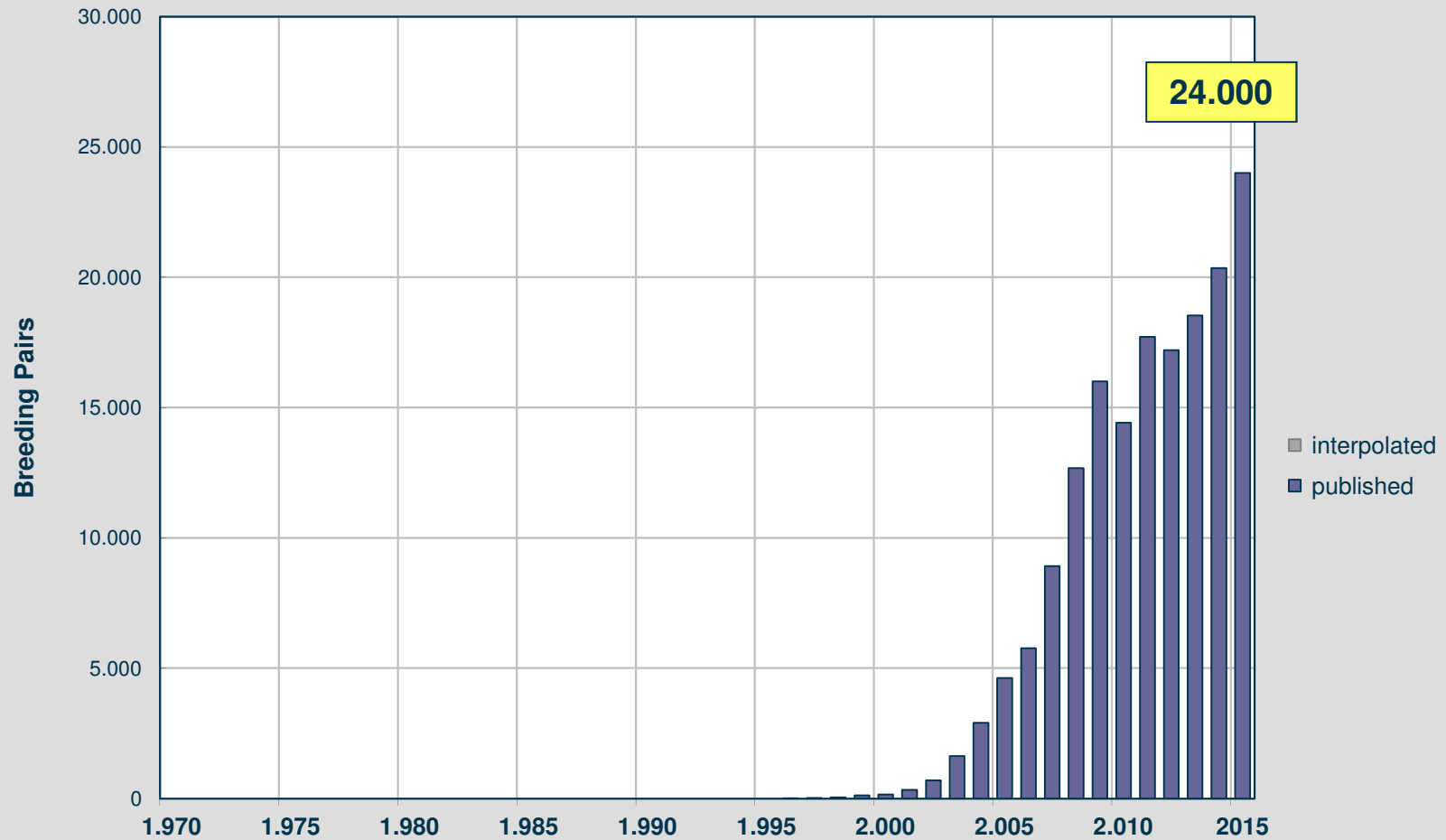


- The Baltic countries and Finland had not been traditional breeding areas of the Great Cormorant. Historically, no colonies have been recorded before 1985/1990.
- The 'Why' is a bit of a mystery. Given the geographical characteristics and the thin human population neither a possible scarcity of fish, the lack of breeding sites or a hypothetical human persecution can explain why for so long there was not a single cormorant colony in this area.
- Since 1990, in just 25 years, the cormorant breeding population in this area has grown from virtually zero to 54.570 pairs. And the upward trend – unlike in Sweden – seems to continue.. This development clearly shows that the Baltic region nowadays provides exceptionally good conditions for the Cormorant.
- No doubt that this was initiated and fuelled by "emigrants" from the overcrowded colonies in the 'old' breeding countries.
- But why haven't the cormorants colonised this area earlier? Even if one assumes that the conditions might have been a bit worse in the past - certainly also 50 years or 100 years ago there were enough space, enough fish and enough undisturbed places for at least one breeding colony. So what is a plausible explanation? Climate change?
- Anyhow, in the past 15 years the Baltic region has seen the steepest growth.

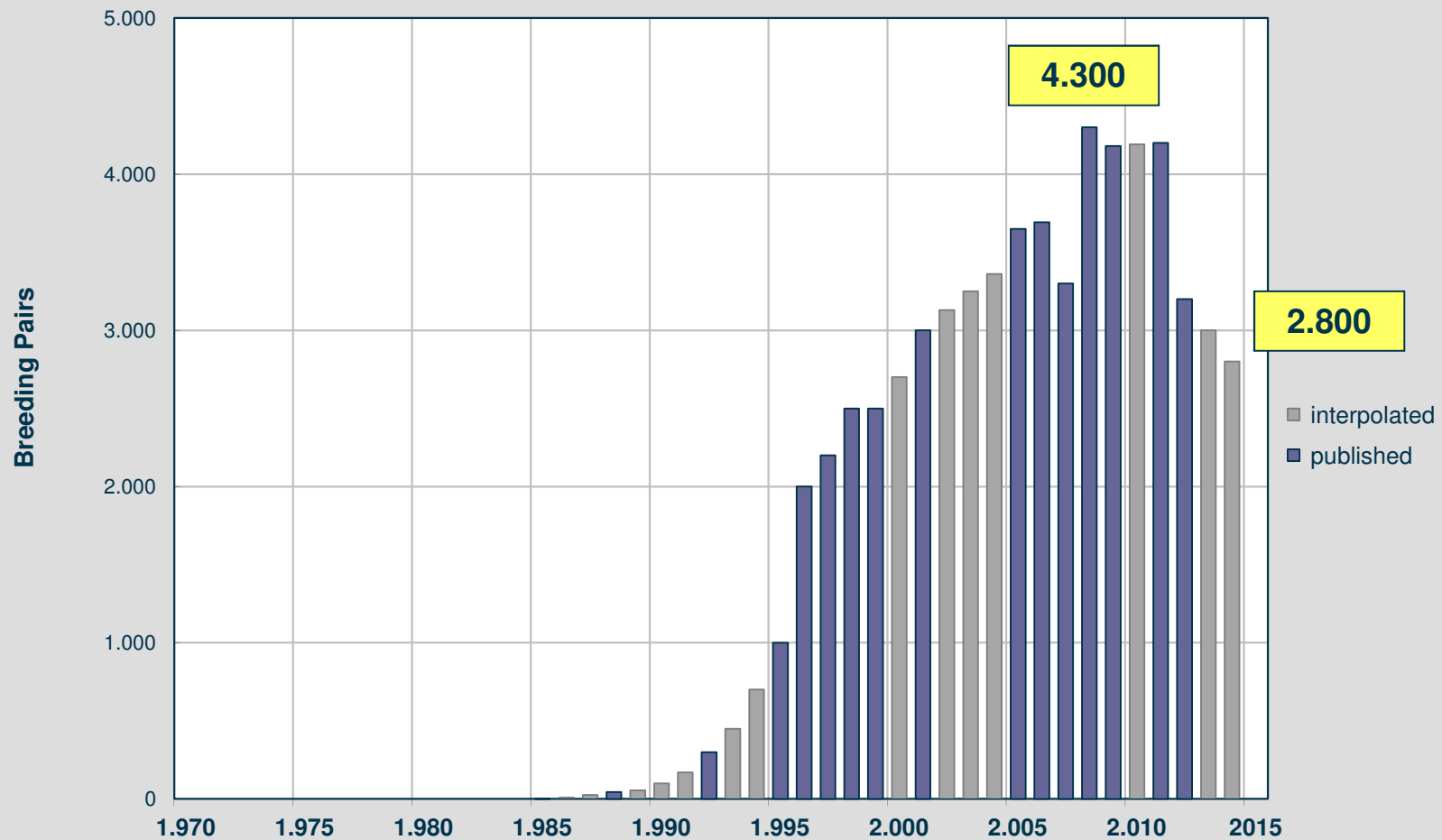
## Cormorant Breeding Pairs - ESTONIA



## Cormorant Breeding Pairs - FINLAND

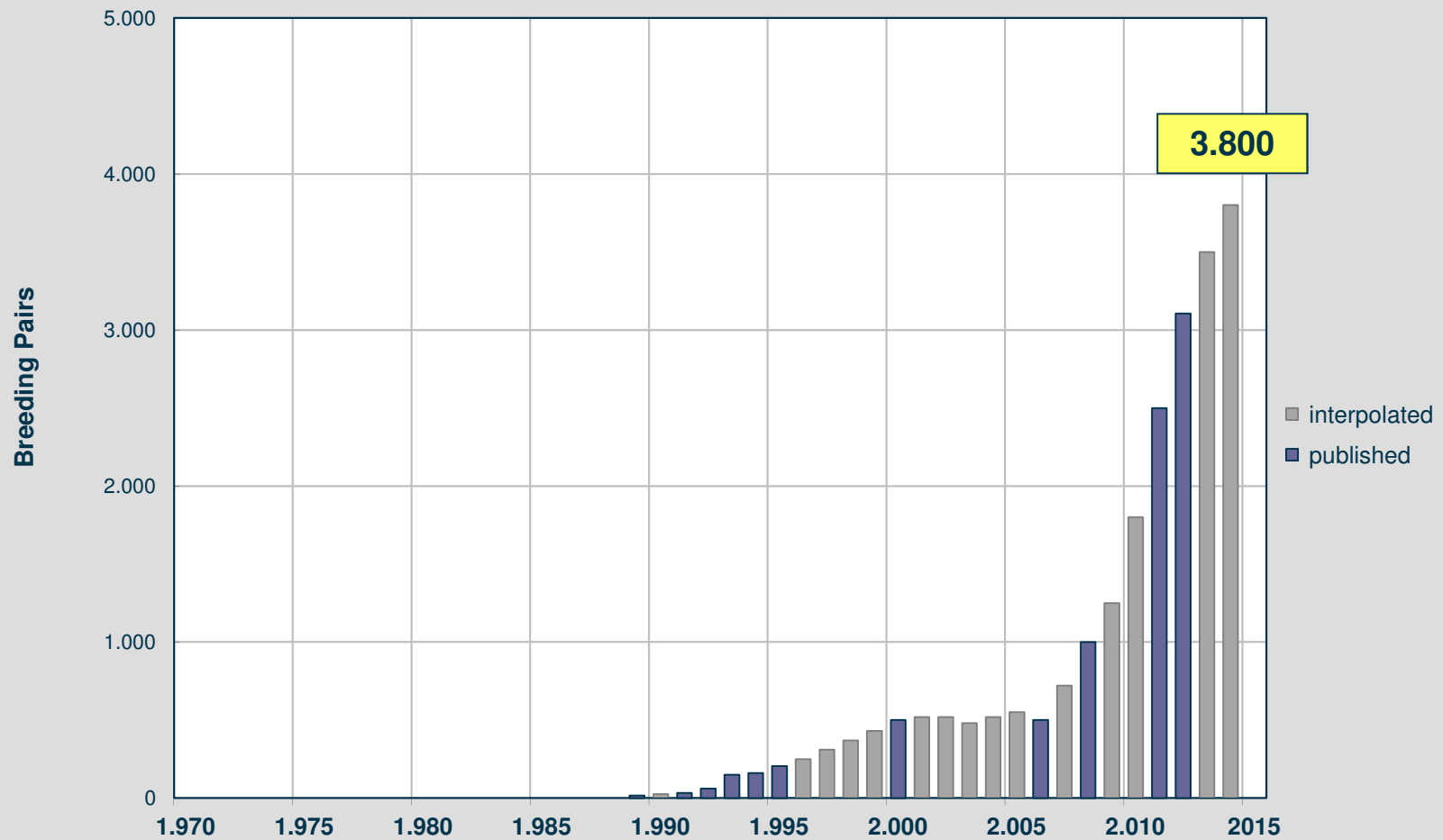


## Cormorant Breeding Pairs - LITHUANIA

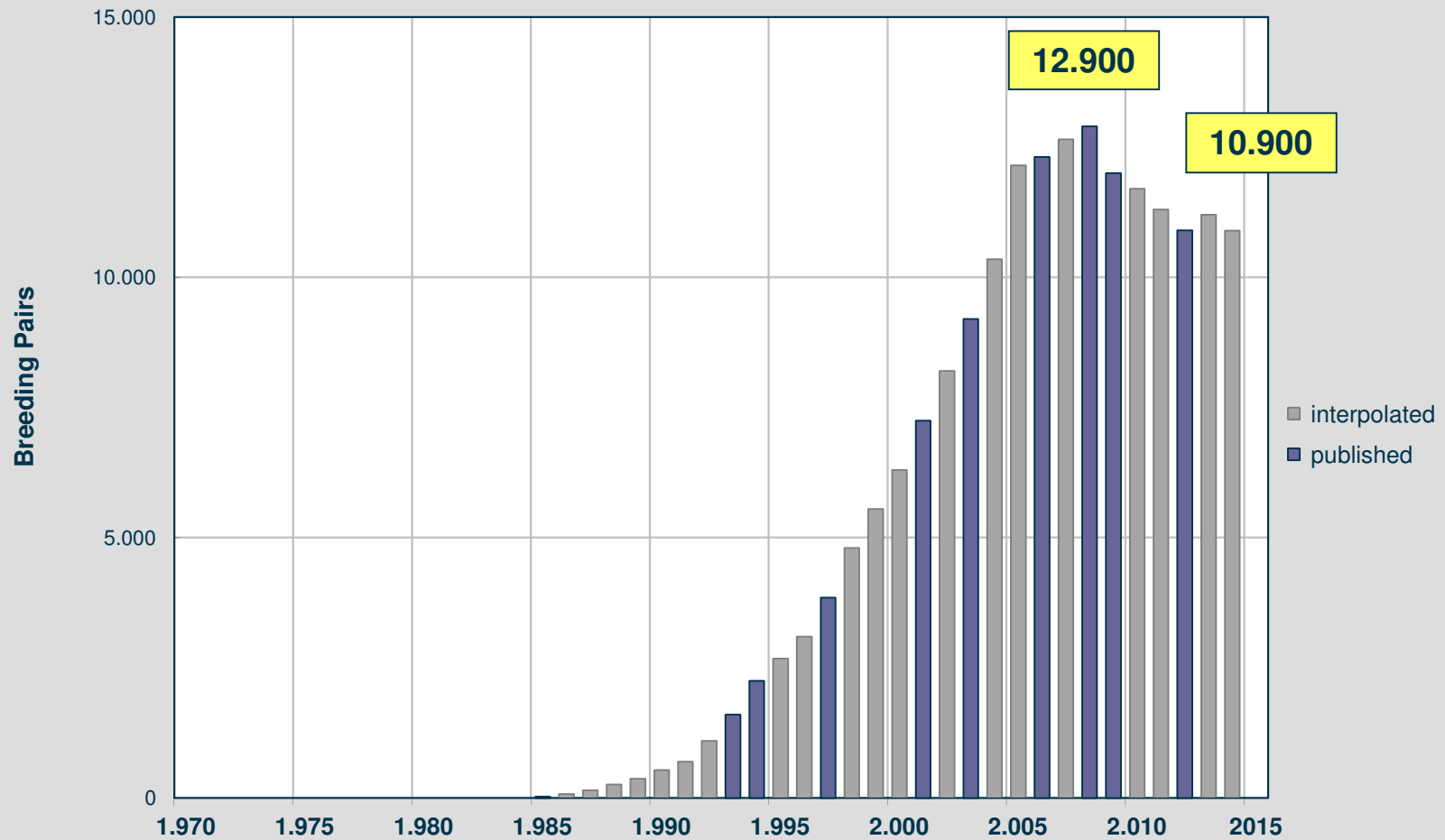




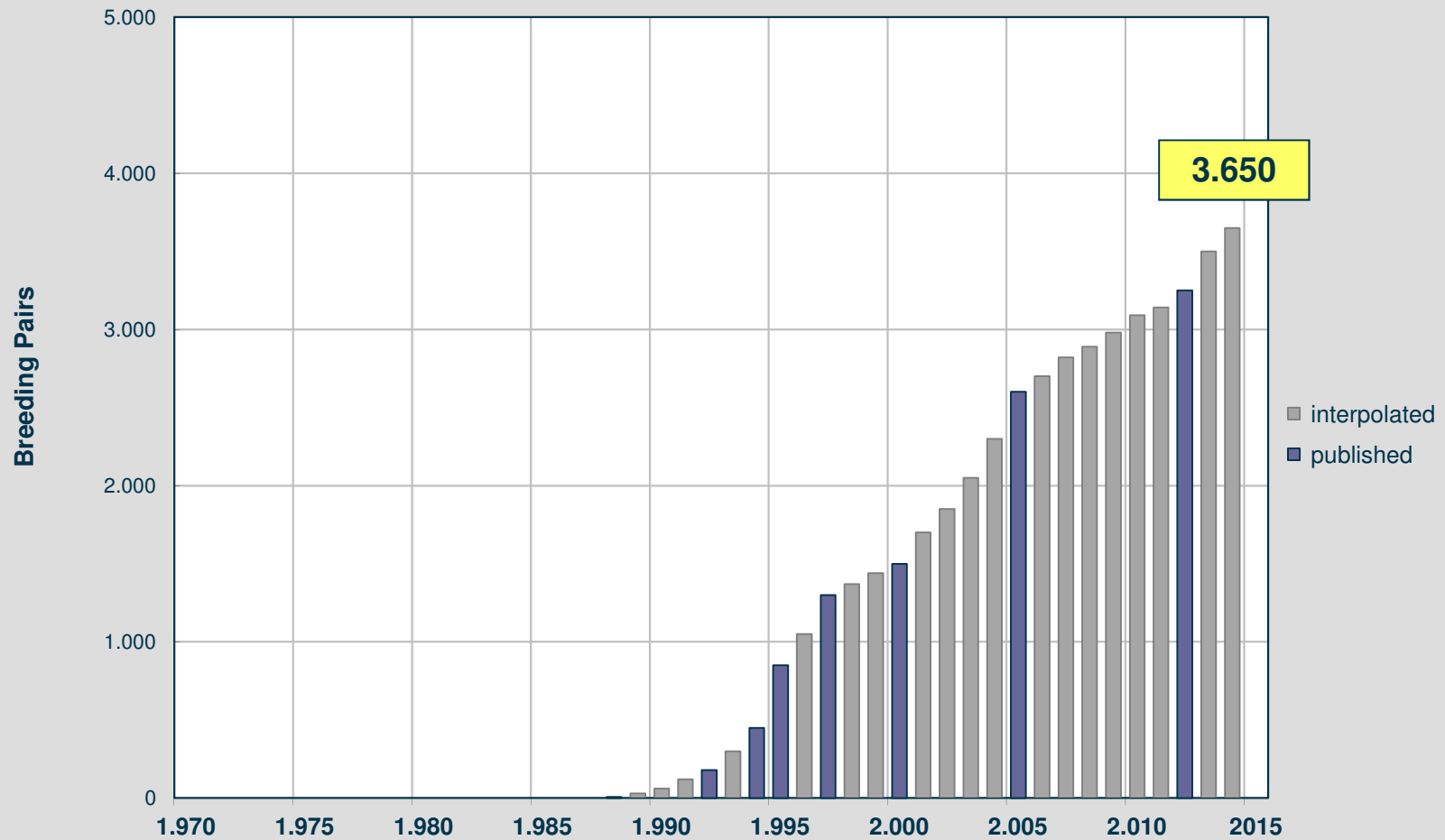
## Cormorant Breeding Pairs - LATVIA



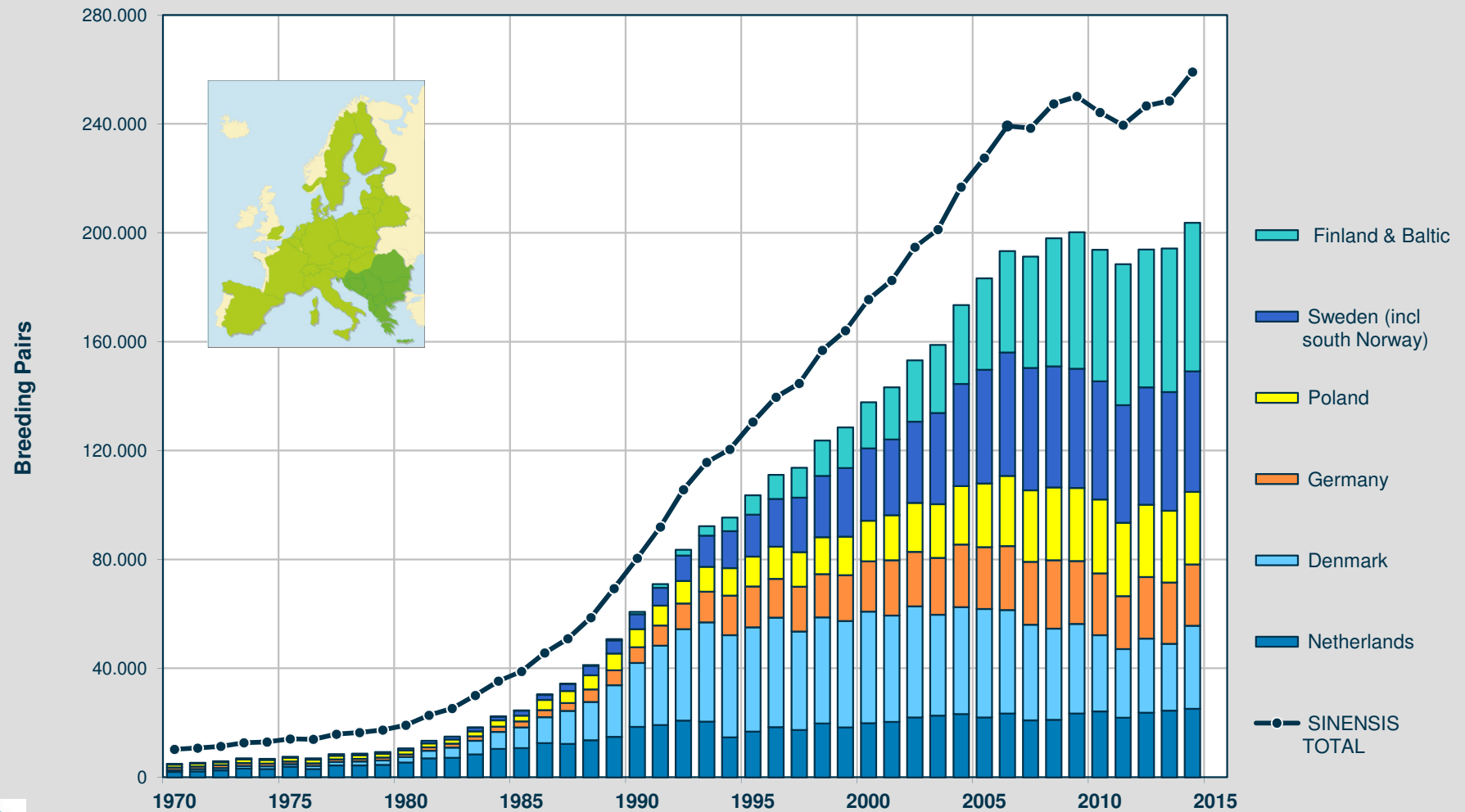
## Cormorant Breeding Pairs – RUSSIA BALTIC



## Cormorant Breeding Pairs - BELARUS



## B3-2a. Breeding Pairs Sinensis West - Country Groups (1+ 2 + 3)



NL + DK fairly stable since mid 1990ies, followed by rapid growth in D + PL + S

since 2000 very steep increase in Baltic area

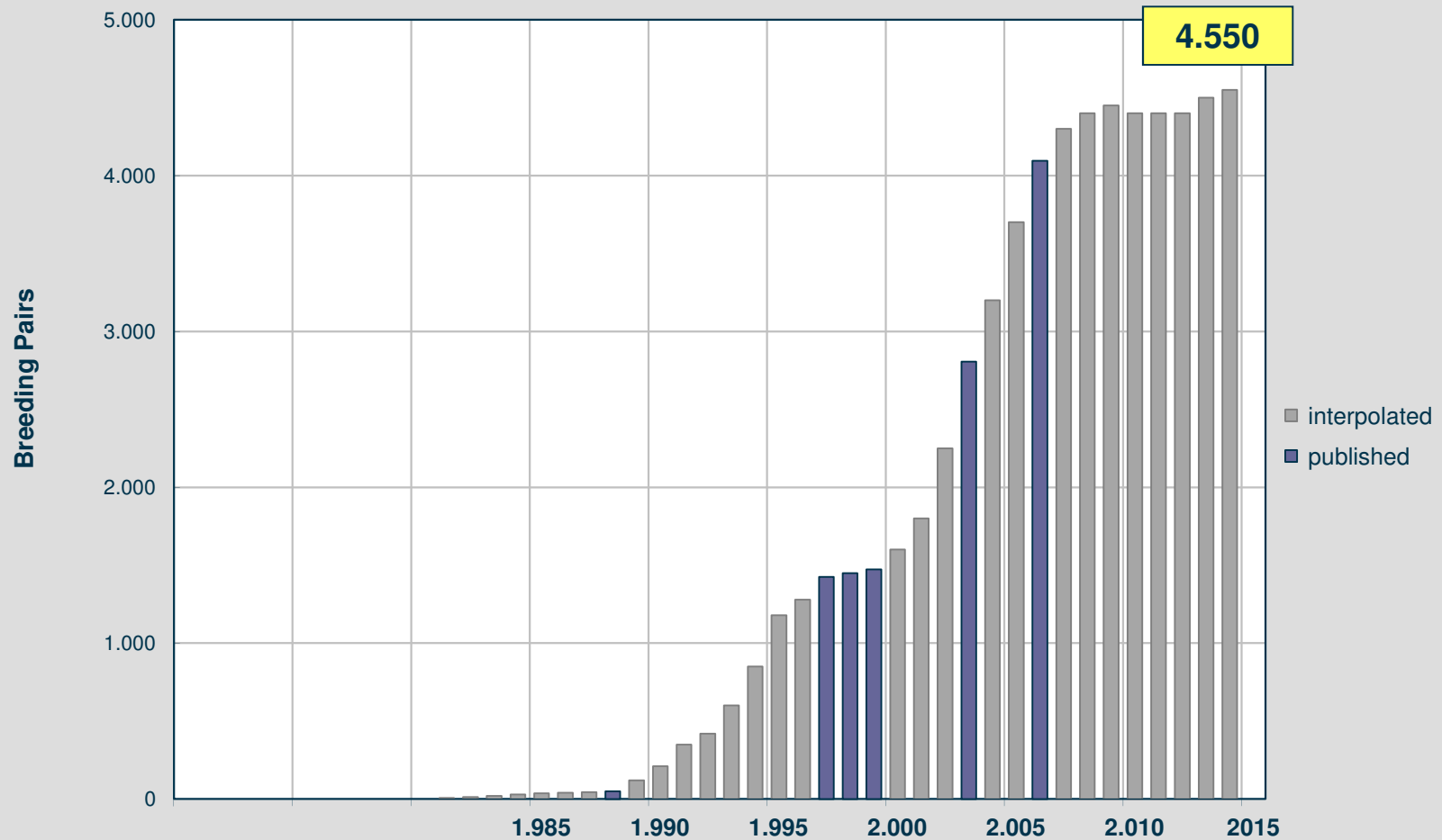


## B3-3. Development of Sinensis in UK (inland), France and Belgium

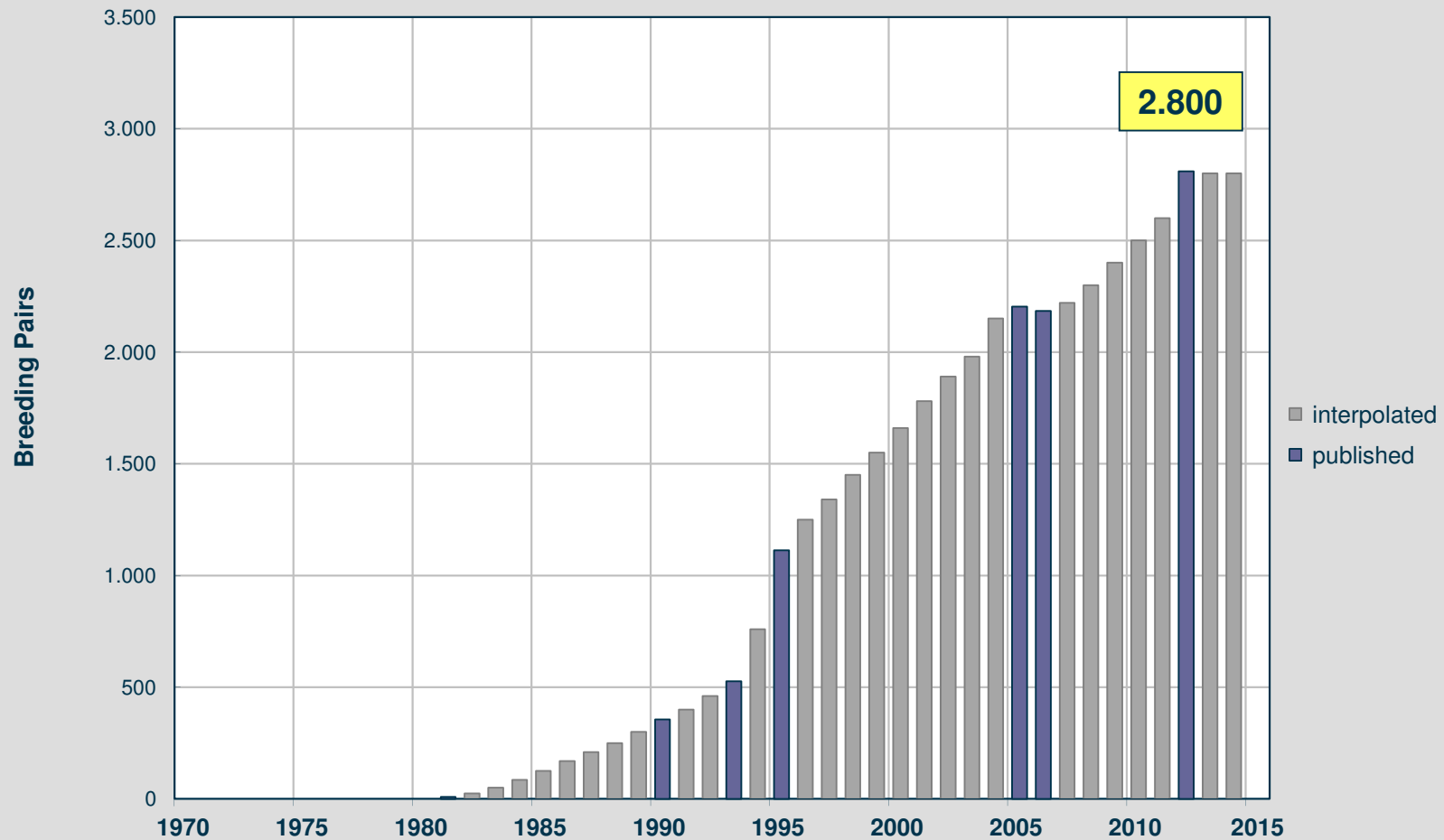


- France always had cormorant colonies on the atlantic coast, which - by definition - are regarded as "Carbo-cormorants". The inland waters of France are a prime wintering area, with actually about 100.000 cormorants each winter. In comparison to that, breeding of Sinensis-cormorants started rather late and despite steep growth the population doesn't exceed a level of 4.000 to 5.000 pairs (much below the levels in Baltic countries).
- In UK the Sinensis-cormorants - obviously originating from Dutch and Danish colonies - started to settle in the 1980ies, almost exclusively on inland waters in south of England. (*As in France, there are some 'mixed' colonies' with Carbo-cormorants, and accurate distinction is difficult.*)
- In Belgium, there were breeding colonies until the mid-1950ies. Re-colonisation started about 40 years later, in the mid 1990ies. Countings normally are done separately for Belgium Vlanders (which borders to Netherlands) and for the 'frankophone' Belgium Wallonie - especially for Vlanders development is very well documented. However, the CorMan report for 2012 only shows the figure for Belgium Total.

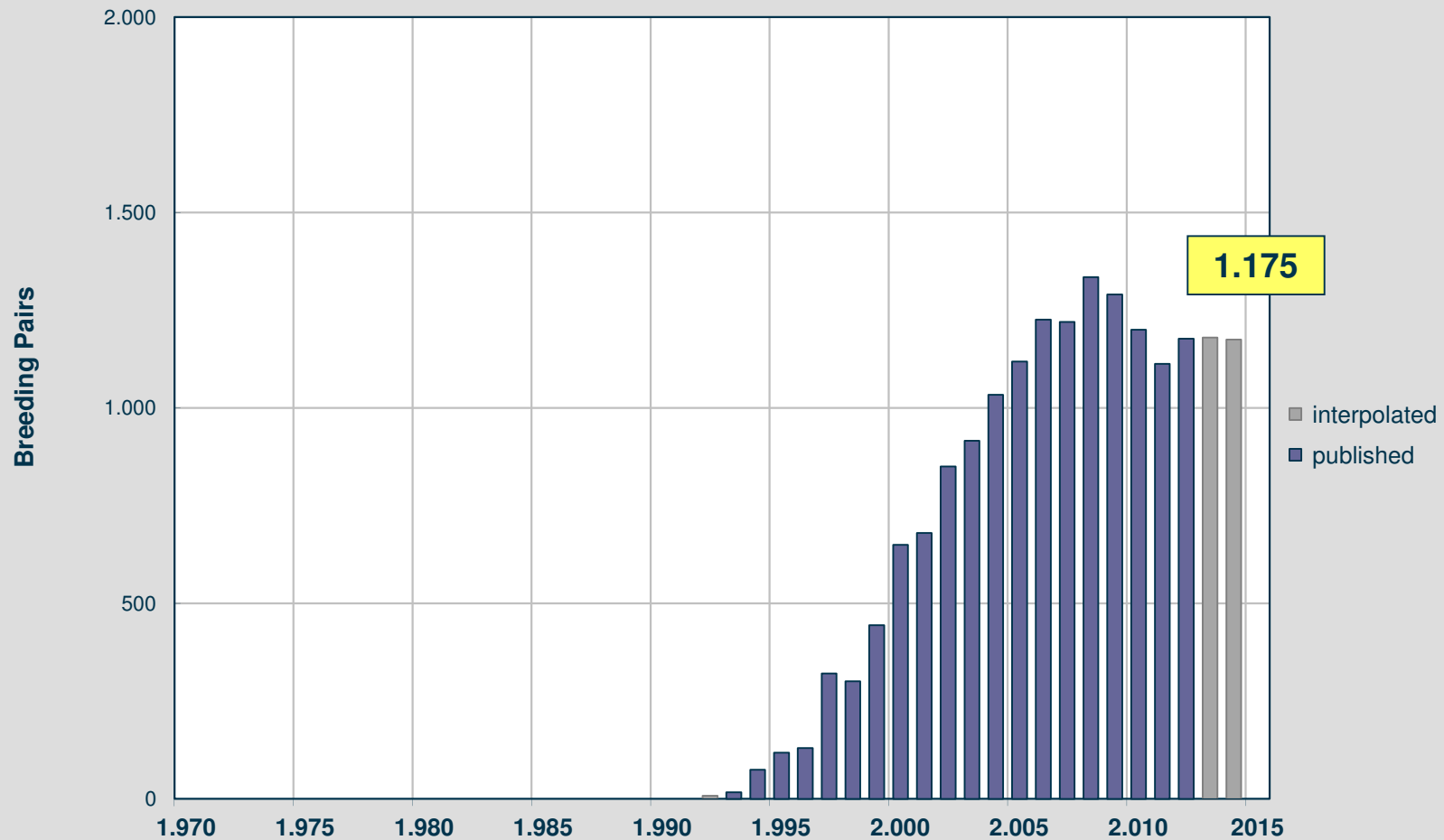
# Cormorant Breeding Pairs - FRANCE inland (sinensis)



## Cormorant Breeding Pairs - UK *sinensis* (inland\*)

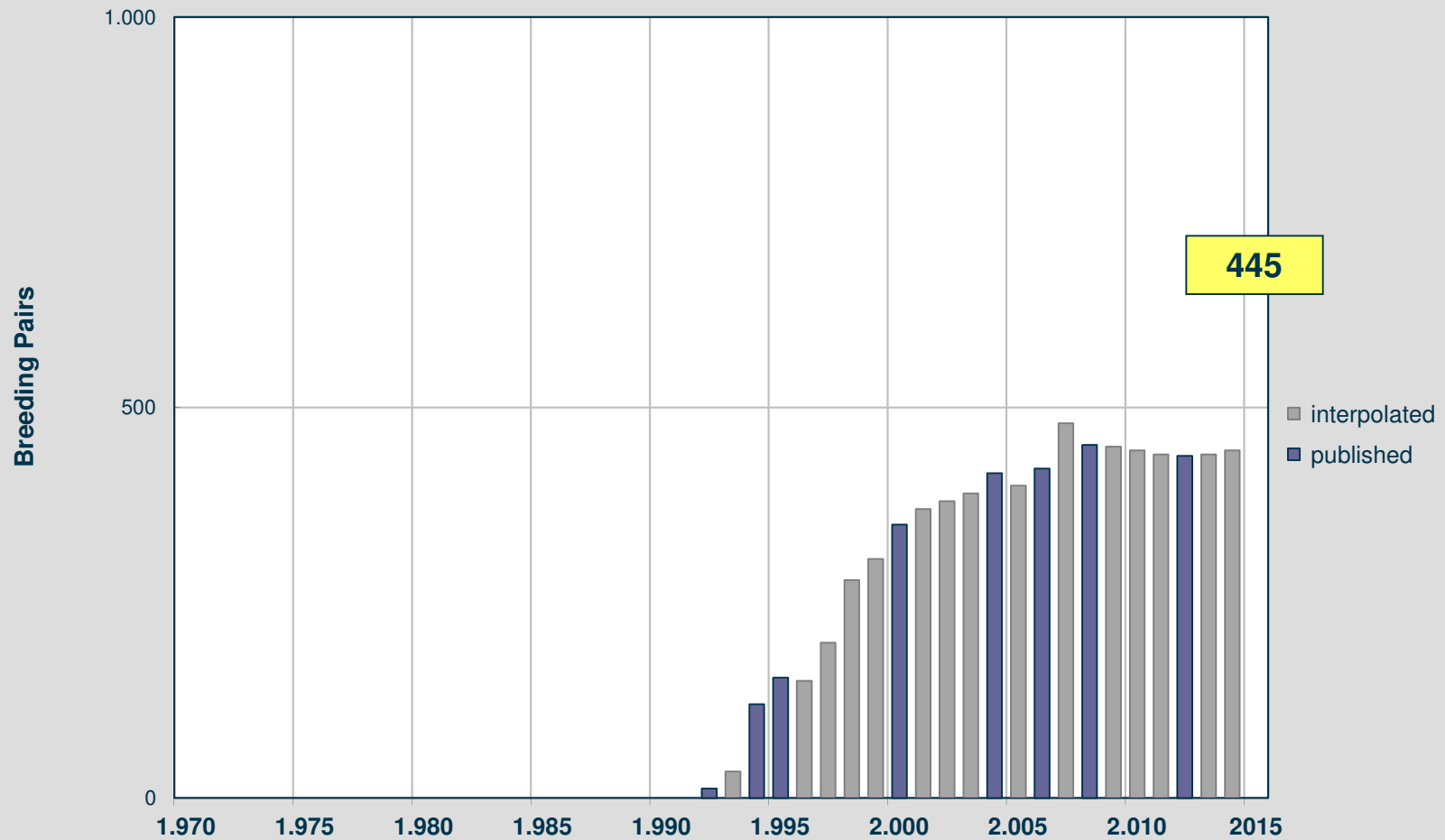


## Cormorant Breeding Pairs - BELGIUM Vlanderen

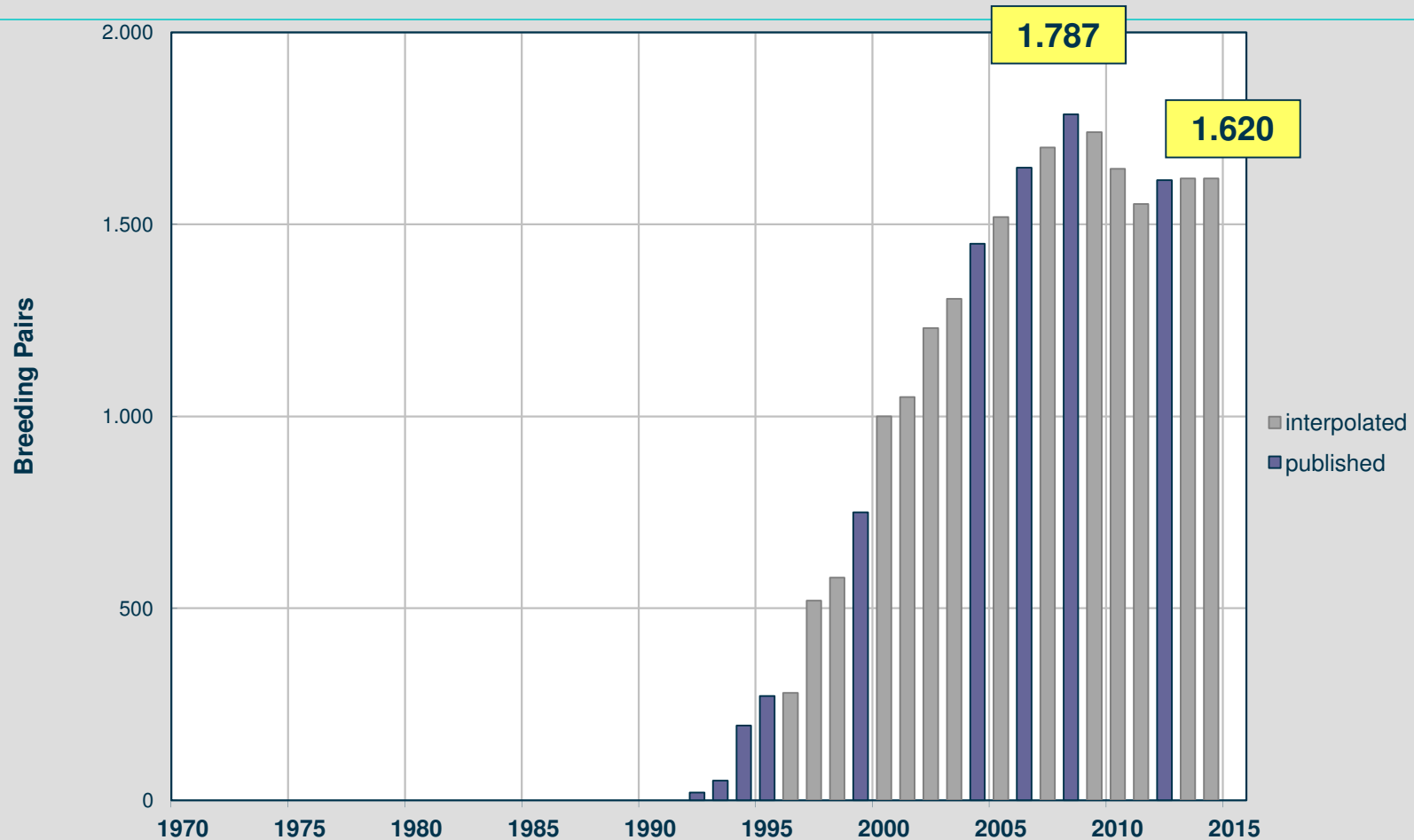




## Cormorant Breeding Pairs - BELGIUM Wallonie



## Cormorant Breeding Pairs - BELGIUM Total



## B3-4. Development of Sinensis in Central Europe

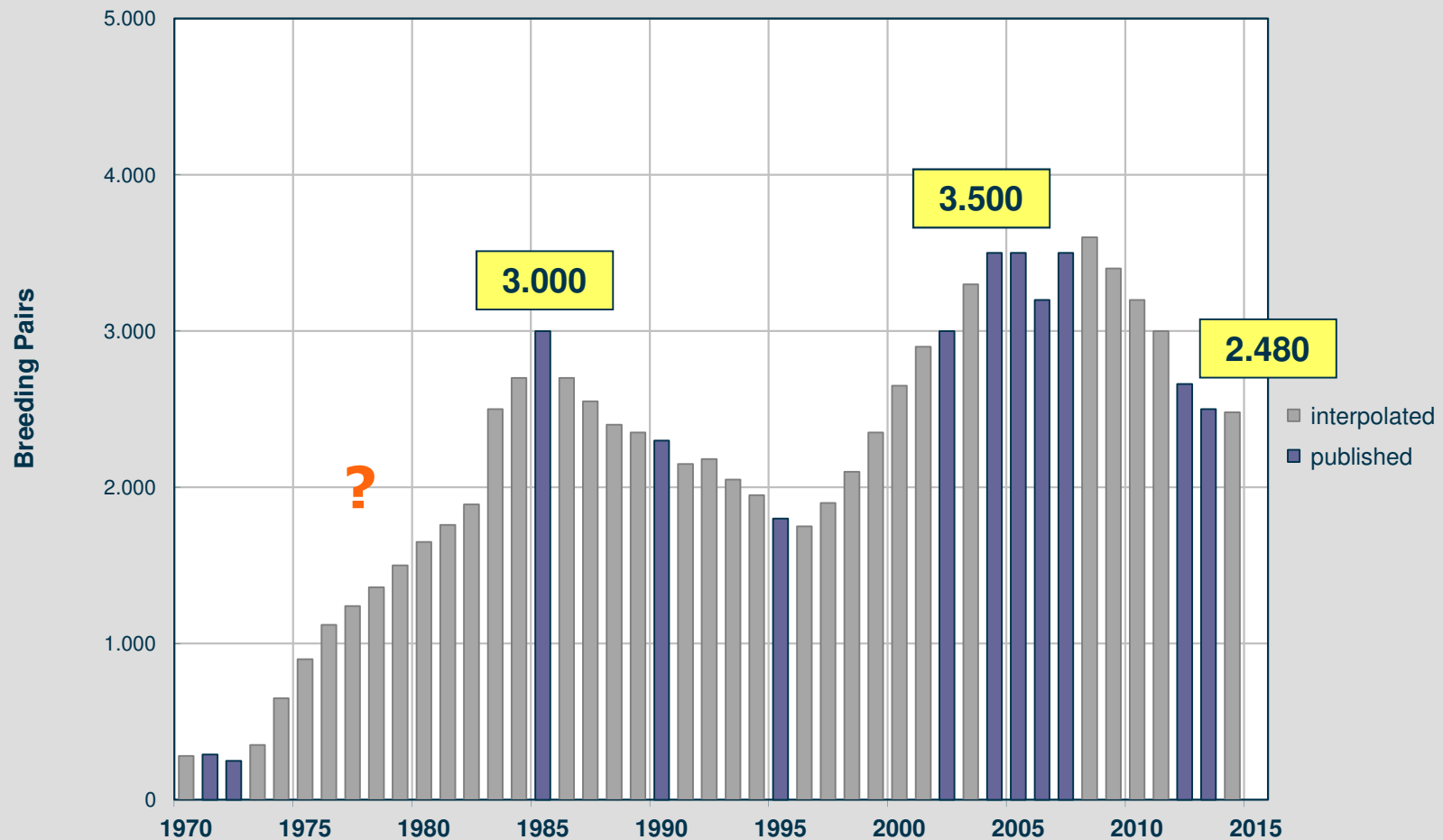


- This group comprises "purely continental inland countries",
- Historically, Hungary, Slovakia and Austria always had breeding colonies in the Danube catchment area. In Hungary this presence was never interrupted. In Slovakia the last small breeding colony disappeared in the mid 1960ies, re-colonisation started around 1990.
- In Austria the last Danube colony expired about 1973, new colonies were established only after 2000. The colony on the March (on Slovakian border) stays small, the colony on Lake Constance grew rapidly to 230 pairs, but since 2009 there are attempts to reduce it by management (removal of breeding trees, selective shooting). Additionally, in 2012 a storm destroyed many nesting trees in the Bodensee-colony, birds moved to a neighbouring colony on Germany territory, but since then the colony builds up again.
- In Czech Republic cormorants started to breed in the mid 1980ies, the first time since the 16th century. Colonies, located near fish-pond areas, grew rapidly in the first years, but in the following years numbers decreased sharply afterwards (a unique development !!)\* and only since 2000 show a slight rise again.
- In Switzerland, already since the 16th century the large lakes had been a traditional target area for wintering cormorants. But no breeding activity had been observed until 2001. Since then, numbers are sharply rising.
- Overall, breeding populations in inland countries apparently stay relatively low - "*no optimal habitat conditions for raising chicks*". Which poses the question whether the labelling of Sinensis as "*continental race*" is adequate

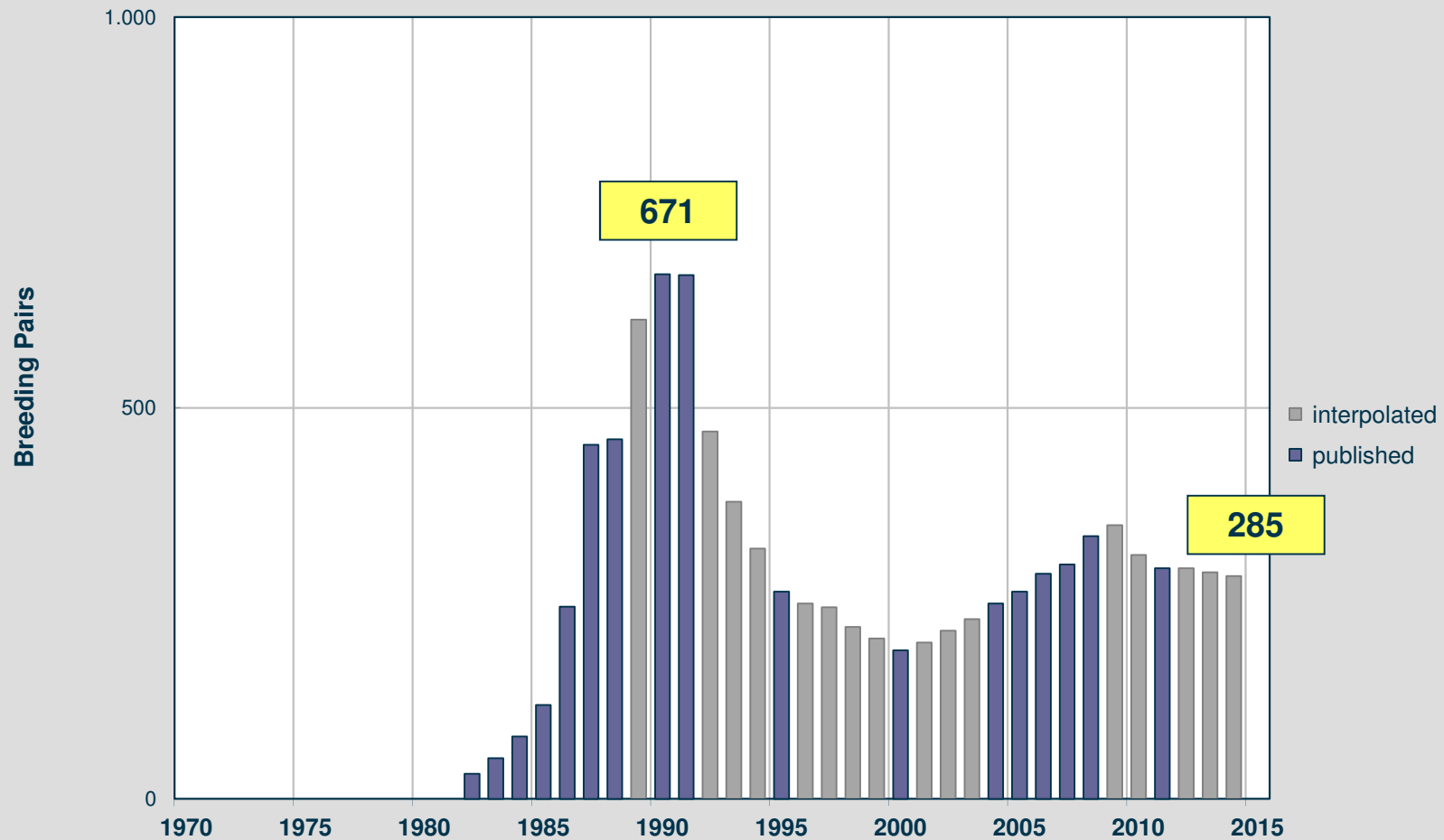


\*) According to Z. Adamek (pers. comm. per April 2010) the decrease was caused by the breakdown of the large old trees which originally were used as nesting trees. "*The reason for the decline was that the breeding colonies which appeared in late 80s/early 90s were located on big dead trees which were left on the newly constructed reservoirs in the nature reserve Nove Mlyny. After several years the trees fall down due to decomposition of their trunks and cormorants lost their very convenient nesting sites.*"

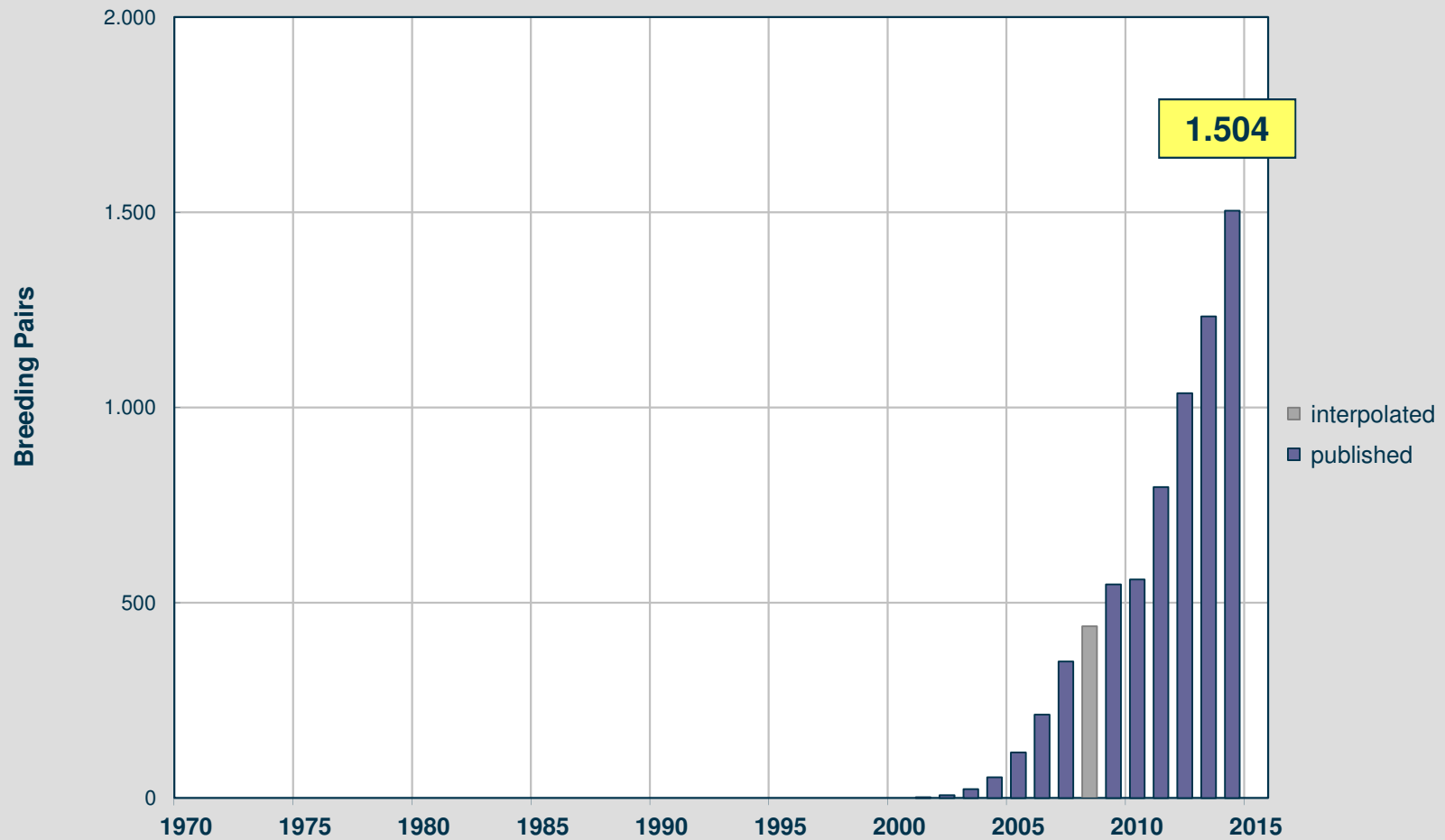
## Cormorant Breeding Pairs - HUNGARY



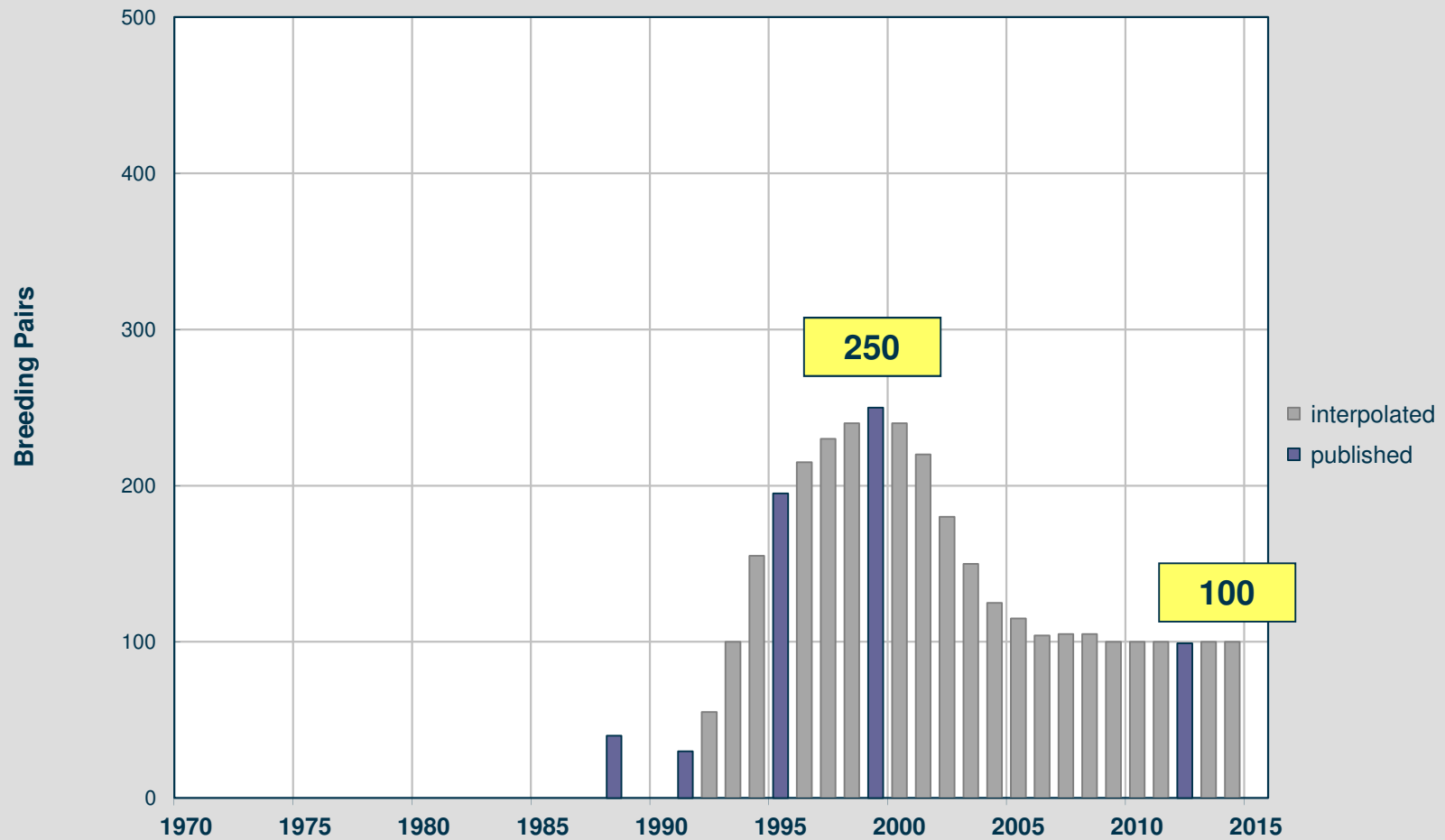
## Cormorant Breeding Pairs - CZECH REPUBLIC



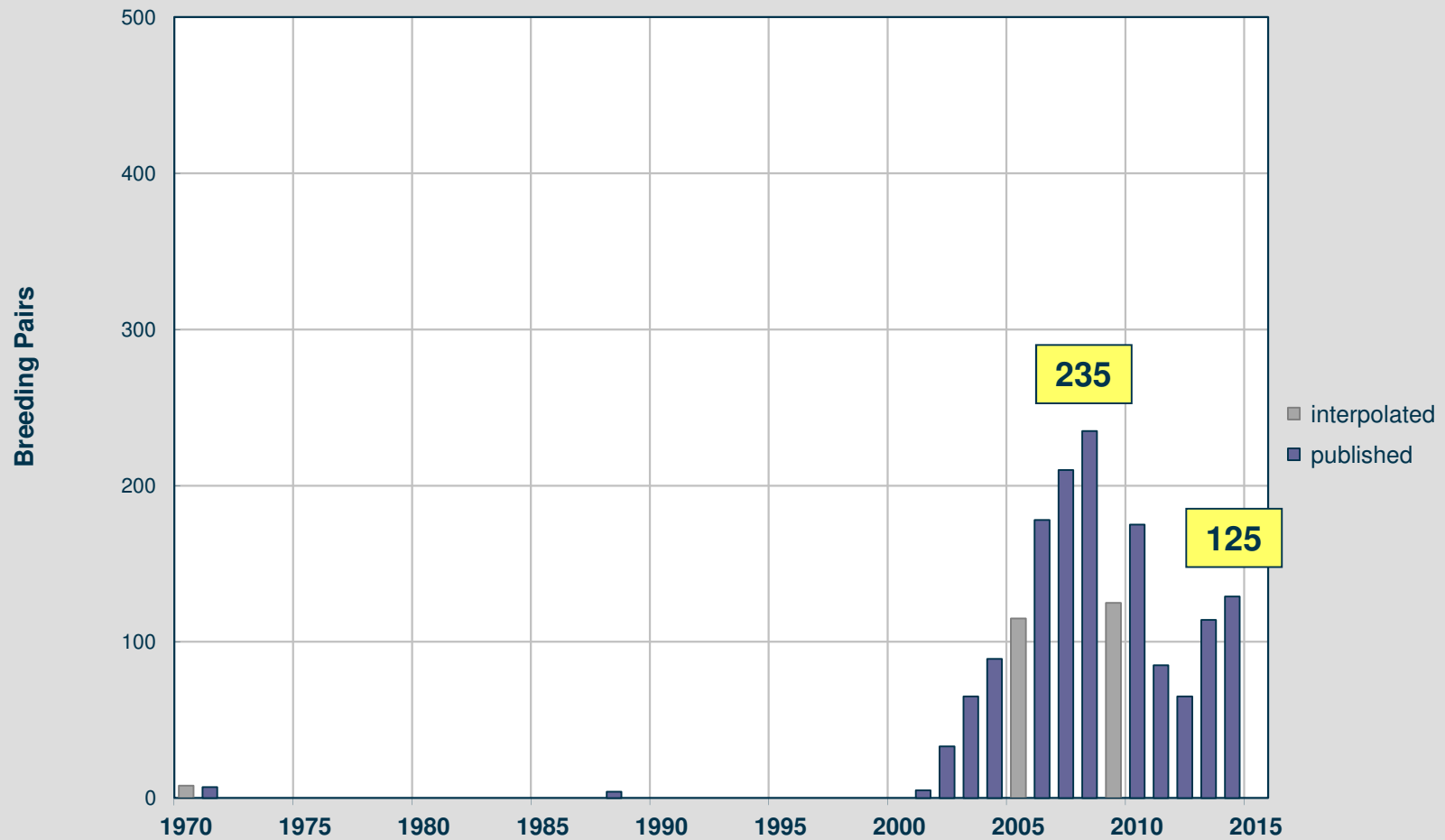
## Cormorant Breeding Pairs - SWITZERLAND



## Cormorant Breeding Pairs - SLOVAKIA



## Cormorant Breeding Pairs - AUSTRIA



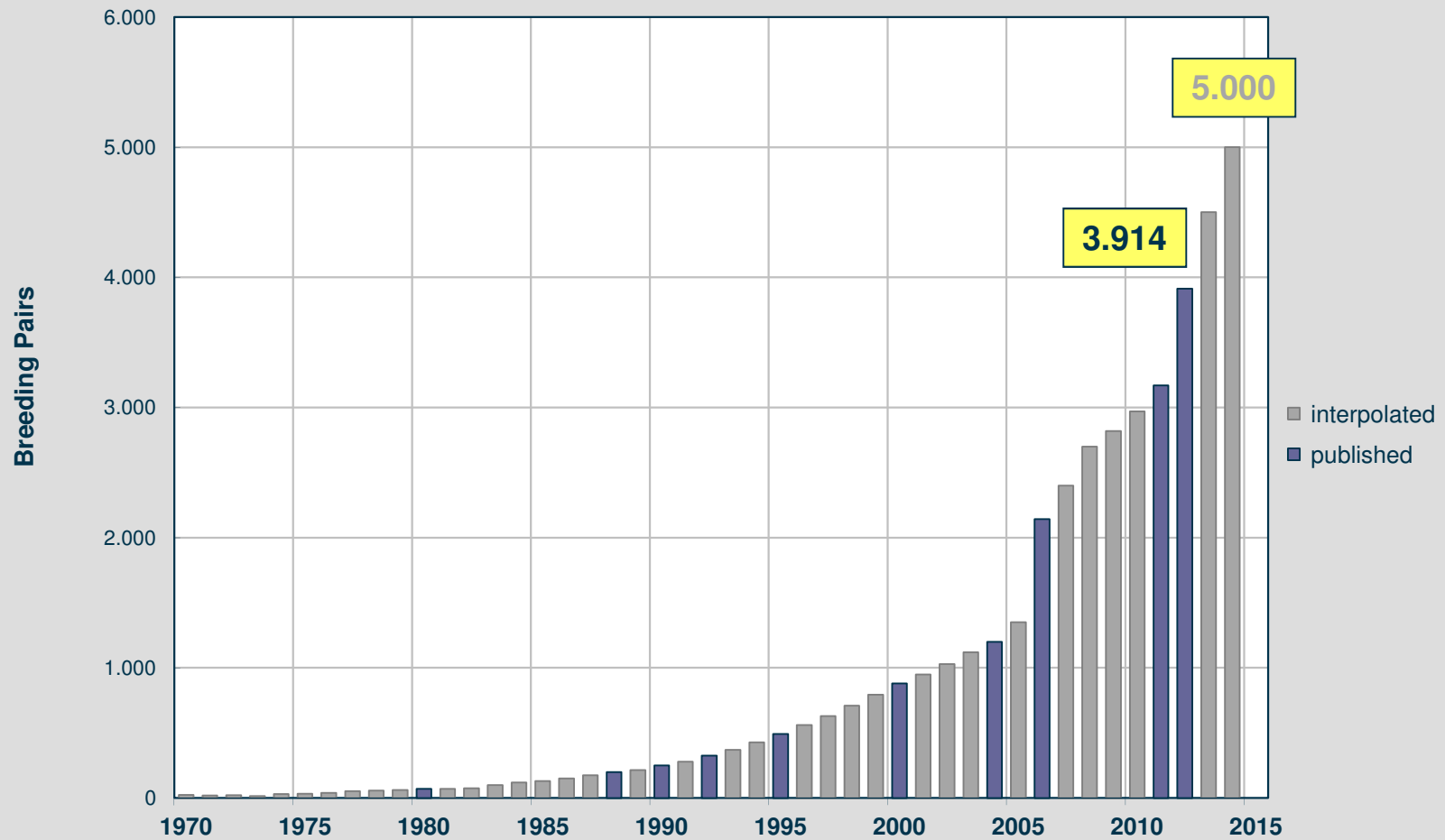


## B3-5. Development of *Sinensis* in Italy and Spain

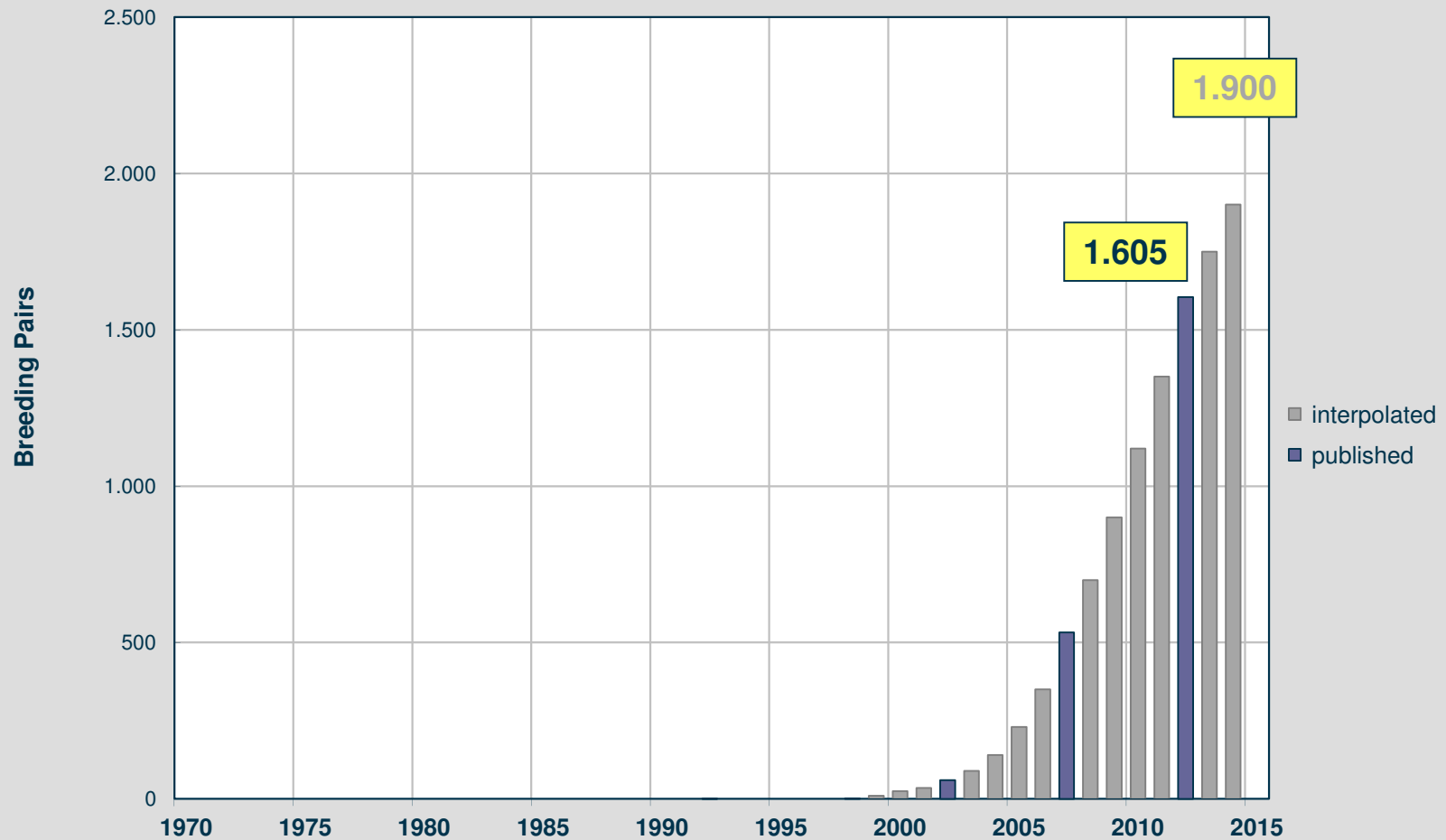


- In Italy a small population of cormorants always had survived throughout the 20th century - however, only in tiny colonies on Sardinia and Sicily. Colonisation on mainland started 1985 in the Po-Delta, showing a steep growth in all years until now. (However, Italy still predominantly is a wintering country)
- In Spain, which holds enormous numbers of cormorants in winter (> 65.000), some small breeding colonies appeared only shortly before 2000. Until 2006 there were still very few colonies, mostly in Ebro valley. Since then, at least, 15 new colonies had been founded in inland Spain. Actual data from 2012 show a steep, almost exponential increase - however, breeding population (1605 pairs in 2012) still seems relatively low compared to the enormous number of wintering cormorants.

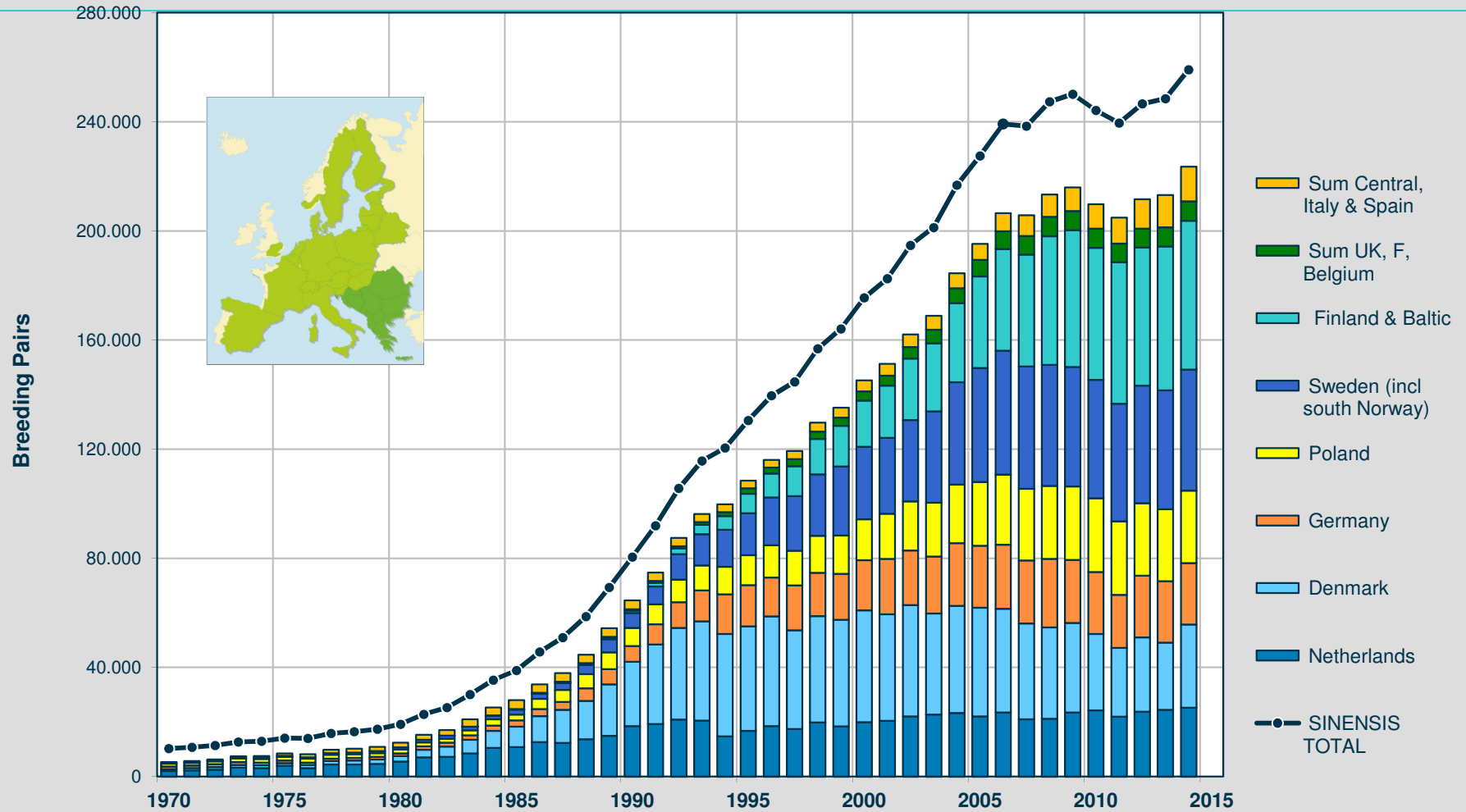
## Cormorant Breeding Pairs - ITALY



## Cormorant Breeding Pairs – SPAIN *sinensis*



## B3-5a. Cormorant Breeding Pairs – Country Groups (1-5) Sinensis West



NL + DK fairly stable since mid 1990ies, followed by rapid growth in D + PL + S

since 2000 very steep increase in Baltic area

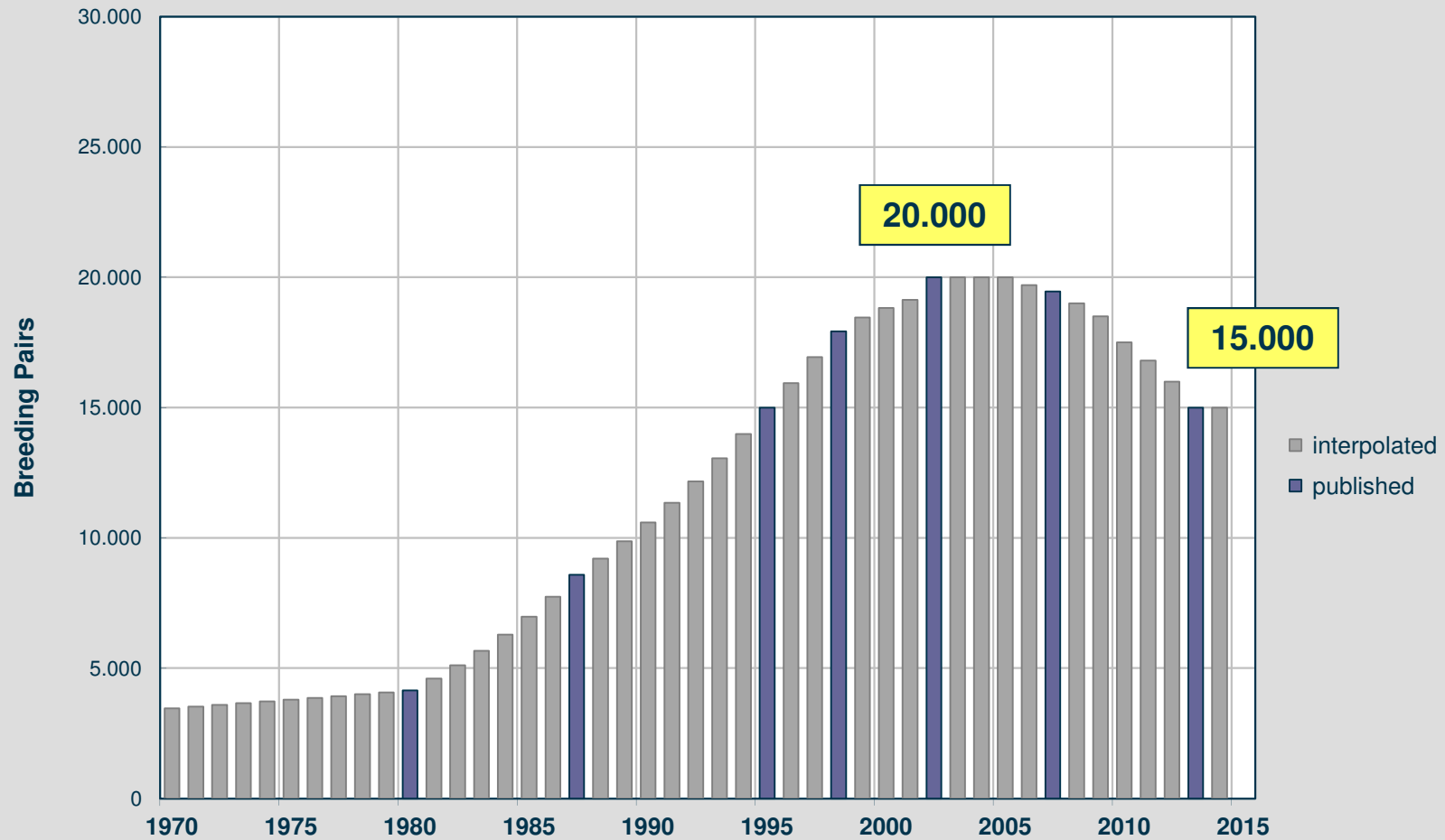


## B3-7. Development of Sinensis East (Romania, ex-Yug, Bulgaria, Greece)

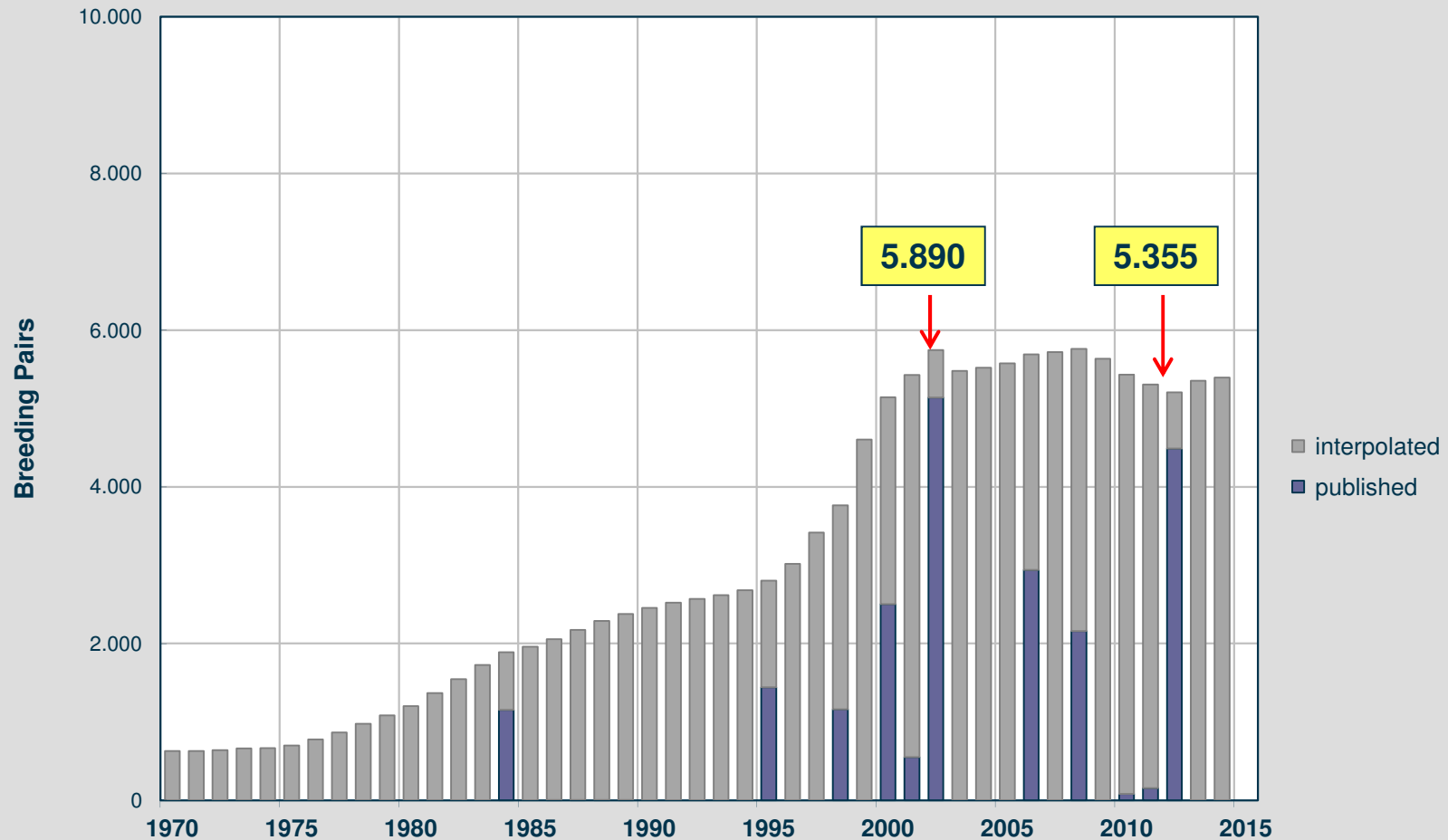


- In eastern Europe cormorants had never vanished and sizeable breeding colonies existed throughout the last century.
  - In Romania the core area is the Danube delta, from where colonies extend westwards up the Danube (*and also eastwards to Ukraine / Krim peninsula*)
  - In ex-Yugoslavia colonies existed in Serbia (along the Danube), Croatia (esp. Kopacki Rit) and Macedonia (Lake Ochrid).
  - In northern Greece (Axios delta) a breeding colony was first recorded in 1944, but numbers stayed low before the 1990ies
  - In Bulgaria existed several colonies on islands in the Danube (one holding up to 387 pairs in the 1970ies).
- Generally, for these countries there is much less information about cormorant population development than in western Europe. 'Historical' data are scarce and even for the last decade counting data are available only in irregular intervals.
- However, available information shows clearly enough that there had been a marked increase between 1990 and 2005. However, in Romania the counts show a significant decrease in the last ten years from 20.000 to 15.000 pairs.

## Cormorant Breeding Pairs - ROMANIA

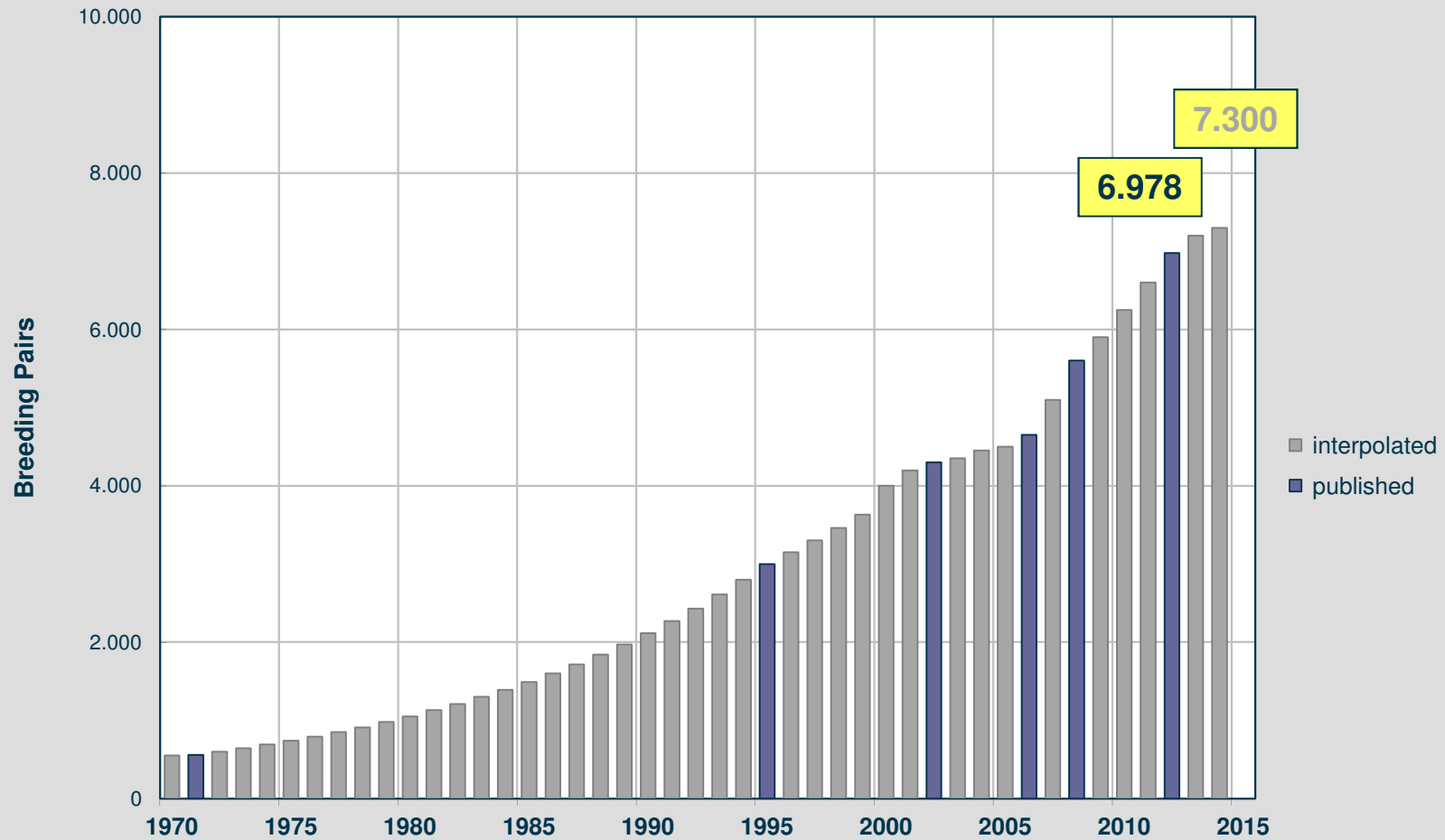


## Cormorant Breeding Pairs - Countries of ex-YUGOSLAVIA\*



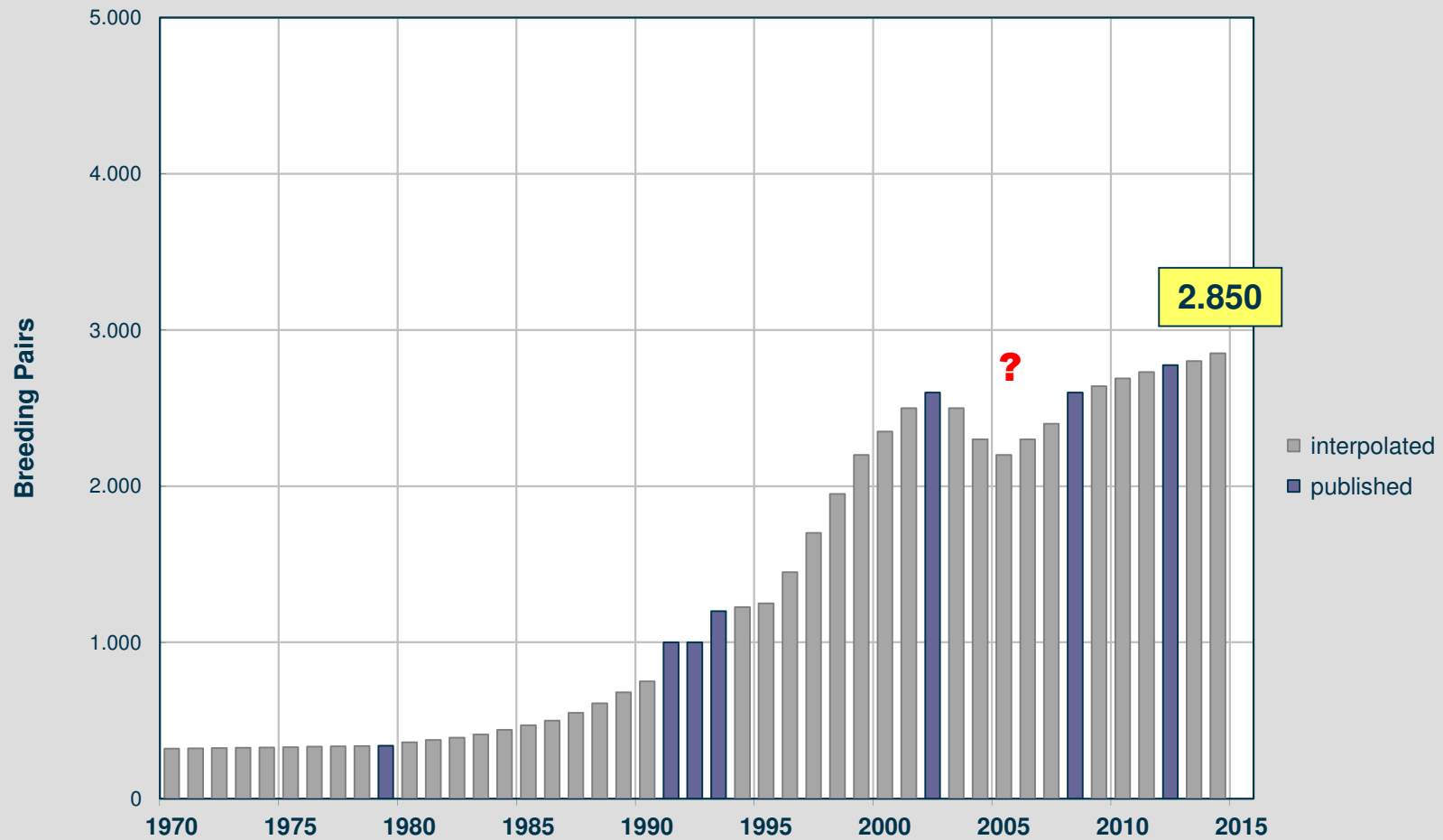
\*) Sources before 1990 show only aggregated figures for "Yugoslavia" and there are no published (accessible) national data before 2000. For 2000 BirdLife Factsheet recorded 6.000 BPs (3.000 in Croatia, 2.400 in Serbia/Montenegro and 600 in Macedonia). The WI-CRG-census 2006 counted 2.156 in Croatia, 940 in Serbia, 2000 in Montenegro. In 2012 there were 1133 in Croatia, 2000 in Serbia, 1156 in Montenegro and 154 in Bosnia Herzcegowina.

## Cormorant Breeding Pairs - GREECE

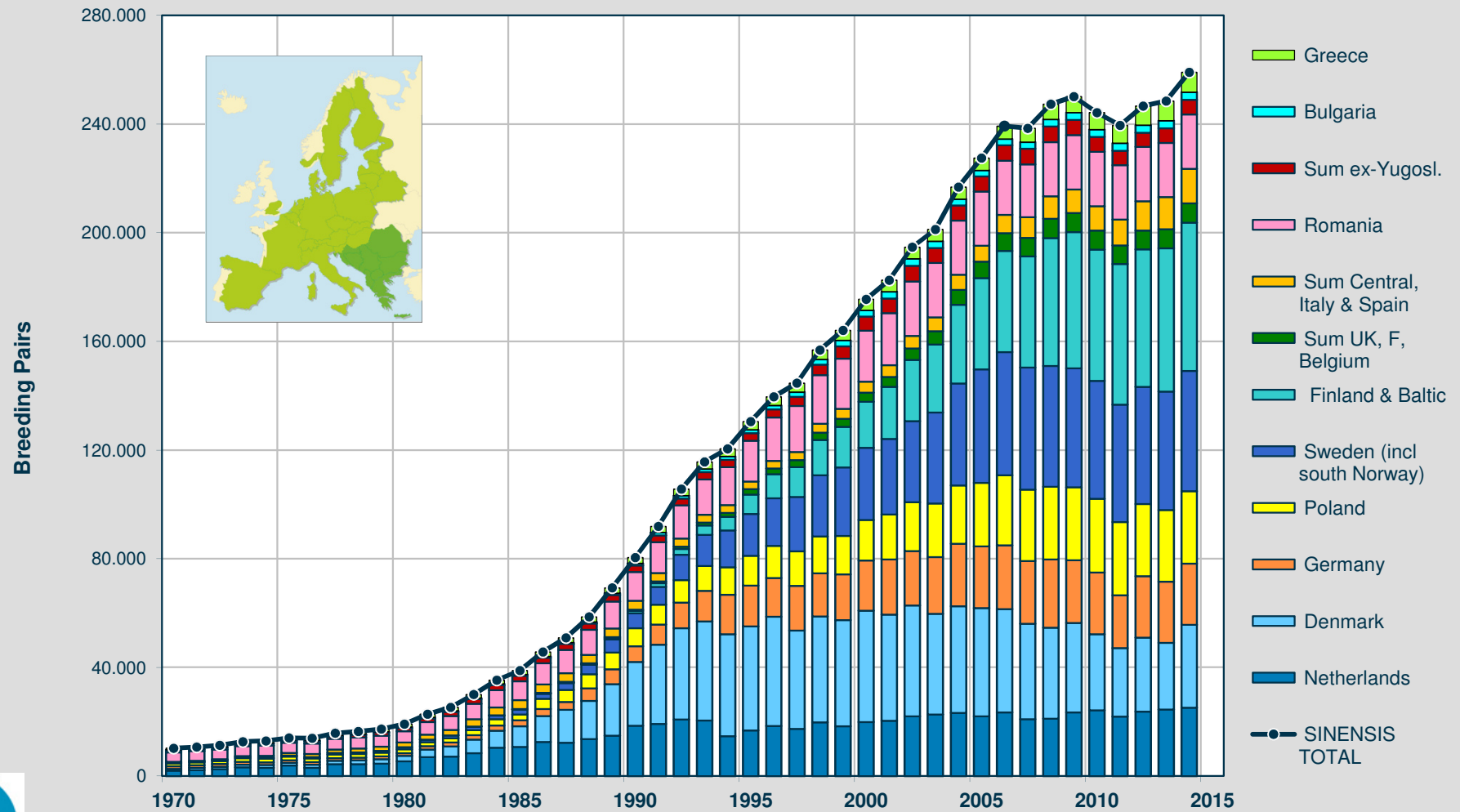




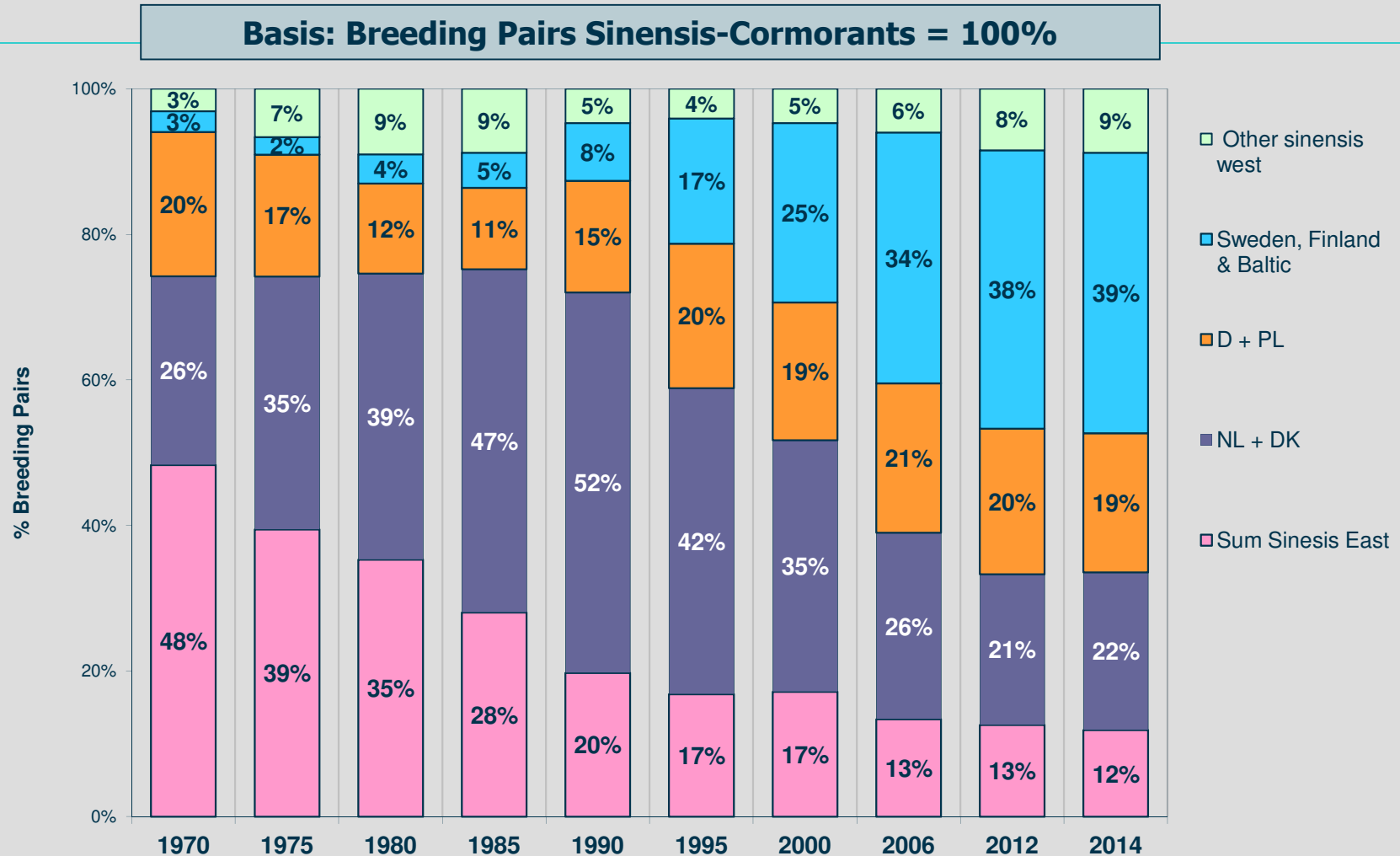
## Cormorant Breeding Pairs - BULGARIA



# B4-1. Overview Sinensis Breeding Pairs 1970-2006

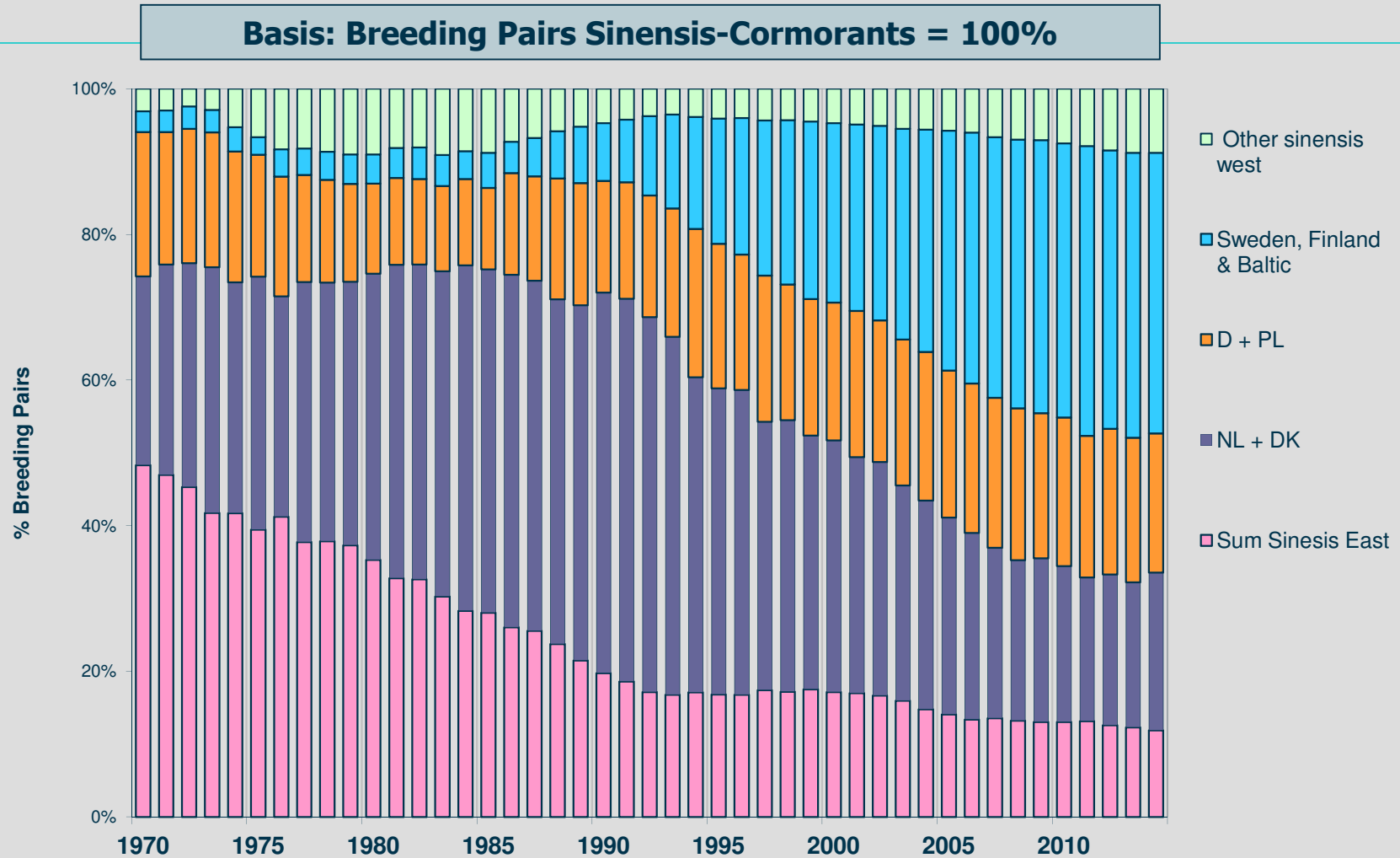


## B4-2. Relative importance of regional sub-populations (Sinensis Total)



Marked shift from the Eastern subpopulation to the West. Within the Western subpopulation NL and DK clearly dominated between 1985-95; since then the Baltic Sea region rapidly expanded and took first place

## B4-2a. Relative importance of regional sub-populations (Sinensis Total)



Marked shift from the Eastern subpopulation to the West. Within the Western subpopulation NL and DK clearly dominated between 1985-95; since then the Baltic Sea region rapidly expanded and took first place

## B5. Development of *Carbo carbo* ("atlantic race") – individual countries

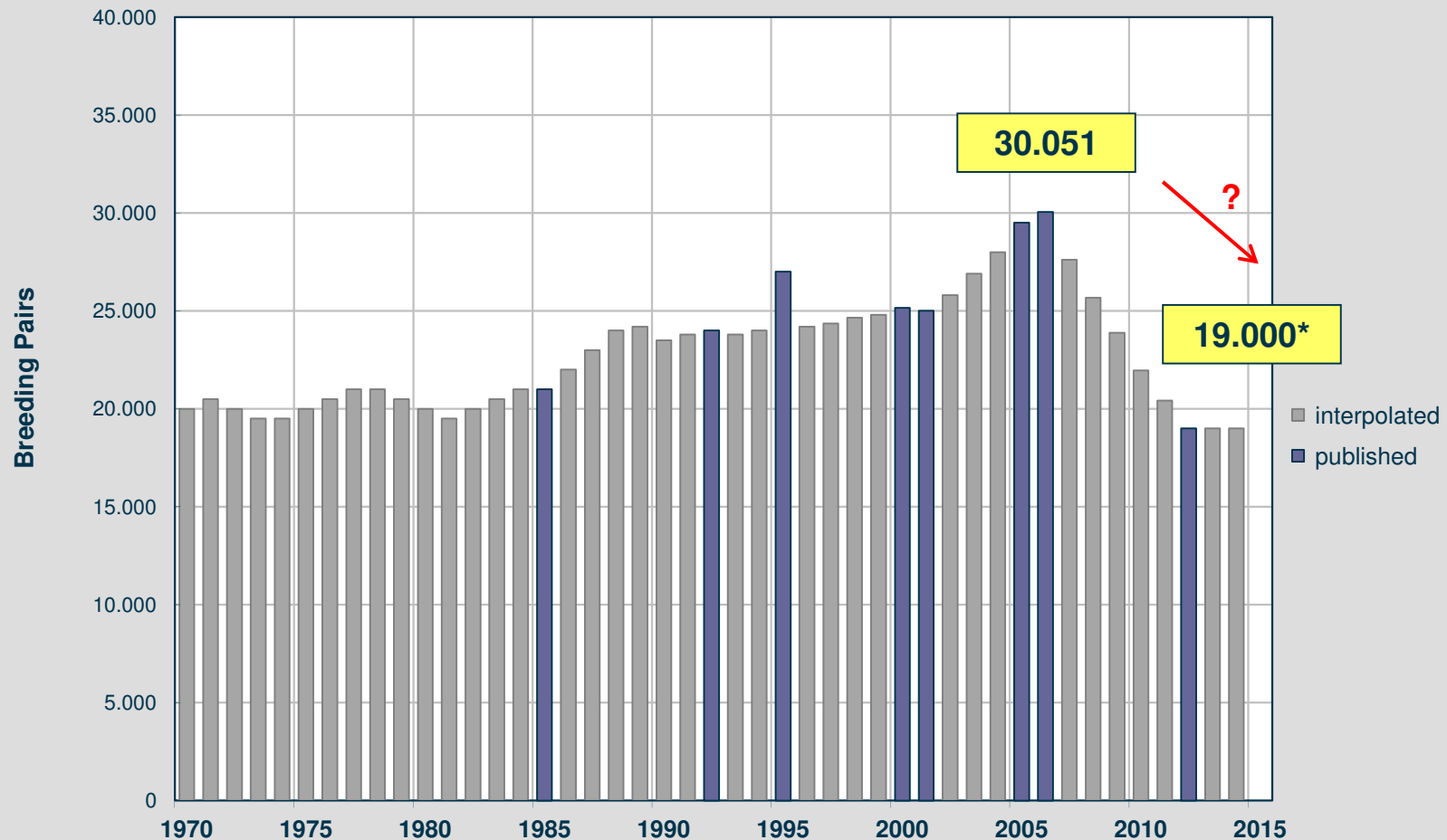


- The European breeding range of the Carbo-subspecies includes Iceland\*, Norway, Ireland, the largest part of UK, the western coast France and some northern parts of Russia (Murmansk, Onega Bay). For 2008 also a first breeding was reported from Portugal, but without info on size, and no colony was observed in 2012.
- While counting data for the Sinensis-subspecies is often available year by year, nationwide counts for the Carbo-cormorant are less frequent. In Norway, which holds the majority of carbo, counting is done only in a sample of individual colonies. In UK there is a regular Seabird Monitoring Program, which investigates population trends on basis of a sample of colonies, however, figures are uncertain due to incomplete coverage.
- Nevertheless, between 1970 and 2006 the numbers can be regarded as fairly reliable because the Carbo-population stayed quite stable in this period.
- From 2000 to 2006 the figures show a marked increase from ca. 42.000 pairs (BirdLife Factsheet) to ca. 52.000 (Wetlands International).
- However, the new CorMan Census report estimates a sharp decline in Norway from over 30.000 pairs in 2006 to 19.000 pairs in 2012. *(As this is based on sample results, the concrete figure should be regarded with caution, but the trend is probably correct.)*



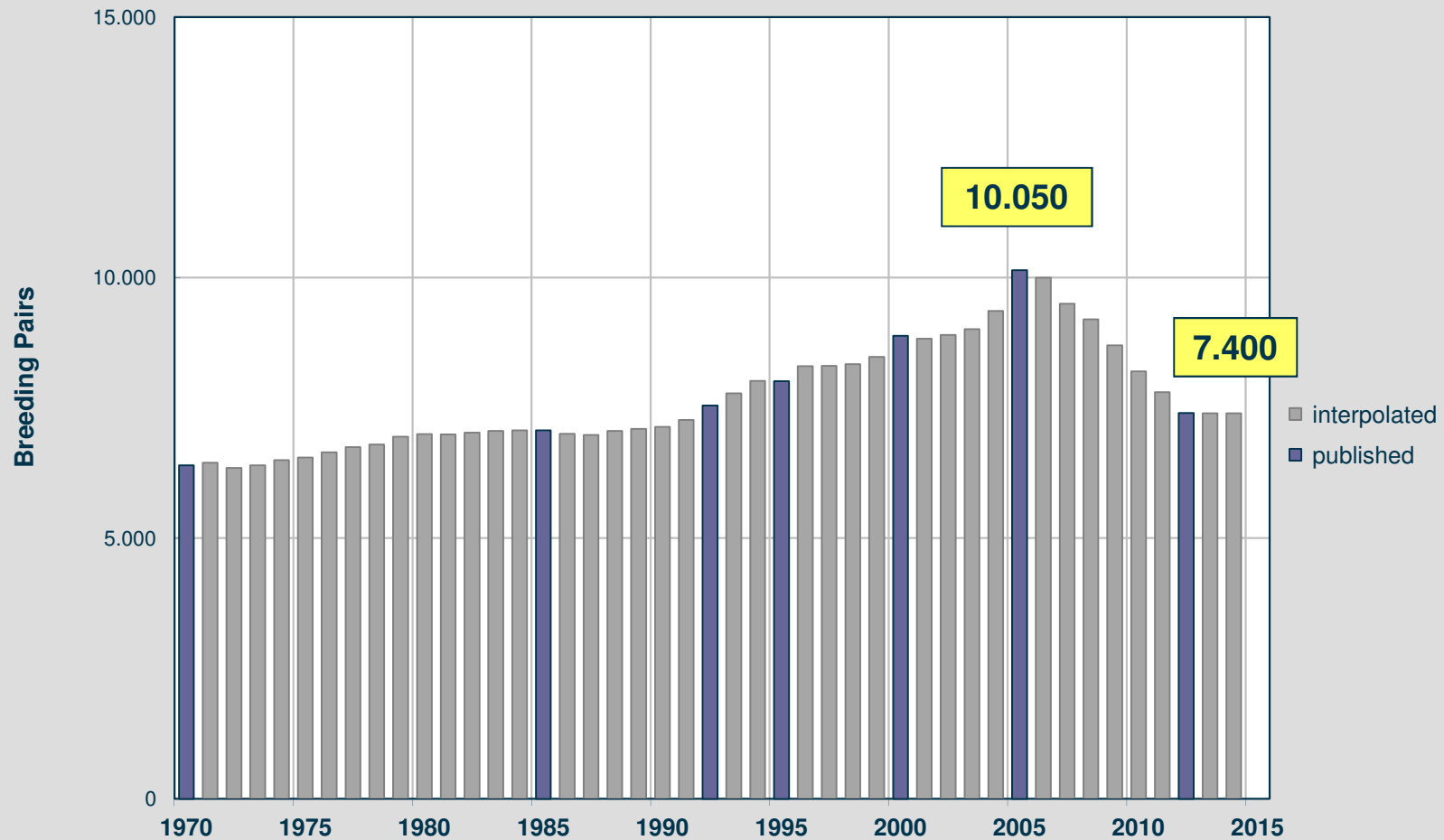
Additional Remarks: There are also some breeding pairs on the Faroe islands, fragmentary records mention about 10 pairs. The number is insignificant, however, they were included in the "total sum" for completeness sake. In England, France and Spain there are also Sinensis-colonies, some of them also mixed with Carbo. Clear distinction is difficult, where separate figures are lacking (as in Spain), numbers were allocated proportionally

## Cormorant Breeding Pairs – NORWAY carbo

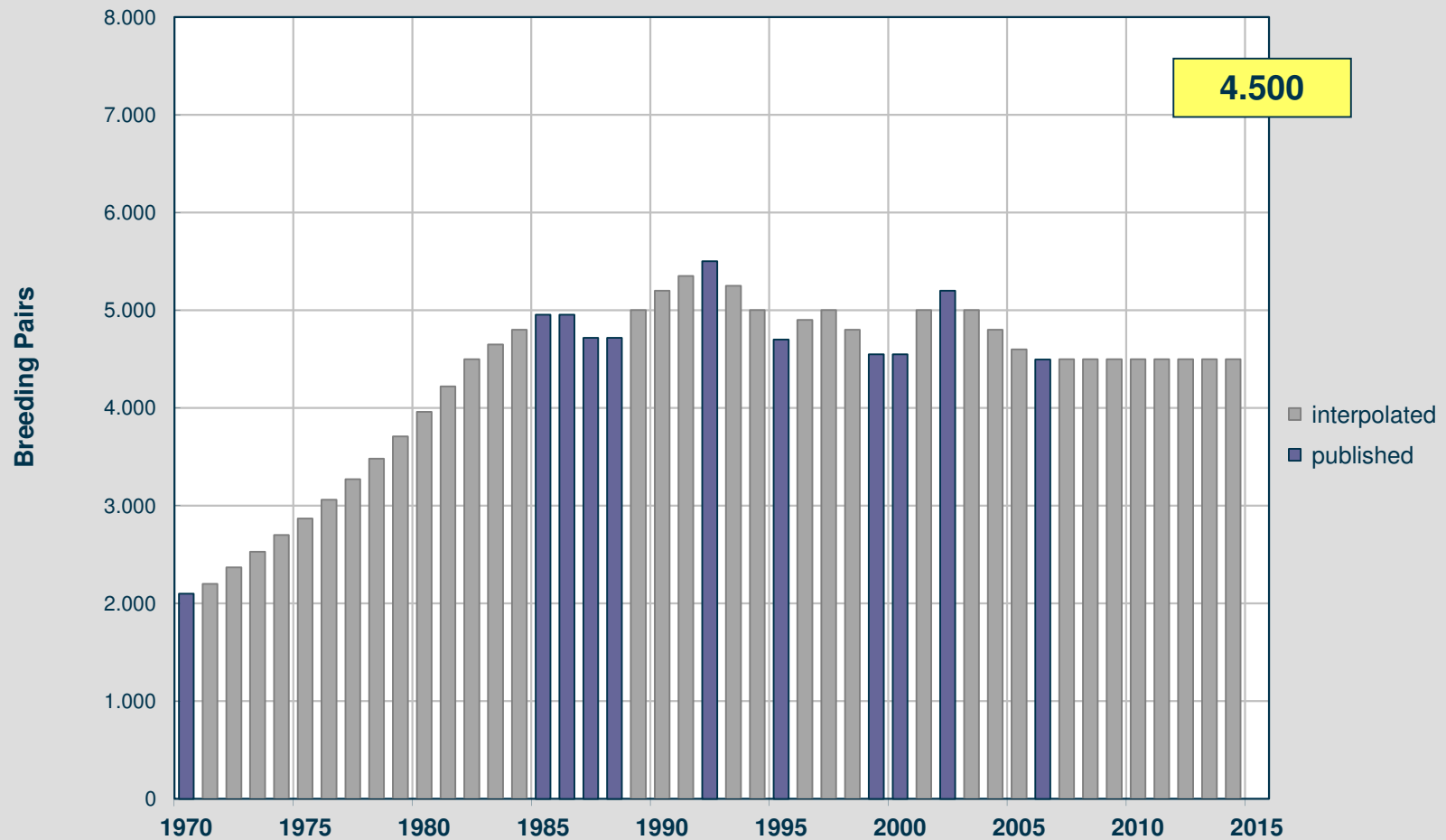


\*) Norwegian figures are not based on complete counts (which understandably would be too difficult in Norway) but on trend estimates from observations in a sample of colonies. "This estimate is based on counts of individual colonies that took place during various years between 2007 and 2013. The long-term trend from ca. 1980 to 2012 was positive or stable for the monitored colonies, whereas for the last 10 years (2002-2012) most of these colonies have decreased by an average of 7.8 % per annum." (CorMan census report, Bregnballe et al. 2014).

## Cormorant Breeding Pairs – UK carbo

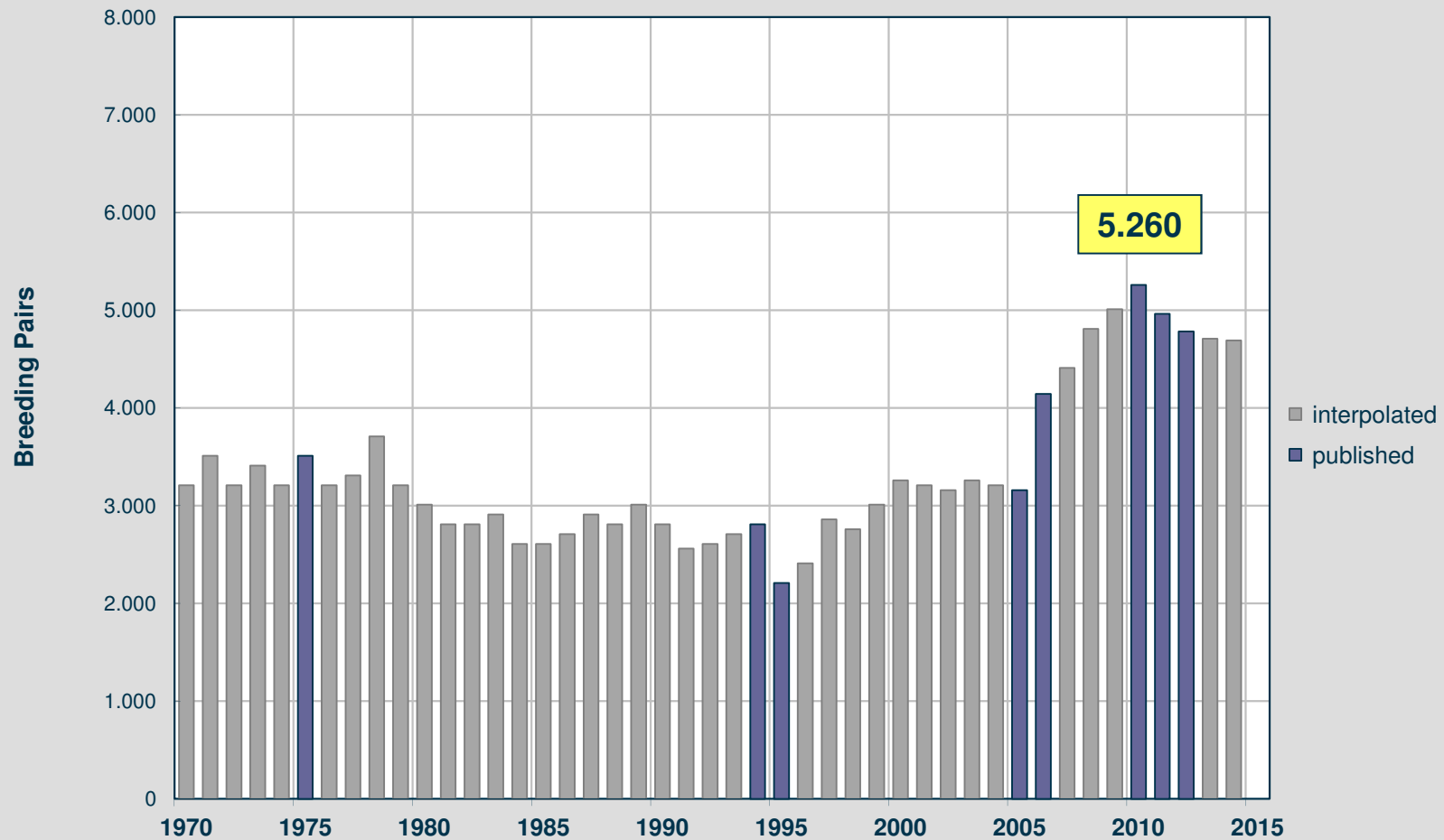


## Cormorant Breeding Pairs – IRELAND



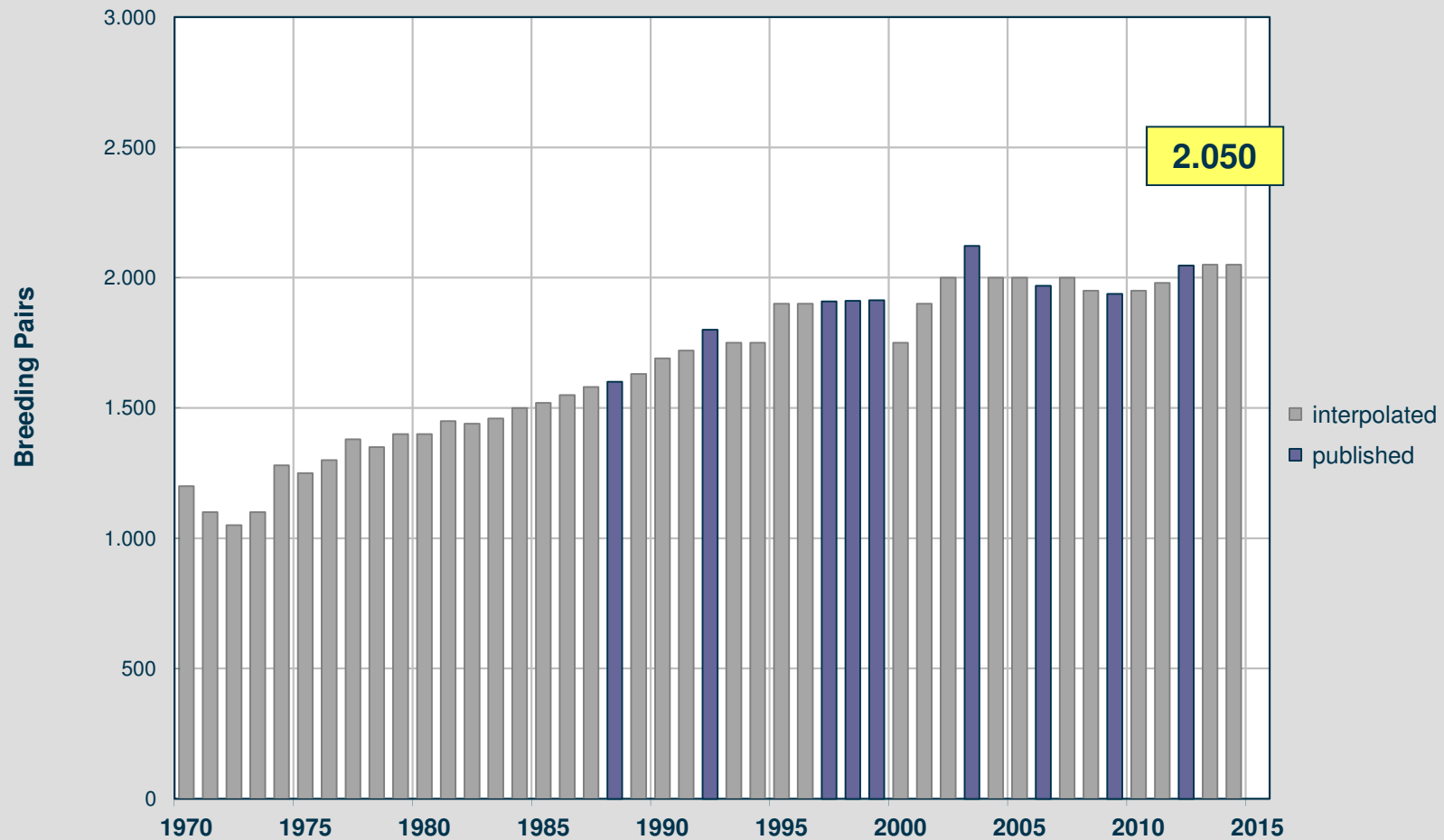


## Cormorant Breeding Pairs – ICELAND (incl. Faroes\*)

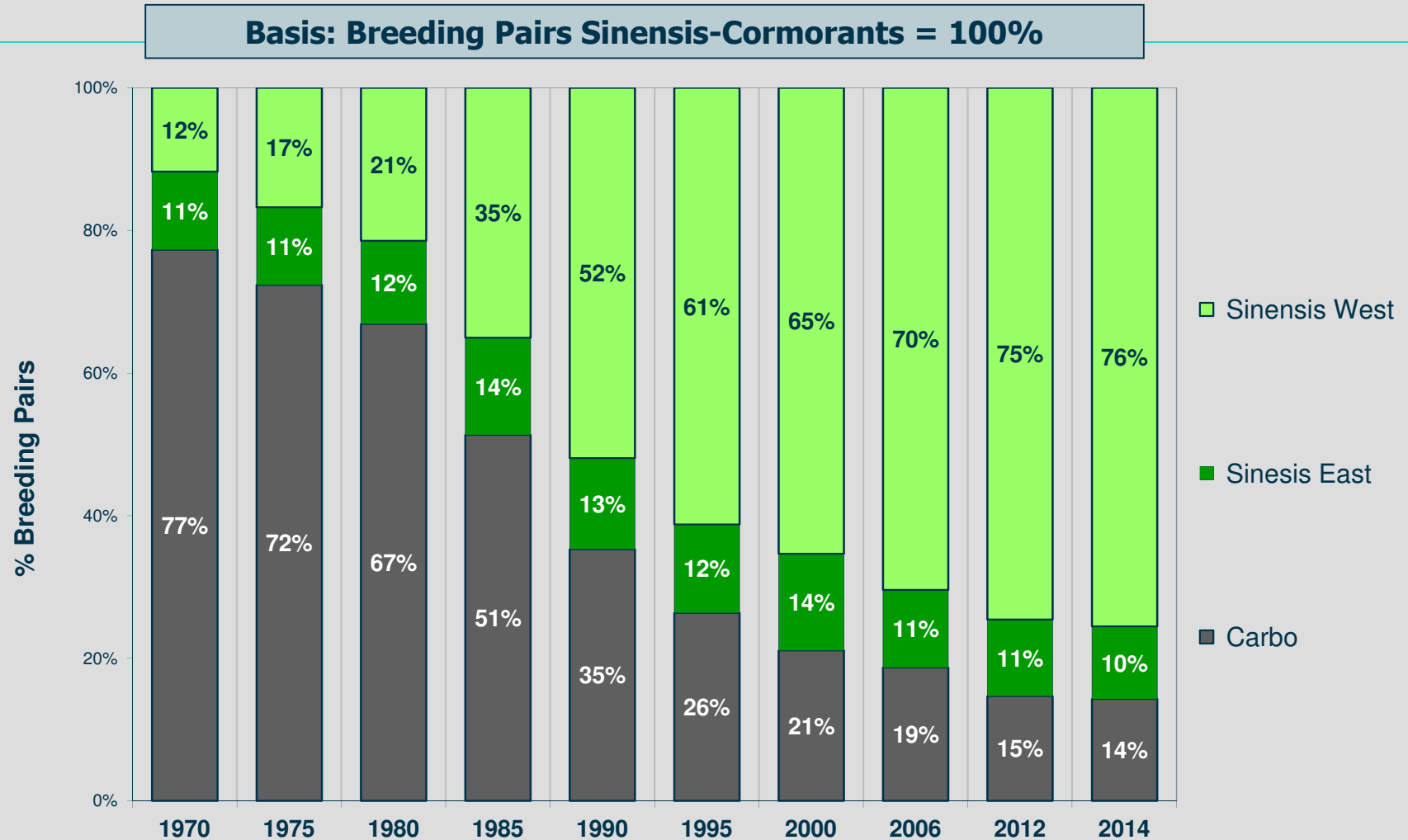


\*) Faroes are mentioned only for completeness sake – they are estimated for only 10 pairs throughout all years

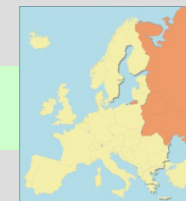
## Cormorant Breeding Pairs – FRANCE coastal (~carbo)



## B6: Breeding Pairs - Relative importance of Carbo vs. Sinensis



In 1970 three quarters of all cormorants were of the Carbo-subspecies ("atlantic race"), now their share has dropped to 14%.



## Part C: Cormorants in Moldova, Ukraine & inland Russia

- In this east-eastern part of Europe there are few regular counts of cormorant breeding population. However, for completeness sake we try to assess the probable range.

Country	1990-2000 BirdLife Factsheet*	2000-2003 V. Belik cit. in CorMan report*	2006 Census WI CRG*	2008 estimate B. Nemtsov*	2012 CorMan Census* Bregnballe et al	2014 Estimate EAA
Ukraine	65-75.000		68.000	~100.000	46.500	46.000
Moldova					700 – 1.500	1.000
Russia between Azov Sea and Caspian Sea		35-55.000			60 – 68.000	68.000
Russia – other (uncovered) eastern inland regions						10.000
<b>Europe East-East</b>						<b>125.000</b>

- On basis of these indications it can be concluded: The Ukraine the cormorant breeding population showed an increasing trend until 2008 (perhaps a bit overestimated), but then sharply dropped to about 46.000 pairs in 2012.
- The neighbouring regions of Russia at Black Sea, Sea of Azov and Volga Delta continued the increasing trend and can be estimated at 68.000 pairs in 2014.
- Assuming an additional 10.000 pairs in other, non-covered wetlands inland Russia, and estimating about 1-000 pairs in Moldova, one can estimate plus/minus **125.000 breeding pairs** per 2014.



\*) Full citation of sources see Appendix III

## C1: Total Cormorant Population incl. East-East Europe 2014

Basis: Whole Europe – including inland Russia, Ukraine & Moldova



- While there are quite reliable counting data for Core Continental Europe, the data basis for the East-Eastern part is fragmentary.
- For 2012 the CorMan census reports 46.500 pairs in Ukraine (markedly lower than in 2006) and about 1.000 pairs in Moldova. . In Russia, the census covered the area between Sea of Azov and Caspian Sea (including the Volga Delta), with about 68.000 pairs.
- Tentatively assuming an additional 10.000 pairs in uncovered Russian wetlands one could expect an actual breeding population of around 125.000 pairs in whole East-Eastern Europe.

Cormorant Population Europe 2014	Breeding Pairs	Expansion Factor	Individuals (Summer)
Sum Core Europe	<b>299.455</b>	~5,3	<b>1.595.400</b>
Sinensis East-East*	<b>125.000</b>	~5,3	<b>663.000</b>
<b>Sum Cormorants Total Europe</b>	<b>424.455</b>		<b>2.258.400</b>

- Looking at whole European continent, in 2014 there were about 452.000 breeding pairs of the Great Cormorant.
- The total population (breeders + non-breeders) per summer 2014 amounted to about 2,2 - 2,3 million individual birds.

\*) Sources: BirdLife Factsheet Cormorants (2004) estimates for Ukraine 65 - 75.000, for Russia 35 – 65.000, for Moldova about 500 breeding pairs. Bregnballe (2011) reports that the WI-CRG census counted about 68.000, Nemtsov (2008) reports that 71.000 pairs were counted in the Black Sea area and estimates additional several thousands in inland areas. In 2012 the CorMan census covered whole Ukraine and reports 46.500 pairs – seemingly a clearly declining trend. CorMan census also covered a large area of inland Russia between Azov Sea and Caspian Sea (including Volga Delta), which holds the majority of Russian cormorants, estimating a minimum of 60.-68.000 pairs, with an increasing trend.

## Appendix I: Sources for Maps of Cormorant Colonies Europe (1)

### THREE CATEGORIES OF SOURCES

**1. “Multi-national” Publications:** which provide an overview of many European countries. Concretely these are the ARDEA-special issue from 1995 (which is very good for all covered countries) and the REDCAFE Country Reports from 2005 (*where information comprehensiveness may differ per country*).

**2. National Publications:** Sources which provide colony-information for one country (which where used either as a substitute for countries for which there was no sufficient information in 'multi-national' publications or as a source for additional detail).

**3. Site-specific, regional/local sources:** Typically, information for one specific cormorant colony (e. g. in national parks, or near fish farms etc - often yielding more up-to-date info on colony size).

### MULTI-NATIONAL

**Van Eerden, M. R., K. Koffijberg & M. Platteeuw (eds.), 1995.** Riding on the Crest of the Wave. Ardea 83(1), (Debout, G., N. Røv, & R. M. Sellers for Ph. carbo carbo, Van Eerden, M. R. & J. Gregersen for Ph. carbo sinensis in western flyway, Lindell, L. and P. Mellin, J. Musil, & H. Zimmermann. 1995 for Ph. carbo sinensis in eastern flyway)

**Carss, D. N. & M. Marzano (eds.) 2005.** REDCAFE Summary & National Overviews (various country reports by national experts, not in all countries information about colony locations).

### NATIONAL & LOCAL

#### **UNITED KINGDOM & IRELAND**

**Seabird 2000**, Census UK, Numbers of breeding Great Cormorants (AON) in Britain and Ireland 1969–2002,

<http://www.jncc.gov.uk/PDF>

**Seabird 2006**, Census UK, ed. Mavor, R.A., Heubeck., M. Schmitt, S. and Parsons., M, Seabird numbers and breeding success, 2006 (2008). <http://www.jncc.gov.uk/page-4363>

**Hughes B, J. Bruce, G. R. Ekins and S. Newson (2000)**, Movements and distribution of inland breeding Cormorants in England.

English Nature Research Report No 360

**Carss, DN; & Ekins, GR (2002):** Further European integration: Mixed sub-species colonies of Great Cormorants Phalacrocorax carbo in Britain. Ardea Vol. 90, no. 1, pp. 23-41. Abstract.

#### **NORWAY**

**Rov, Niels. 2006.** Cormorant Breeding Colonies (Norsk Fugle Atlas – Storskarv).

[www.birdlife.no/fuglekunnskap/fugleatlas/pdf/storskarv.pdf](http://www.birdlife.no/fuglekunnskap/fugleatlas/pdf/storskarv.pdf).

## Appendix I: Sources for Maps of Cormorant Colonies Europe (2)

### SWEDEN

**Engström, Henri** (2001) Effects of Great Cormorant Predation on Fish Populations and Fishery, Uppsala Dissertations

### FINLAND

**Lehikoinen, Aleks**i (2006), Cormorants in the Finnish archipelago, *Ornis Fennica* 83:34–46. 2006

**Finnish Environment Institute (2004)**. Rapid growth of cormorant breeding population. <http://www.ymparisto.fi>.

**Finnish Environment Institute (2006)**, Cormorant populations still growing in the Archipelago Sea and the Gulf of Bothnia, [www.environment.fi](http://www.environment.fi).

**Finnish Museum of Natural History (2006)**. Bird Atlas Merimetso (=Cormorant) 1974 - 2006. [http://www.hatikka.fi/birdatlas\\_public\\_result](http://www.hatikka.fi/birdatlas_public_result).

**Finnish Environment Institute (2007)**. Cormorant Population and Breeding Colonies <http://www.ymparisto.fi/default.asp?contentid=244630&lan=en>.

**Finnish Environment Institute (2007)**. Cormorant population grew by more than fifty percent, <http://www.ymparisto.fi/default.asp?contentid=244630&lan=en>.

**Finnish Environment Institute (2010)**. Press release. Numbers of breeding cormorants declined due to harsh winter conditions <http://www.ymparisto.fi/default.asp?contentid=364476&lan=en>.

### RUSSIA White Sea (*Ph. carbo carbo*)

**Bianki, V**; Boiko, N. & Kokhanov, V (1997) The cormorant *Phalacrocorax carbo* in Kandalaksha Bay (White Sea, Russia) in: *Ekologia Polska* Vol. 45, no. 1, p. 15. 1997. Abstract

**Lehikoinen, Aleks**i & Alexander V. Kondratyev, Timo Asanti, Esko Gustafsson, Olli Lamminsalo, Nikolay V. Lapshin, Jorma Pessa and Pekka Rusanen (2005). Survey of arctic bird migration and staging areas at the White Sea, in the autumns of 1999 and 2004. <http://www.ymparisto.fi/download.asp?contentid=56350&lan=fi>.

### SPAIN

**Onrubia, A.**, (1999) Cormorant Grande *Phalacrocorax carbo carbo*: Breeding at Reservoir Ullibarri-Gamboa. *Noticiario Ornitologico* [www.ardeola.org/files/ardeola\\_499.pdf](http://www.ardeola.org/files/ardeola_499.pdf).

**Lekuona, Jesús M.** 2002. Ecología Trófica Del Cormorant Grande *Phalacrocorax Carbo Sinensis* Durante La Época Reproductora En Una Zona De Reciente Colonización (Valle Del Ebro), in: *Ardeola* 49(2), 2002, 241-247.

**De la Cruz, M. A.** (2004). Most important Spanish Cormorant colony Embalse de Rosarito. *Noticiario Ornitologico* [www.ardeola.org/files/Ardeola\\_51\(2\)\\_543-557.pdf](http://www.ardeola.org/files/Ardeola_51(2)_543-557.pdf).

## Appendix I: Sources for Maps of Cormorant Colonies Europe (3)

### LITHUANIA

**Jusys, V.** (1997). The cormorant *Phalacrocorax carbo* in western Lithuania

Ekologia Polska Vol. 45, no. 1, pp. 69-70. Abstract.

**Zydelis, R., et al.** 2002, Expansion of the Cormorant (*Phalacrocorax Carbo Sinensis*) population in Western Lithuania, Acta Zoologica Lituonica, 2002, Volumen 12, Numerus 3.

### POLAND

**Gmitrzuk K.** 2004. Influence of cormorant *Phalacrocorax carbo* on water and forest ecosystems of Wigierski National Park,

<http://www.wigry.win.pl/kormorany.htm>.

**Pajkert, Z; & Gorski, W** (1997) Breeding ecology of cormorants *Phalacrocorax carbo sinensis* in Slowinski National Park (northern Poland). Ekologia Polska Vol. 45, no. 1, pp. 181-183. Abstract.

**Poluda, AM; Chernichko, II; Serebryakov, VV; Siokhin, VD; Korzyukov, AI; Zhmud, ME; Koshelev, AI; Shchegolev, I; Belashkov, ID** (1997) The cormorant *Phalacrocorax carbo* in Ukraine Ekologia Polska Vol. 45, no. 1, pp. 105-110. 1997. Abstract.

**Przybysz, J; Mellin, M; Mirowska-Ibron, I; Przybysz, A; Gromadzka, J.** 1997. Recent development of the cormorant *Phalacrocorax carbo sinensis* population in Poland.

Ekologia Polska Vol. 45, no. 1, pp. 111-115. Abstract.

### GERMANY, MECKLENBURG

**Müller Siegmur,** 1999. Kormoran *Phalacrocorax carbo*: Brutvorkommen, Ornithologische Arbeitsgemeinschaft Mecklenburg-Vorpommern, Jahresbericht 1999

### DENMARK

**Bregnballe, Thomas & Jörn Eskildsen** (2008). Danmarks ynglebestand af skarver i 2007 (Breeding Population of Cormorants).

<http://www.dmu.dk – NyhedsbrevVIBI>.

### NETHERLANDS

**Meininger, Peter L. & Rob C.W. Strucker** (2001), Kustbroedvogels in het Deltagebied in 2001, NL, Directoraat Generaal Rijkswaterstaat

**SOVON Vogelonderzoek Nederland** (2008). Aalscholver: Verspreiding en aantalsontwikkeling. Published

<http://www.sovon.nl/soorten.asp?euring=720>, (last retrieved 2010-03-29)



## Appendix I: Sources for Maps of Cormorant Colonies Europe (4)

### BELGIUM

**Jacob, J. P. et al.** (1999) Le cormorans en Wallonie (Belgique, map of breeding colonies).

<http://mrw.wallonie.be/dgrne/sibw/organisations/OFFH/progISB/oiseaux/cormoran.html>.

**Coussement M.** (2004) De impact van aalscholvers op visbestanden in private wateren in Vlaanderen, Milieucel V.V.H.V.

### FRANCE

**Conseil Supérieur de la Pêche, France / Alsace**(2006), Le Grand Cormoran, Evolution de la population hivernante e de la population nicheuse de 1997 a 2005

### SPAIN

**Onrubia, A.**, (1999) Cormoran Grande Phalacrocorax carbo carbo: Breeding at Reservoir Ullibarri-Gamboa. Noticiario Ornitologico [www.ardeola.org/files/ardeola\\_499.pdf](http://www.ardeola.org/files/ardeola_499.pdf).

**Lekuona, Jesús M.** 2002. Ecología Trófica Del Cormoran Grande Phalacrocorax Carbo Sinensis Durante La Época Reproductora En Una Zona De Reciente Colonización (Valle Del Ebro), in: Ardeola 49(2), 2002, 241-247.

**De la Cruz, M. A.** (2004). Most important Spanish Cormorant colony Embalse de Rosarito. Noticiario Ornitologico [www.ardeola.org/files/Ardeola\\_51\(2\)\\_543-557.pdf](http://www.ardeola.org/files/Ardeola_51(2)_543-557.pdf).

### ITALY

**Veronesi, Eva** , Bregnballe, Thomas & Jens Gregersen (1999). Evoluzione di due grandi colonie di cormorano (Italy).

**Regione Emilia-Romagna, Italia** (post 1994).Cormorano *Phalacrocorax carbo* Status e Distribuzione. <http://www.regione.emilia-romagna.it/agricoltura/faunistico>.

**Volponi, Stefano** (1999). Reproduction of a Newly-Established Population of the Great Cormorant in Northeastern Italy. *Waterbirds: The International Journal of Waterbird Biology*, Vol. 22, No. 2 (1999), pp. 263-273

**Toffoli, Roberto** (2003). Il cormorano phalacrocorax carbo in Provincia di Cuneo, Ente Tutela Faunistica Cuneo

## Appendix I: Sources for Maps of Cormorant Colonies Europe (5)

### BELARUS

**Samusenko, I;** Nikiforov, M; Kozulin, A. (1997). Status of the cormorant *Phalacrocorax carbo* in Belarus: Distribution and population trends. *Ekologia Polska* Vol. 45, no. 1, pp. 119-121. 1997. Abstract.

**Nikiforov, Michael** (2003). Distribution trends of breeding bird species in Belarus under conditions of global climate change, *Acta Zoologica Lituanica*, Vol 13, Num 3.

### BULGARIA

**Ivanov, B;** Michev, T; Nankinov, D; Pomakov, V; Profirov, L (1997). Breeding and wintering status of the cormorant *Phalacrocorax carbo* in Bulgaria, in *Ekologia Polska* Vol. 45, no. 1, pp. 63-68. Abstract.

### ROMANIA

**Romania Tourism Board** (2007) Breeding Cormorants in the Danube Delta, <http://www.romaniatourism.com/delta.html>.

### HUNGARY / CROATIA

**Fishery Associations** (pers. information)

### SLOVAKIA

**Chladecki, Boris** (2007). Slovak Angling Association, pers. Mitteilungen

### SWITZERLAND

**Rapin, P.** (2003) Kormoran *Phalacrocorax carbo*: Erster Schweizer Brutnachweis von Wildvögeln, in: *NosOiseaux*, N°471 - Volume 50 / 1 - mars 2003

**SFV Schweizer Fischereiverband** (2007). Kormoran-Brutbestand, in: *Petri Heil* 6/2007

### AUSTRIA

**BirdLife Österreich** 2006/08. Positionspapier Fischfresser. [http://www.birdlife.at/downloads/BirdLife\\_Fischfresser\\_Position.pdf](http://www.birdlife.at/downloads/BirdLife_Fischfresser_Position.pdf).

**Fischereiverband Vorarlberg** (2005-08). Var. Press-Releases / Articles

**Zuna-Kratky, Thomas & Manuel Denner** (2005). Die Situation der Fischfresser-Kolonien in den March-Thaya-Auen im Jahr 2004. [http://www.auring.at/\\_pdf/Fischfresser\\_MTA\\_2004.pdf](http://www.auring.at/_pdf/Fischfresser_MTA_2004.pdf).

## Appendix II: Sources for Breeding Population / Breeding Pairs (1)

### MULTI-NATIONAL SOURCES

**Danish Miljøministeriet** Skov- og Naturstyrelsen (ed.) 1992. Forvaltningsplan for Skarven i Danmark (Management Plan for Cormorants in Denmark)

**Staub**, E. et al (1992), Grundlagenbericht zum Thema Kormoran und Fische, BUWAL Bundesamt für Wald und Landschaft CH

**Knief**, W. 1994. Zum sogenannten Kormoran-"Problem". Staatliche Vogelschutzwarte Schleswig Holstein D - 24118 Kiel, (Stellungnahme-Bestand, Verbreitung, Nahrungsökologie, Managementmaßnahmen), Natur und Landschaft 6 69: 251 - 258

**Debout** G., N. Røv & Sellers R. M. 1995. Status and population development of Cormorants *Phalacrocorax carbo carbo* breeding on the Atlantic coast of Europe. *Ardea*, 83 (1): 47--59

**Van Eerden**, M. R. & Gregersen, J. 1995. Long-term Changes in the Northwest European Population of Cormorants *Phalacrocorax carbo sinensis*. *Ardea* 83 : 61 - 79

**Lindell** L. et al. 1995. Status and population development of breeding Cormorants *Phalacrocorax carbo sinensis* of the central European flyway. *Ardea*, 83 (1): 81-92.

**Suter** W. 1995. Are Cormorants *Phalacrocorax carbo* wintering in Switzerland approaching carrying capacity? An analysis of increase patterns and habitat choice. *Ardea*, 83 (1): 255-266.

**Veldkamp**, R. 1996. Cormorants *Phalacrocorax carbo* in Europe. A first step towards a European management plan. Report by order of: The National Forest and Nature Agency, Denmark, and The National Reference Centre for Nature Management, The Netherlands

**BirdLife Factsheet Cormorants** (2004) Cormorant Breeding Pairs Europe  
([www.birdlife.org/datazone/species/BirdsInEuropeII/BiE2004Sp3679.pdf](http://www.birdlife.org/datazone/species/BirdsInEuropeII/BiE2004Sp3679.pdf))

**Carss**, D. N. & M. Marzano (eds.) 2005. REDCAFE Summary & National Overviews (various country reports by national experts).

**EIFAC** (2007) Workshop on a European Cormorant Management Plan, Bonn, 20–21 November 2007

**Wetlands International** Cormorant Research Group, van Eerden et al. (2008). Cormorants in the Western Palearctic (Folder with results of pan-european census of Breeding Population 2006; aggregated data only)

**EU Commission DG Environment** (2009). Interaction between Cormorants and fisheries. Overview of phone interviews with the Member States. As revised by 31 March 2009. Published on [http://circa.europa.eu/Public/irc/env/wild\\_birds/library?l=/cormorants](http://circa.europa.eu/Public/irc/env/wild_birds/library?l=/cormorants)

**Helkom Habitat** (2009). Fact Sheet on Population Development of Baltic Bird Species Great Cormorant *Phalacrocorax carbo sinensis*

**Baltic Cormorant Symposium** Helsinki (2010). Organised by Finnish Environment Institute Timo Asanti), 2010 Jan 26-28

## Appendix II: Sources for Breeding Population / Breeding Pairs (1a)

### (1) BirdLife Fact Sheet

<http://www.birdlife.org/datazone/species/BirdsInEuropeII/BiE2004Sp3679.pdf>

#### *Phalacrocorax carbo* GREAT CORMORANT



Non-SPEC (1994: —) Status Secure

Criteria —

European IUCN Red List Category —

Criteria —

Global IUCN Red List Category —

Criteria —

*Phalacrocorax carbo* breeds patchily across much of Europe, which accounts for less than half of its global breeding range. Its European breeding population is large (>310,000 pairs), and underwent a large increase between 1970–1990. The species continued to increase during 1990–2000, with almost all national trends either stable or increasing, including those of key populations in Denmark, Ukraine and Russia. Consequently, it is evaluated as Secure.



Country	Breeding pop. size (pairs)	Year(s)	Trend	Magn%	References
Albania	0 – 0	96–02	–	X	
Austria	0 – 33	03	+	N	
Azerbaijan	2,000 – 4,000	96–00	(?)	(0–19)	
Belarus	1,300 – 1,500	97–00	+	50–79	2
Belgium	900 – 1,000	01–02	+	>80	1
Bosnia & HG	Present	85–89	?	–	1
Bulgaria	2,000 – 2,900	95–02	+	>80	
Croatia	2,000 – 3,000	02	0	0–19	26
Czech Rep.	170 – 190	00	–	50–79	
Denmark	36,000 – 41,000	97–00	0	0–19	1
Greenland	5,000 – 5,000	95–00	+	0–19	4
Estonia	9,000 – 10,000	98	+	50–79	1
Finland	800 – 1,200	02	+	N	
France	3,350 – 3,350	00	+	50–79	1
Georgia	Present	03	?	–	
Germany	16,800 – 16,800	95–99	+	0–19	
Greece	4,300 – 4,300	02	+	20–29	
Hungary	1,800 – 3,000	95–02	+	>80	
Iceland	2,600 – 3,700	75–94	(?)	(–)	13
Rep. Ireland	4,550 – 4,550	99–02	+	0–19	
Italy	880 – 880	00	+	30–49	16
Latvia	400 – 500	90–00	+	>80	17
Lithuania	2,500 – 3,000	99–01	+	>80	20
Luxembourg	Present	02	?	–	
Macedonia	(400 – 600)	98–00	(?)	(30–49)	
Moldova	300 – 500	90–00	0	0–19	
Netherlands	18,400 – 19,500	90–00	+	10	1
Norway	20,000 – 25,000	96–01	+	0–19	25,20,63
Poland	12,500 – 12,500	00	+	200–230	2
Romania	18,000 – 20,000	99–02	+	0–19	47
Russia	35,000 – 60,000	90–00	0	0–19	8,11,120,58,60, 82,120,154,155
Serbia & MN	2,100 – 2,400	00–02	+	50–79	363,65,186,212, 200,198,201
Slovakia	50 – 250	80–99	+	50–79	
Spain	0 – 50	98–02	+	>80	10
Sweden	25,000 – 26,000	99–00	+	>80	
Switzerland	0 – 7	00–02	+	N	
Turkey	3,000 – 4,500	01	+	30–49	
Ukraine	65,000 – 75,000	90–00	+	50–79	
UK	9,100 – 9,100	99–02	+	27	20
Total (approx.)	310,000 – 370,000		Overall trend	Large increase	
Breeding range	>1,000,000 km <sup>2</sup>		Gen. length 11	% Global pop. 25–49	(See p. 28, bottom, for data quality graph)
		Winter pop. size (individuals)			
Total (approx.)	>420,000		Overall trend	Large increase	
% in European BAs	41–44		Gen. length 11	% Global pop. 25–49	

## Appendix II: Sources for Breeding Population / Breeding Pairs (2)

### MULTI-NATIONAL SOURCES continued

**Bregnballe, T., Volponi, St., van Eerden, M. R., van Rijn, St. & Lorentsen, S-H. (2011)** Status of the breeding population of Great Cormorants *Phalacrocorax carbo* in the Western Palaearctic in 2006. Proceedings of the 7th International Conference on Cormorants November 2005 Villeneuve.

**Bregnballe, T., Lynch, J., Parz-Gollner, R., Marion, L., Volponi, S., Paquet, J-Y. & van Eerden, M.R. (eds.) 2013.** National reports from the 2012 breeding census of Great Cormorants *Phalacrocorax carbo* in parts of the Western Palearctic. IUCN-Wetlands International Cormorant Research Group Report. Aarhus University, DCE. Danish Centre for Environment and Energy, 106 pp. Technical Report from DCE. Danish Centre for Environment and Energy No. 22. . <http://dce2.au.dk/pub/TR22.pdf>

**Bregnballe, T., Lynch, J., Parz-Gollner, R., Marion, L., Volponi, S., Paquet, J.-Y., David N. Carss & van Eerden, M.R. (eds.) 2014.** Breeding numbers of Great Cormorants *Phalacrocorax carbo* in the Western Palearctic, 2012/2013. IUCN-Wetlands International Cormorant Research Group Report. - Scientific Report from DCE – Danish Centre for Environment and Energy No. 99, 224 pp. <http://dce2.au.dk/pub/SR99.pdf>

### ADDITIONAL NATIONAL & LOCAL SOURCES

#### AUSTRIA

**Aubrecht, Gerhard (1991).** Historische Verbreitung und aktuelle Brutversuche des Kormorans in Österreich. In: Vogelschutz in Österreich Nr. 6. Mitteilungen der Österr. Gesellschaft für Vogelkunde

**Zuna-Kratky, T. & Mann, H. 1994a.** Der Kormoran. Winterbestand, Nahrungsökologie und Auswirkung auf die Fischfauna in den Donau-Auen östlich von Wien. WWF Studienreihe Studie 16

**Kohl, F. (1996).** Kormorane und Fische, Naturschutz und Fischerei. Eine Dokumentation des ÖKF

**Zuna-Kratky, Thomas & Denner, Manuel (2005).** Die Situation der Fischfresser-Kolonien in den March-Thaya-Auen im Jahr 2004

**Rey, Peter & Becker, Andreas (HYDRA), 2005.** Kormorane in der Fußacher Bucht. Expertise im Auftrag der Vorarlberger Landesregierung  
**Vorarlberger Landesregierung (2008).** Schreiben an die EU Kommission DG 15 betr. Regulierung des Kormoranbestands in der Fußacher Bucht, per 21. August 2008

**Niederer, Walter & Leib, Vera (2010),** Die Bestandsituation des Kormorans im Naturschutzgebiet Rheindelta im Sommerhalbjahr 2009

**Grabher, Gernot (2010).** Bodensee-Fischer mit Sorgenfalten. Petri Heil Sept 2010

**Vorarlbergs Fischerei, 2011 09,** Kormorane verlegen Brut ins Eriskirchner Ried



## Appendix II: Sources for Breeding Population / Breeding Pairs (3)

### ADDITIONAL NATIONAL & LOCAL SOURCES

#### **AUSTRIA (continued)**

**Auring.** 2012. Die Situation der Fischfresser-Kolonien in den March-Thaya-Auen im Jahr 2012

**Nemeth, Erwin.** 2014. Die Brutbestände der Reiher, Löffler und Zwergscharben im Neusiedler See-Gebiet im Jahr 2014. In: Ornithologisches Monitoring im Nationalpark Neusiedler See–Seewinkel. Bericht über das Jahr 2014, S. 41-431

**Ornithologische Arbeitsgemeinschaft Bodensee.** 2014. Ornithologischer Rundbrief für das Bodenseegebiet Nr. 214 / November 2014

**Niederer W.,** 2014. Der Kormoran im Naturschutzgebiet Rheindelta

#### **BELGIUM**

**Devos, Koen & Anselin, Anny** (2007). Aalscholvers in Vlaanderen. Telresultaten 2006-2007.

**Coussement, M.** (2008). De impact van aalscholvers op visbestanden in private wateren 2008 (Milieucel V.V.H.V.)

**Devos, Koen** (2009). Aalscholvers in Vlaanderen. Telresultaten 2008-2009

**Devos, Koen** (2013). Vlaamse Aalscholver over hun hogtepunt. In: Instituut voor Natuur- en Bosonderzoek. <http://www.natuurbericht.be>

#### **DENMARK**

**Bregnballe, Thomas & Eskildsen, Jörn** (2009). Forvaltning af skarvkolonier i Danmark 1994-2008

**Bregnballe, T. & Eskildsen, J.** (2010) Danmarks ynglebestand af skarver i 2010

**Bregnballe T., Rasmussen J.S. & Therkildsen O. R.** (2011) Danmarks ynglebestand af skarver i 2011. Nyhetsbref Nationalt Center for Miljø og Energi. Aarhus University

**Bregnballe T. & Therkildsen O. R.** (2011) Danmarks ynglebestand af skarver i 2011. Nyhetsbref Nationalt Center for Miljø og Energi. Aarhus University

**Bregnballe, T., Hyldgaard, A.M. & Therkildsen, O.R.** 2013. Danmarks ynglebestand af skarver i 2013. Aarhus Universitet, DCE – Nationalt Center for Miljø og Energi, 30 s. - Teknisk rapport fra DCE - Nationalt Center for Miljø og Energi nr. 26

**Bregnballe, T. & Therkildsen, O.R.** 2014. Danmarks ynglebestand af skarver i 2014. Aarhus Universitet, DCE – Nationalt Center for Miljø og Energi, 24 s. - Teknisk rapport fra DCE - Nationalt Center for Miljø og Energi nr. 41

**Bregnballe, T. & Nitschke, M.** 2015. Danmarks ynglebestand af skarver 2015. Aarhus Universitet, DCE – Nationalt Center for Miljø og Energi, 34 s. - Teknisk rapport fra DCE - Nationalt Center for Miljø og Energi nr. 63 <http://dce2.au.dk/pub/TR63.pdf>

#### **ESTONIA**

**Ojaste, Ivar & Rattiste, Kaley** (2010) Cormorants in Estonia. ppt-Presentation at Helsinki Cormorant Symposium 2010 Jan 26-28

## Appendix II: Sources for Breeding Population / Breeding Pairs (4)

### ESTONIA

**Ojaste**, Ivar & Rattiste, Kalev (2010) Cormorants in Estonia. ppt-Presentation at Helsinki Cormorant Symposium 2010 Jan 26-28

### FINLAND

**Finnish Environment Institute** (2008). Breeding population of cormorants 1996-2008 Figures & Diagrams

**Finnish Environment Institute** (2010). Numbers of breeding cormorants declined due to harsh winter conditions. Figures & Diagrams

<http://www.ymparisto.fi/default.asp?contentid=364476&lan=en>

**Finnish Environment Institute** (2012) Cormorant Breeding Pairs 2004 - 2011

**Finnish Environment Institute** (2013) Slight increase in the Cormo

**Finnish Environment Institute** (2014) Cormorant population exceeds 20,000 breeding pairs

**Finnish Environment Institute** (2015) Cormorant population grew to 24,000 breeding pairs <http://www.syke.fi/en>

[S/Research\\_\\_Development/Maintaining\\_ecosystem\\_services\\_and\\_biodiversity/Cormorant\\_population\\_grew\\_to\\_24000\\_breed\(34247](S/Research__Development/Maintaining_ecosystem_services_and_biodiversity/Cormorant_population_grew_to_24000_breed(34247)

### GERMANY

**Fischer und Teichwirt** (1996). Kormorant Brut- und Rastbestand in Deutschland, nach Ländern. Heft 9/1996

**Bundesregierung Deutschland** (2006). Antwort auf parlamentarische Anfrage Christel Kasan et. al. betr. Schäden in der deutschen Fischereiwirtschaft und an der heimischen Fischfauna durch Kormorane ( 21.03.2006, Drucksache 16706)

**Kieckbusch**, J. J. & Knief, W. (2006). Brutbestandsentwicklung des Kormorans (*Phalacrocorax carbo sinensis*) in Deutschland und Europa. In: Herzig & Böhnke ed (2007) Fachtagung Kormorane (Bundesamt für Naturschutz BfN Skripten 204)

**NABU Naturschutzbund Deutschland** (2010). Broschüre "Kormoran-Vogeldes Jahres 2009", Grafik zur Entwicklung der Kormoran-Brutpaare basierend auf Daten von Knief

**Herrmann**, Christof (2010). Development of Cormorants in Germany. ppt-Presentation at Helsinki Cormorant Symposium 2010 Jan 26-28

### GREENLAND & ICELAND

**Boertmann**, David & Mosbech, Anders (1997). Breeding distribution and abundance of the great cormorant *Phalacrocorax carbo carbo* in Greenland.

**Lilliendahl** Kristjan & Solmundsson Jon (2006). Feeding ecology of sympatric European shags *Phalacrocorax aristotelis* and great cormorants *P. carbo* in Iceland

**Focus on Nature Tours** (2009). Iceland Birds. Website <http://www.focusonnature.com/BirdListAllIceland.html>

## Appendix II: Sources for Breeding Population / Breeding Pairs (5)

### NETHERLANDS

**Heinis**, F., van der Vegte, J. W., de Vlas, J., van Edden, M. & Jager, Z. (2005). Effecten MV2 op de Waddenzee en Noordzeekust

**SOVON Vogelonderzoek Nederland** (2008). Aalscholver: Verspreiding en aantalsontwikkeling. Published

<http://www.sovon.nl/soorten.asp?euring=720>, (last retrieved 2010-03-29)

**SOVON NL** 2013-1 Broedvogels Nederland Rap\_2013-1\_Broedvogelrapport 2011

**SOVON NL** 2014 Broedvogels NL Rap\_2014-13\_Broedvogels-2012

**SOVON NL** 2014 De Aalscholver als broedvogel in Nederland in 2014

### POLAND

**Bzoma**, Szymon (2010), National report Cormorants in Poland, ppt-Presentation at Helsinki Cormorant Symposium 2010 Jan 26-28

**Krzywosz** T. & Trczuk P. (2011). Einfluss des Kormorans und anderer Raubtiere auf den Zustand und die Perspektiven der polnischen Ichthyofauna. Powerpoint-Vortrag Symposium Spala Dec. 2012 (Übermittlung Prof. Steffens).

### SPAIN

**Lekuona**, Jesús M. (2002). Ecología Trófica del Cormoran Grande en una zona de reciente colonización (Valle del Ebro). *Ardeola* 49(2), 2002, 241-247

### SWEDEN

**Engström**, Henri (2001). Effects of Great Cormorant Predation on Fish Populations and Fishery. Comprehensive Summaries of Uppsala Dissertations 670

**Engström**, Henri (2010). Cormorants in Sweden, ppt-Presentation distributed at Helsinki Cormorant Symposium 2010 Jan 26-28

### SWITZERLAND

**Rippmann** U., Müller W., Peter M. & Staub E. (2005). Erfolgskontrolle Kormoran und Fischerei, Bericht der Arbeitsgruppe Kormoran und Fischerei (Switzerland)

**SFV** Schweizer Fischereiverband (2008). Kormoranpetition (22. Aug. 2008)

**Robin**, Klaus & Graf, Roland F. (2008). Zum Management des Kormorans *Phalacrocorax carbo sinensis* am Neuenburgersee während der Brutzeit



## Appendix II: Sources for Breeding Population / Breeding Pairs (6)

### SWITZERLAND (continued)

**Vet-Magazin** (2008). Schweiz: neue Wege im Umgang mit dem Kormoran

(<http://www.vet-magazin.com/wissenschaft/meldungen/Wildtiere/Kormoran-Schweiz.html>)

**swissinfo.ch** 9. April 2010, [http://www.swissinfo.ch/ger/politik\\_schweiz/Streit\\_um\\_den\\_Kormoran](http://www.swissinfo.ch/ger/politik_schweiz/Streit_um_den_Kormoran)

**BAFU Pressemitteilung**, 2010 04 21 Kormorane am Neuenburgersee - Kantone erhalten teilweise grünes Licht

**Keller**, Verena & Müller, Claudia (2011) Kormoranbruten in der Schweiz 2010 und 2011. Quelle: Schweizerische Vogelwarte Sempach. [www.vogelwarte.ch](http://www.vogelwarte.ch)

**Keller**, V. & C. Müller (2012): Breeding colonies of Great Cormorants *Phalacrocorax carbo* in Switzerland 2012. Swiss Ornithological Institute, Sempach. 9 pp

**Keller**, V. & Müller, C. (2013). Breeding colonies of Great Cormorants *Phalacrocorax carbo* in Switzerland in 2012. Western Palearctic census of breeding Cormorants 2012. National report for Switzerland

**Keller**, V. & Müller, C. (2013). Kormoranbruten Schweiz 2013. In: [Vogelwarte.ch](http://www.vogelwarte.ch)

**Keller**, V. & Müller, C. (2015). Kormoranbruten Schweiz 2014. In: [Vogelwarte.ch](http://www.vogelwarte.ch)

### UK & IRELAND

**Seabird Census 2000** UK (2004). Great Cormorant - Tables, maps and international data

**Seabird 2000**. Mitchell, P. Ian, Newton, Stephen F., Ratcliffe, Norman and Dunn, Timothy E. (2004). Seabird Populations of Britain and Ireland. Executive Summary

**Sellers**, RM (2006) Cormorant breeding colony survey 2006. UK. Report No. CBCS-R-024. Unpublished report.

**Baker**, Helen et al. (2006). Population estimates of birds in Great Britain and the United Kingdom

**Seabird 2006**. Mavor, R.A., Heubeck, M., S. Schmitt and Parsons, M. 2008. Seabird numbers & breeding success in Britain and Ireland 2006

**UK Seabirds in 2008**, ed.JNCC (Joint Nature Conservation Committee)

### UKRAINE

**Schogolev**, I., Rudenko, A. & Crivelli, A.J. (2005). Status of pelicans and cormorants on the northern Black Sea

**Nemtsov**, Simon C., 2008, Israel-Ukraine Cooperation for Experimental Management of a Shared Overabundant Population of Great Cormorants (*Phalacrocorax carbo*). In: Proc. 23rd Vertebr. Pest Conf. Published at Univ. of Calif., Davis. 2008