Brief review of Japanese longline fishery and its albacore catch in the Indian Ocean

by

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1. Introduction

There are two kinds of Japanese tuna fishery in the Indian Ocean, i.e. longline and purse seine fisheries. In those fisheries only the longline fishery has caught albacore. The longline fishery was commenced in 1952 in the eastern equatorial waters in the Indian Ocean, The fishing effort of the longline first expanded westward, and then southward. In the late 1960s, the effort covered entire fishing ground of the longline in the Indian Ocean. The annual amount of the effort has changed since the late 1960s. And also annual albacore catch have considerably changed, ranging from 400 t to 18,000 t (Table 1), as well as catches of other tunas. Those changes were mainly due to the change of targeting as seen in the other Oceans.

In this document, historical and spatial changes of albacore catch and the fishing effort were described conjunction with the catches of the other tunas. In addition to this, the size data of albacore caught by the longline was shown to seek the possibility of the application of the age-structured stock assessment for Indian albacore stock, which might be introduced in the Working Party on Temperate Tuna, IOTC in the future.

2. Data source

In order to count number of hooks and catches in number of tunas and billfish, basic data used here is the logbook data that has been compiled at National Research Institute of Far Seas Fisheries (NRIFSF) based on the logbook mandatory submitted by the fishermen of the longline vessel larger than 20 gross ton (GRT). The data is so-called “raised” data, which is aggregated by month and 5˚x5° block, and then expanded with coverage rate of the logbook. The basic data is available for1952-2002. The geographical range as the "Indian Ocean" to count the amount of the effort and the catches from the basic data is shown in Fig.1a.

There were a few sources of the size data for the albacore, i.e. onboard measurement by training vessels and commercial vessels, and port sampling at Yaizu and Tokyo. The data was collected and compiled at NRIFSF and is available for 1965-2002. Area stratification to compute the area-specific sample number of the measurement is shown in Fig.1b.

3. Trend of catch and effort

Table 2 and Fig. 2a shows that after the beginning of the exploitation by this fishery in the Indian Ocean annual fishing effort increased until 1966 then fluctuated ranging from 50% to 99% of the peak year. The albacore catch peaked (1,010 thousands fish) in 1962, then decreased to 100 thousands fish in 1972, corresponding to 10% of the level in peaked year, and then became relatively stable at the level ranging from 3% to 27% of the peak year. Following is the detailed description for the temporal and spatial changes of the catch and the effort.

In the 1950s, where the effort increased (Fig. 2a), the effort was deployed mainly in the region north of 15˚S (Fig. 3-1a). The main component of the catch was yellowfin tuna in this fishing ground (Fig. 2b).

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Following this period, the effort continued to increase up to 130 million hooks until the late 1960s (Fig.2a). In this period, the total catch of four species of tunas, i.e., yellowfin, albacore, southern bluefin and bigeye tunas was historical highest, and species-specific catches were also the highest for yellowfin, albacore and bluefin tunas (Fig. 2b). Of the four species, yellowfin tuna was the most dominant catch in this period, to the lesser extent, albacore and southern bluefin tuna. Also the catch of bigeye tuna in this period increased compared to the 1950s. In this period, fishing ground of this fishery expanded to southward, in the west side and the east side of the Indian Ocean, excluding the southern central of the Indian Ocean (Fig. 3-2a). Albacore catch was large in the region between 10˚S and 35˚S, where correspond to the region of South Equatorial Current (Sub-tropical waters). The CPUE of albacore was also high in the west side of the region (Fig. 3-2b), eventually increasing overall CPUE of entire Indian Ocean (Fig. 2c), but in the west side the CPUE were lower compared with west side. In the west side of this region, the main component of the catch was albacore (Fig. 4-2), on the other hand, southern bluefin tuna was the largest component in the east side.

In the period from the late 1960s to the late 1970s, the effort decreased to about 60 million hooks, about 50% of the peak year (Fig. 2a). In this period, each catch of yellowfin and albacore drastically decreased compared to that in the previous period (Fig. 2b). This decrease of those catches was due to withdrawing in the effort from the fishing ground ranging from 10˚S to 35˚S (Fig. 3-3a).

In the period from the late 1970s to the mid 1980s, the effort increased again and reached to130 million hooks (Fig. 2a), the same level to the previous peak in the 1960s. Those increase of effort was seen in the regions off Somalia and the south of 35˚S, targeting bigeye tuna and high quality (=oily) southern bluefin tuna, respectively (Fig. 3-4a).

In the period from the mid 1980s to the early 1990s, the effort decreased again (Fig. 2a). This decrease was due to the decrease of the effort in the region south of 35˚S, corresponding to the fishing ground for southern bluefin tuna, by introduction of the TAC for southern bluefin tuna in 1986.

In the period from the early 1990s to the late1990s the effort increased (Fig. 2a). The increase was seen in the regions off west coast of Australia probably targeting bigeye tuna, and south of Madagascar Island where yellowfin, albacore and bigeye was mainly fished (Fig. 4-5). In those region albacore was substantialy caought, and this contributes the increase of total catch in the period (Fig. 2a).

As the situation of the longline in the latest years, the geographical distribution of the effort, the albacore catch and the CPUE in 2000, 2001 and 2002 is shown in Fig. 5. This shows there was no substantial change from the situation in the1990s. As mentioned above, since the late 1960s, the longline fishery has been run without targeting albacore, and the effort has not deployed in the region where albacore is abundant in general. Eventually, albacore have been caught only as a bycatch with southern bluefin tuna and bigeye tuna, to lesser extent yellowfin tuna.

4. Size data

Table 3 shows the sample number of measurement for albacore caught by the longline vessel by type of measurement. The annual number of samples is roughly more than five thousand individuals in the period from 1965 to 1990, but then decreased to one to five thousand individuals. The measurement by port sampling contributes only in the earlier period because longer trip made it difficulty to know about the date and position for the catch. Table 4-1 and 4-2 shows the sample number by quarter (and area). The area classification used here is divided into four with 80˚E in latitude and 30˚S in latitude as shown in Fig. 2b. In general the size data tend to be distributed in Area 2, to lesser extent in Area3 particularly in the recent year.

Appendix 1 shows length distribution of the albacore stratified with year, quarter and area for 1965-2002. This shows the length were distributed between roughly 80 cm 120 cm in the northern area (Areas 1 and 2), but the length between roughly 60 cm and 110 cm in the southern area (Areas 3 and 4).

Table 1. Albacore catch in weight (t) caught by Japanese longline Fishery.

Year	Western	Eastern	Total
1952	0	61	61
1953	0	1,094	1,094
1954	75	2,659	2,734
1955	1,192	1,867	3,059
1956	1,609	3,466	5,075
1957	1,483	3,179	4,662
1958	3,667	2,618	6,285
1959	5,246	5,164	10,410
1960	5,872	5,190	11,062
1961	11,393	3,848	15,241
1962	13,694	3,955	17,649
1963	7,565	4,994	12,559
1964	13,249	4,565	17,814
1965	6,496	4,870	11,366
1966	9,746	3,312	13,058
1967	9,702	4,400	14,102
1968	6,857	3,196	10,053
1969	7,708	859	8,567
1970	2,897	2,029	4,926
1971	1,934	1,384	3,318
1972	904	505	1,409
1973	1,143	839	1,982
1974	1,141	1,652	2,793
1975	412	849	1,261
1976	700	473	1,173
1977	217	187	404
1978	184	234	418
1979	234	159	393
1980	331	290	621
1981	602	584	1,186
1982	1,033	259	1,292
1983	1,094	575	1,669
1984	923	907	1,830
1985	1,013	1,268	2,281
1986	1,789	712	2,501
1987	1,496	772	2,268
1988	970	342	1,312
1989	612	278	890
1990	504	450	954
1991	590	392	982
1992	1,570	208	1,778
1993	788	493	1,281
1994	1,141	646	1,787
1995	871	1,168	2,039
1996	1,280	1,133	2,413
1997	2,049	1,184	3,233
1998	2,546	668	3,214
1999	1,377	905	2,282
2000	1,484	1,083	2,567
2001	1,875	1,128	3,003
2002	1,862	1,231	3,093

Table 2. Annual fishing effort (number of hooks) for the Japanese longline fishery and its catch in number by species.

	#of hook	Catch in number (thousand)							
	(thousand)	SBT	ALB	BET	YFT	SWO	STM	BUM	BKM
1952	2,021	6	3	21	131	0	3	9	6
1953	7,071	50	57	53	240	2	7	27	17
1954	12,557	31	142	137	472	4	21	47	25
1955	16,106	24	157	173	972	5	19	51	24
1956	30,064	119	258	281	1,245	10	45	74	41
1957	26,609	193	232	215	728	8	50	57	36
1958	23,269	120	301	191	556	12	46	62	30
1959	34,021	693	524	169	598	12	56	64	28
1960	52,554	1,072	574	314	962	15	52	56	41
1961	59,807	910	777	270	869	17	65	49	35
1962	65,755	432	1,010	419	1,331	22	48	46	45
1963	56,453	649	722	264	655	17	34	27	26
1964	68,342	490	1,010	334	594	21	38	43	34
1965	80,372	459	630	386	767	25	81	50	30
1966	93,511	428	752	479	1,156	29	105	50	31
1967	129,496	787	850	517	903	40	114	51	35
1968	124,438	689	623	541	1,714	30	63	34	44
1969	108,171	674	589	378	771	31	59	26	35
1970	89,731	454	304	342	375	27	45	17	25
1971	96,596	411	228	290	480	24	28	14	16
1972	80,158	467	100	212	294	21	21	14	6
1973	82,768	442	145	138	148	17	15	8	5
1974	88,397	476	182	190	200	18	38	13	10
1975	90,236	322	79	179	249	19	25	10	11
1976	80,284	452	99	61	95	9	14	4	4
1977	62,583	365	33	98	85	6	13	4	2
1978	69,281	259	32	312	170	23	44	13	7
1979	67,728	254	32	122	133	12	25	6	3
1980	91,661	357	47	161	106	13	24	8	4
1981	88,407	294	87	191	159	16	21	10	4
1982	88,257	238	105	283	228	22	15	15	4
1983	116,631	367	141	428	239	26	16	22	6
1984	118,289	296	136	346	245	28	25	19	11
1985	128,438	250	176	410	281	47	25	20	8
1986	123,252	181	204	382	311	30	24	17	5
1987	109,888	152	160	382	238	30	16	13	4
1988	93,254	141	99	295	266	33	6	10	3
1989	82,513	143	68	182	129	21	3	5	2
1990	52,576	86	68	199	175	23	2	4	1
1991	62,434	98	61	208	122	20	4	3	1
1992	59,284	102	127	133	142	25	3	3	1
1993	52,337	80	96	214	172	24	2	4	1
1994	81,657	90	141	393	253	39	5	8	1
1995	92,232	69	148	395	222	27	5	5	1
1996	107,875	79	179	384	326	33	6	7	1
1997	126,309	97	275	433	382	46	7	15	1
1998	124,226	136	237	407	443	39	6	16	2
1999	107,647	119	157	348	410	26	6	11	2
2000	103,238	65	200	336	433	26	7	12	1
2001	109,439	92	223	320	401	21	3	6	1
2002	102,793	54	212	309	403	23	3	6	1

Table 3. Number of fish measured on the albacore length by type of measurement.

	Onboad			Port sampling		Total
	Training Vessel	Commercial vessel	SBT related survay	Training Vessel	Commercial vessel	
1965	0	0	0	21,944	7,237	29,181
1966	0	0	0	17,344	7,188	24,532
1967	5,697	0	0	0	4,388	10,085
1968	4,206	0	0	0	2,718	6,924
1969	5,480	0	0	0	3,017	8,497
1970	6,375	0	0	0	881	7,256
1971	7,982	0	0	0	1,010	8,992
1972	4,819	0	0	0	0	4,819
1973	7,398	0	0	0	150	7,548
1974	7,369	0	0	0	240	7,609
1975	4,157	0	0	0	0	4,157
1976	8,644	0	0	0	0	8,644
1977	5,583	0	0	0	0	5,583
1978	5,076	0	0	0	0	5,076
1979	4,831	0	0	0	0	4,831
1980	5,818	0	0	0	0	5,818
1981	13,694	0	0	0	0	13,694
1982	10,554	0	0	0	0	10,554
1983	9,265	0	0	0	0	9,265
1984	9,299	0	0	0	0	9,299
1985	14,006	0	0	0	0	14,006
1986	14,047	266	0	0	0	14,313
1987	12,848	60	0	0	0	12,908
1988	7,121	79	0	0	0	7,200
1989	6,873	1,261	0	0	0	8,134
1990	6,982	1,147	0	0	0	8,129
1991	2,368	624	0	0	0	2,992
1992	1,582	2,064	2,127	0	0	5,773
1993	742	848	278	0	0	1,868
1994	103	753	88	0	0	944
1995	266	654	293	0	0	1,213
1996	291	68	777	0	0	1,136
1997	570	2,279	2,464	0	0	5,313
1998	969	379	957	0	0	2,305
1999	171	1,600	1,521	0	0	3,292
2000	238	2,077	1,190	0	0	3,505
2001	51	2,116	2,012	0	0	4,179
2002	27	2,128	440	0	0	2,595

Table 4-1. Number of fish measured on the albacore length data for Japanese longline fishery by area. Area classification was shown in Fig. 1b. Only the resolution of month 5˚x5˚ block were indicated.

Year	Area1	Area2	Area3	Area4	Total
1965	3,487	10,856	12,798	127	27,268
1966	7,694	9,053	6,414	0	23,161
1967	260	6,525	702	2,137	9,624
1968	470	5,016	0	590	6,076
1969	372	4,136	3,596	200	8,304
1970	106	6,255	795	0	7,156
1971	19	7,036	0	1,276	8,331
1972	22	4,797	0	0	4,819
1973	1,036	6,351	0	11	7,398
1974	0	7,353	256	0	7,609
1975	245	3,895	17	0	4,157
1976	44	8,600	0	0	8,644
1977	4	5,578	0	0	5,582
1978	0	4,781	295	0	5,076
1979	97	4,237	495	2	4,831
1980	6	5,748	47	0	5,801
1981	20	13,436	238	0	13,694
1982	841	9,343	360	10	10,554
1983	173	7,915	1,087	90	9,265
1984	297	8,557	445	0	9,299
1985	243	12,984	779	0	14,006
1986	25	14,022	266	0	14,313
1987	92	12,759	57	0	12,908
1988	36	7,118	43	3	7,200
1989	342	6,848	919	25	8,134
1990	707	6,982	440	0	8,129
1991	19	2,465	508	0	2,992
1992	0	1,582	3,227	964	5,773
1993	92	754	1,015	7	1,868
1994	507	103	317	16	943
1995	48	266	759	140	1,213
1996	0	267	790	79	1,136
1997	40	595	4,626	52	5,313
1998	52	966	1,155	132	2,305
1999	161	326	1,302	452	2,241
2000	152	340	2,803	210	3,505
2001	1,237	112	2,756	16	4,121
2002	2,078	64	453	0	2,595

Table 4-2. Number of fish measured on the albacore length data for Japanese longline fishery by area and quarter. Area classification was shown in Fig. 1b. Only the resolution of month 5˚x5˚ block were indicated.

Year	Qt	Area1	Area2	Area3	Area4	Total
1965	1	799	3,502	0	100	4,401
1965	2	1,943	3,816	2,567	0	8,326
1965	3	604	1,142	9,319	0	11,065
1965	4	141	2,396	912	27	3,476
1966	1	0	4,341	0	0	4,341
1966	2	127	881	1,162	0	2,170
1966	3	2,503	1,388	5,252	0	9,143
1966	4	5,064	2,443	0	0	7,507
1967	1	0	3,270	0	205	3,475
1967	2	0	1,308	100	1,126	2,534
1967	3	10	1,606	571	128	2,315
1967	4	250	341	31	678	1,300
1968	1	163	3,280	0	1	3,444
1968	2	19	331	0	582	932
1968	3	0	475	0	0	475
1968	4	288	930	0	7	1,225
1969	1	67	1,448	370	0	1,885
1969	2	305	313	1,504	200	2,322
1969	3	0	1,621	1,204	0	2,825
1969	4	0	754	518	0	1,272
1970	1	15	650	241	0	906
1970	2	91	3,336	0	0	3,427
1970	3	0	1,163	540	0	1,703
1970	4	0	1,106	14	0	1,120
1971	1	2	2,179	0	1,126	3,307
1971	2	3	2,330	0	150	2,483
1971	3	4	1,753	0	0	1,757
1971	4	10	774	0	0	784
1972	1	0	2,439	0	0	2,439
1972	2	0	852	0	0	852
1972	3	0	703	0	0	703
1972	4	22	803	0	0	825
1973	1	1,036	3,018	0	0	4,054
1973	2	0	1,385	0	0	1,385
1973	3	0	394	0	0	394
1973	4	0	1,554	0	11	1,565
1974	1	0	3,262	0	0	3,262
1974	2	0	1,200	16	0	1,216
1974	3	0	1,476	240	0	1,716
1974	4	0	1,415	0	0	1,415
1975	1	164	1,427	17	0	1,608
1975	2	0	725	0	0	725
1975	3	3	594	0	0	597
1975	4	78	1,149	0	0	1,227
1976	1	44	3,802	0	0	3,846
1976	2	0	1,306	0	0	1,306
1976	3	0	1,471	0	0	1,471
1976	4	0	2,021	0	0	2,021
1977	1	4	2,875	0	0	2,879
1977	2	0	342	0	0	342
1977	3	0	241	0	0	241
1977	4	0	2,120	0	0	2,120
1978	1	0	2,784	24	0	2,808
1978	2	0	340	31	0	371
1978	3	0	404	238	0	642
1978	4	0	1,253	2	0	1,255
1979	1	0	1,263	5	2	1,270
1979	2	2	76	59	0	137
1979	3	47	1,559	420	0	2,026
1979	4	48	1,339	11	0	1,398
1980	1	6	307	0	0	313
1980	2	0	2,260	37	0	2,297
1980	3	0	1,448	10	0	1,458
1980	4	0	1,733	0	0	1,733
1981	1	13	2,052	0	0	2,065
1981	2	0	5,678	150	0	5,828
1981	3	0	3,184	86	0	3,270
1981	4	7	2,522	2	0	2,531
1982	1	478	1,153	117	0	1,748
1982	2	0	2,848	198	0	3,046
1982	3	1	2,593	45	10	2,649
1982	4	362	2,749	0	0	3,111
1983	1	38	1,396	19	0	1,453
1983	2	8	2,629	760	0	3,397
1983	3	47	1,472	308	72	1,899
1983	4	80	2,418	0	18	2,516
1984	1	99	332	0	0	431
1984	2	0	972	222	0	1,194
1984	3	192	3,552	159	0	3,903
1984	4	6	3,701	64	0	3,771
1985	1	62	760	5	0	827
1985	2	26	3,824	454	0	4,304
1985	3	155	2,921	320	0	3,396
1985	4	0	5,479	0	0	5,479
1986	1	25	1,351	0	0	1,376
1986	2	0	1,575	265	0	1,840
1986	3	0	4,033	1	0	4,034
1986	4	0	7,063	0	0	7,063
1987	1	81	2,074	0	0	2,155
1987	2	0	2,556	8	0	2,564
1987	3	0	3,193	49	0	3,242
1987	4	11	4,936	0	0	4,947
1988	1	0	867	0	0	867
1988	2	0	1,303	0	0	1,303
1988	3	36	2,170	43	0	2,249
1988	4	0	2,778	0	3	2,781
1989	1	0	804	0	0	804
1989	2	95	814	325	0	1,234
1989	3	247	1,531	579	13	2,370
1989	4	0	3,699	15	12	3,726
1990	1	0	195	0	0	195
1990	2	60	407	238	0	705
1990	3	646	2,330	202	0	3,178
1990	4	1	4,050	0	0	4,051
1991	1	0	174	0	0	174
1991	2	18	303	93	0	414
1991	3	1	580	363	0	944
1991	4	0	1,408	52	0	1,460
1992	1	0	132	0	161	293
1992	2	0	176	2,378	771	3,325
1992	3	0	174	814	32	1,020
1992	4	0	1,100	35	0	1,135
1993	1	0	385	42	0	427
1993	2	7	353	591	0	951
1993	3	80	0	343	7	430
1993	4	5	16	39	0	60
1994	1	0	0	0	0	0
1994	2	76	103	168	0	347
1994	3	405	0	61	14	480
1994	4	26	0	88	2	116
1995	1	0	0	333	0	333
1995	2	10	27	275	0	312
1995	3	38	67	143	134	382
1995	4	0	172	8	6	186
1996	1	0	0	10	0	10
1996	2	0	267	573	24	864
1996	3	0	0	207	52	259
1996	4	0	0	0	3	3
1997	1	3	281	1	0	285
1997	2	16	197	1,459	1	1,673
1997	3	19	46	3,056	1	3,122
1997	4	2	71	110	50	233
1998	1	15	0	1	0	16
1998	2	37	209	621	0	867
1998	3	0	740	533	118	1,391
1998	4	0	17	0	14	31
1999	1	9	0	17	0	26
1999	2	24	171	438	173	806
1999	3	128	52	766	278	1,224
1999	4	0	103	81	1	185
2000	1	0	0	0	0	0
2000	2	123	238	429	0	790
2000	3	29	0	1,871	208	2,108
2000	4	0	102	503	2	607
2001	1	0	6	0	0	6
2001	2	17	51	260	0	328
2001	3	1,096	0	1,813	0	2,909
2001	4	124	55	683	16	878
2002	1	33	64	69	0	166
2002	2	0	0	147	0	147
2002	3	2,007	0	35	0	2,042
2002	4	38	0	202	0	240

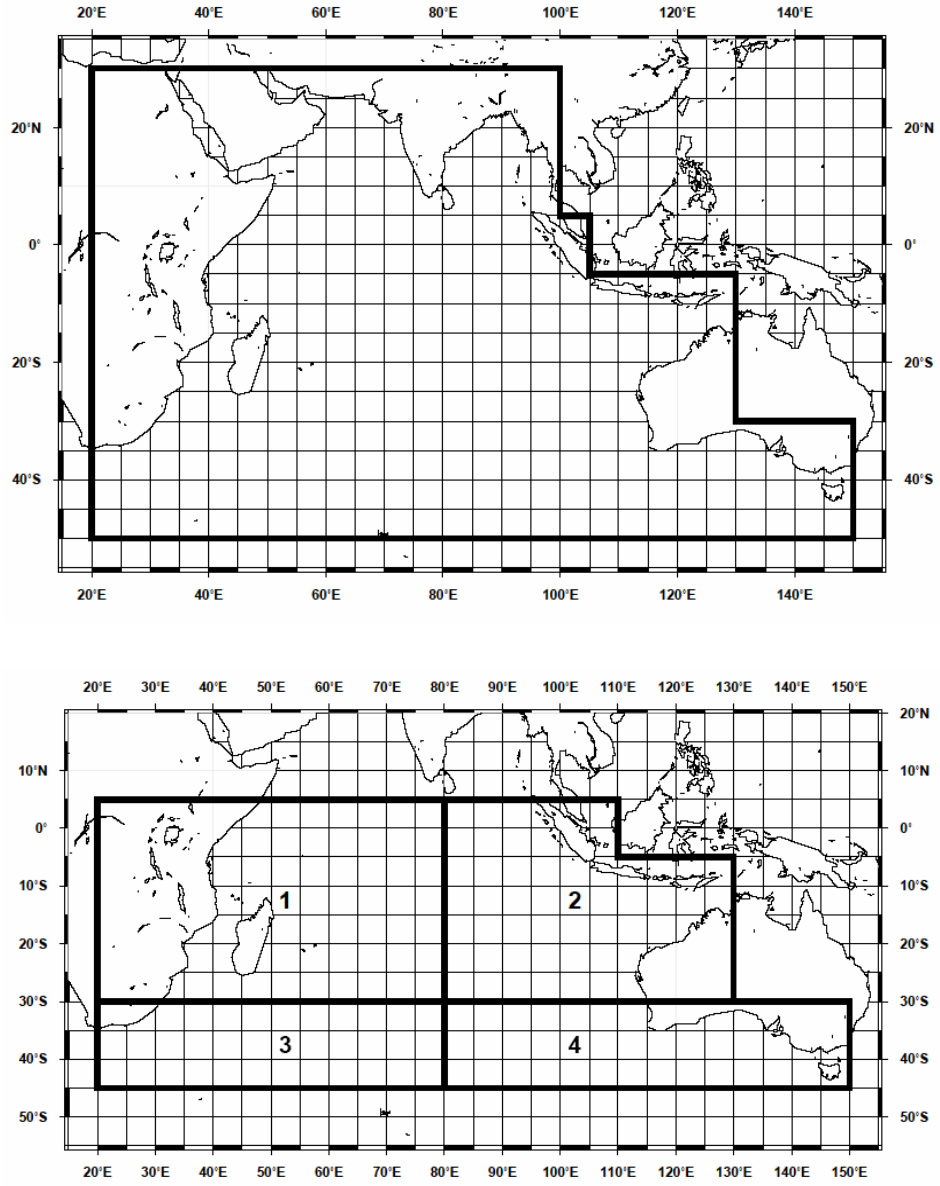
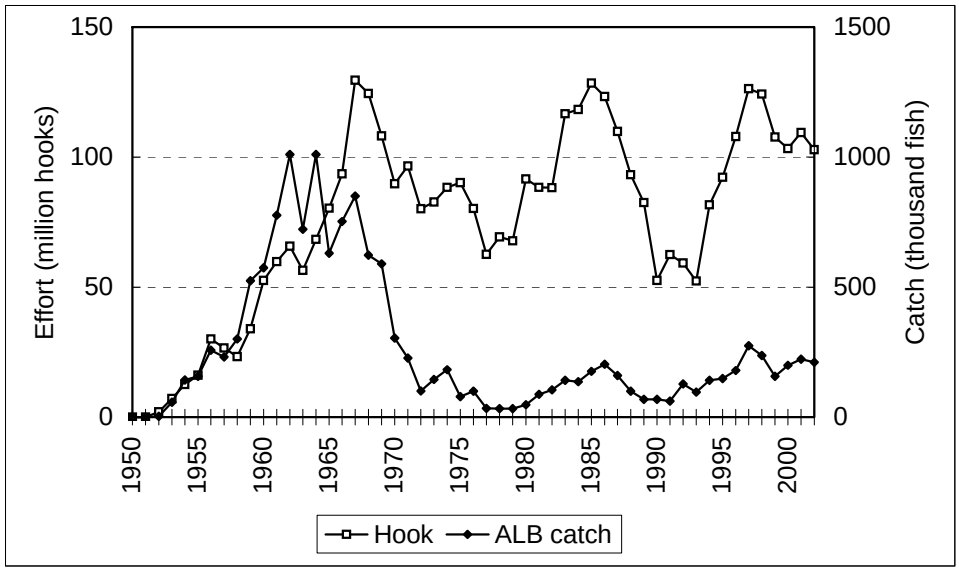
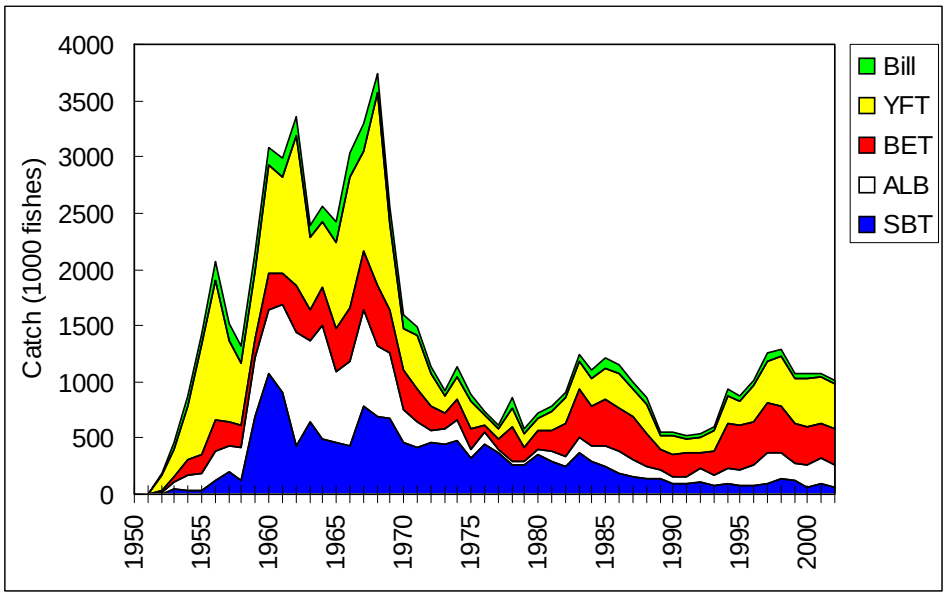


Fig. 1. The geografical range to count the amount of the effort and the catches (Top) and area difinition to count number of sample of albacore length data (bottom).





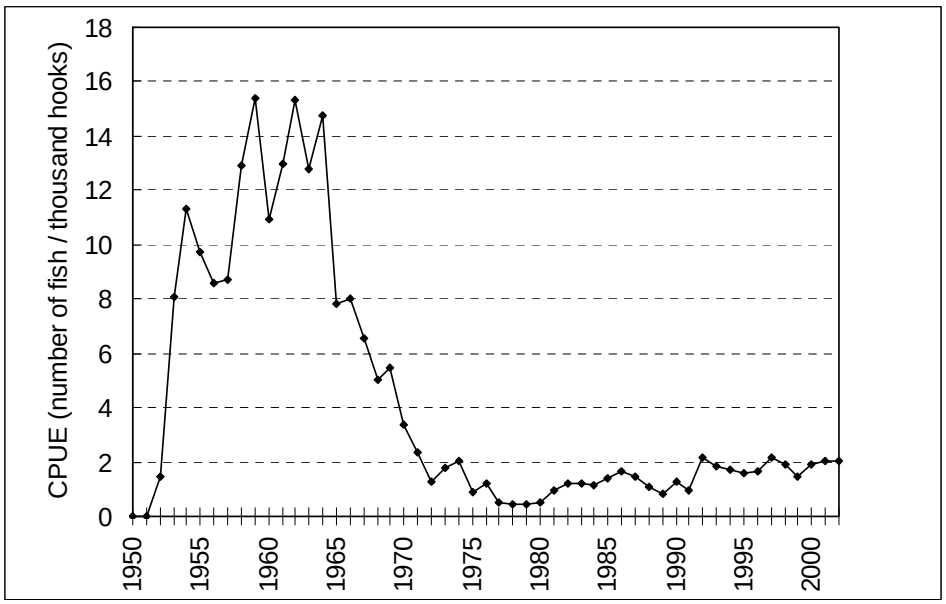


Fig. 2. The numbers of hooks employed and albacore catch (a), species composition (b), and nominal CPUE of albacore (c) caught by Japanese longline fishery.

Fig. 3. The average distribution of the effort (number of hooks), albacore catch (number of fish) and CPUE (number of fish/1000hooks) for each decadal period.
Fig. 3. (Continued)
Fig. 4-1. The averaged distribution of amount of catch in number by species for the 1956-1959 period. Size of circle shows amount of total of catches i.e. southern bluefin tuna (SBT), albacore (ALB), bigeye tuna (BET), yellowfin tuna (YFT) and billfishes (Bill).
Fig. 4-2. The averaged distribution of amount of catch in number by species for the 1960-1969 period.
Fig. 4-3. The averaged distribution of amount of catch in number by species for the 1970-1979 period.
Fig. 4-4. The averaged distribution of amount of catch in number by species for the 1980-1989 period.
Fig. 4-5. The averaged distribution of amount of catch in number by species for the 1990-1999 period.
Fig. 5. The geographical distribution of the effort (number of hooks), albacore catch (number of fish) and CPUE (number of fish/1000hooks) in 2000, 2001 and 2002.

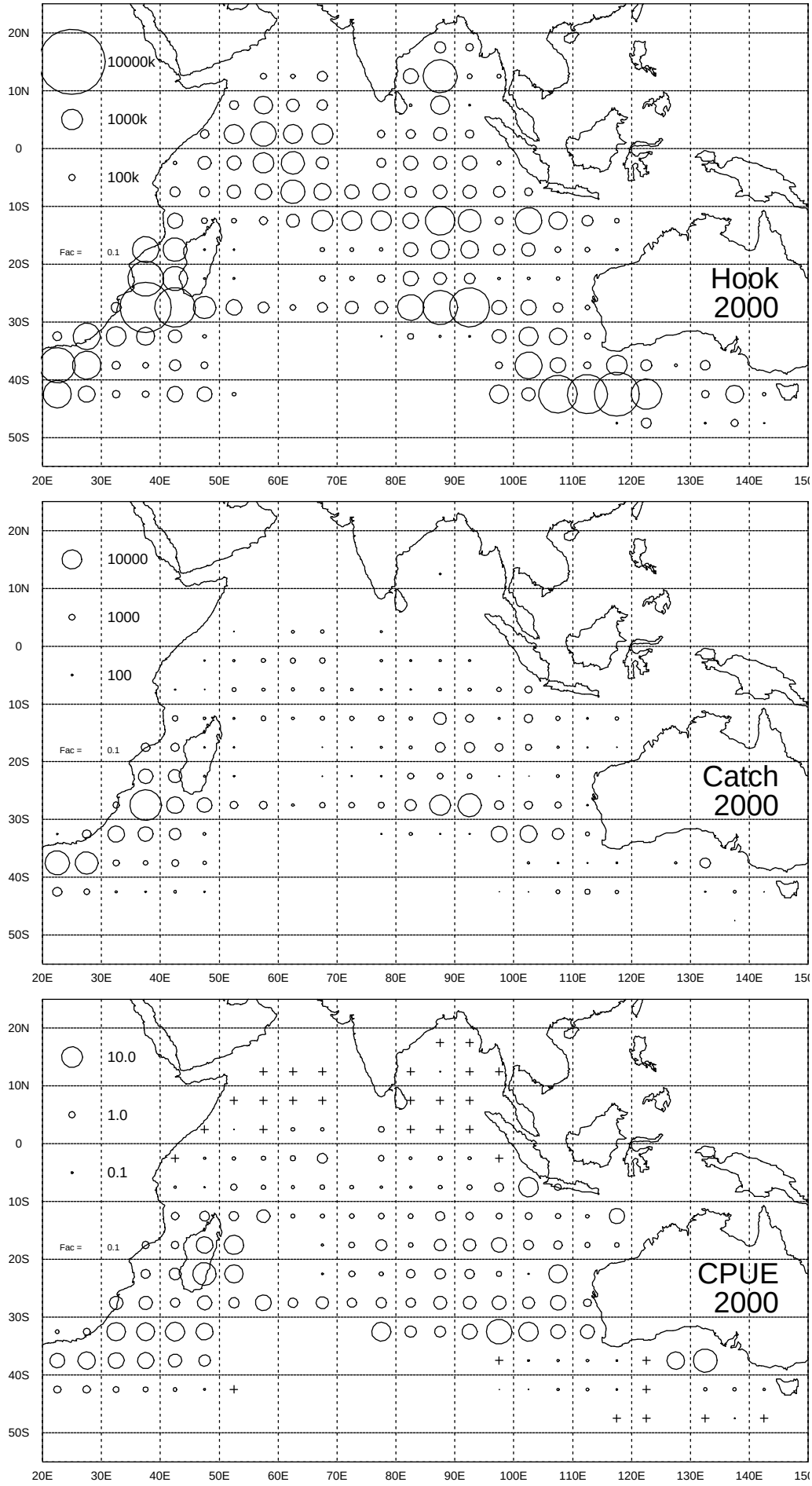
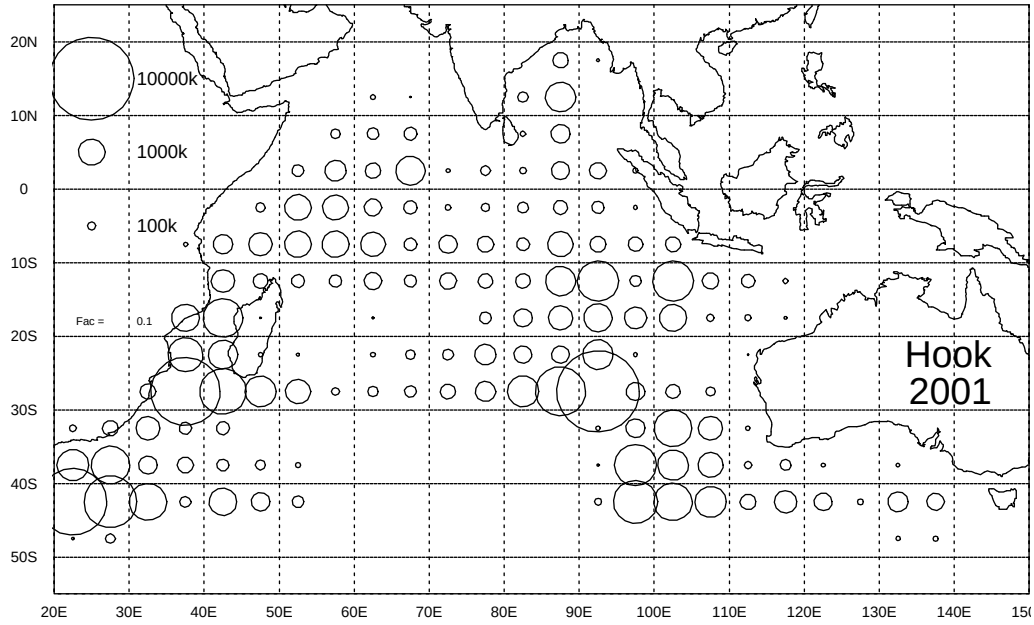
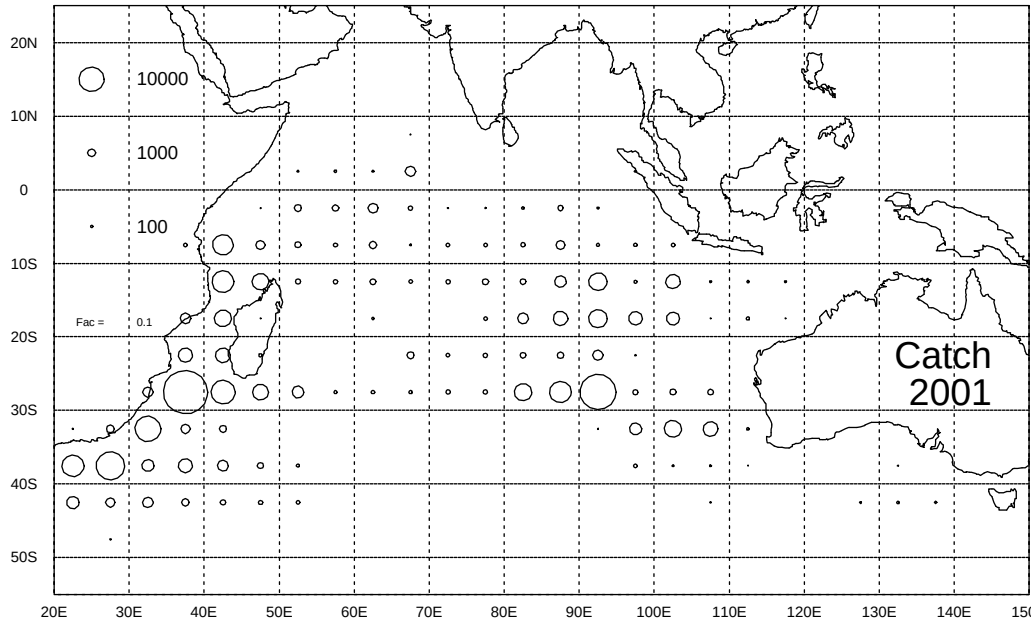


Fig. _____ Distribution of effort(number of hooks), albacore cacth and CPUE (fish/1000hooks) by the Japanese longline fishery in 2000 .





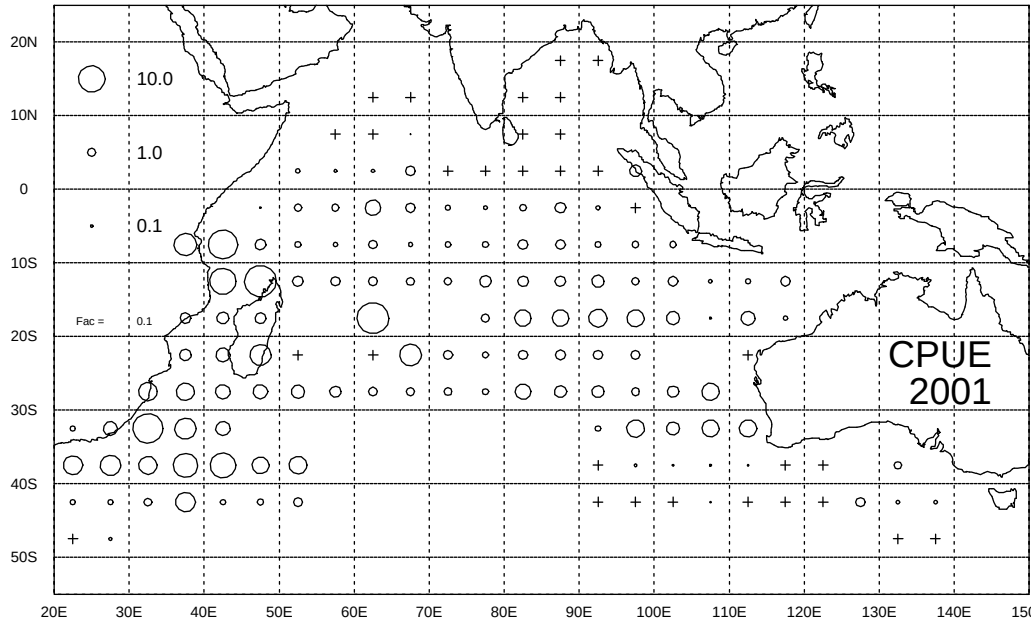


Fig. _____ Distribution of effort(number of hooks), albacore cacth and CPUE (fish/1000hooks) by the Japanese longline fishery in 2001 .

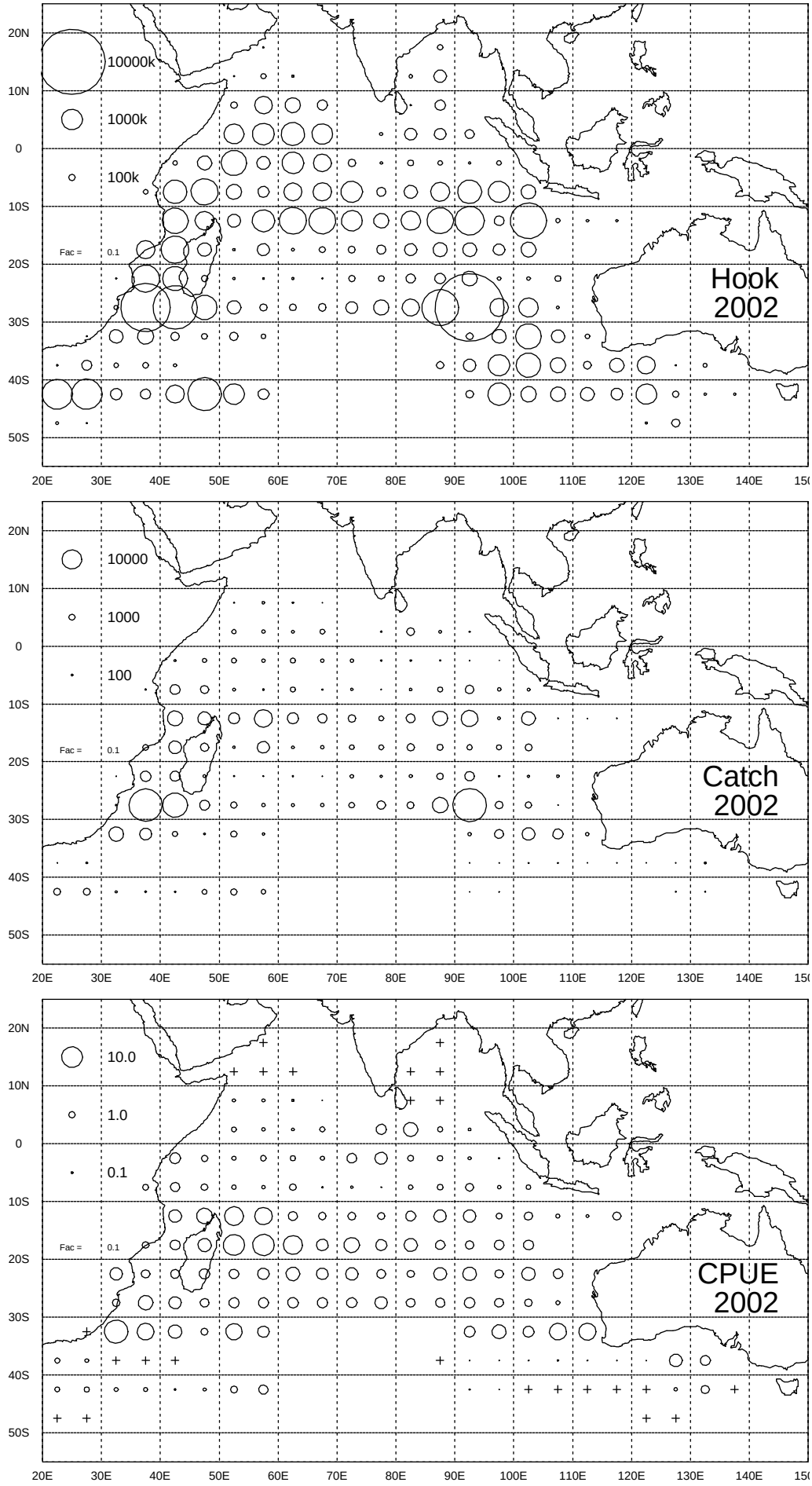
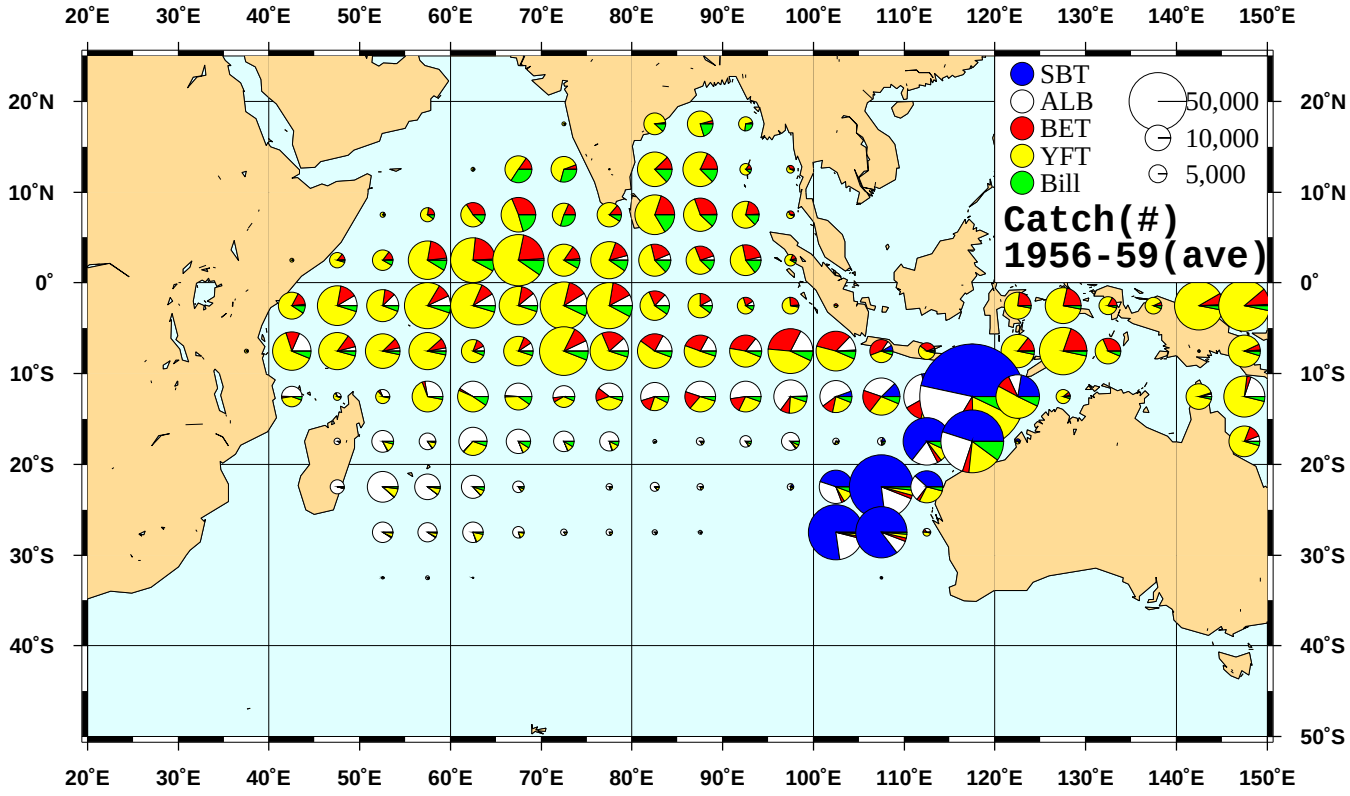


Fig. _____ Distribution of effort(number of hooks), albacore cacth and CPUE (fish/1000hooks) by the Japanese longline fishery in 2002 .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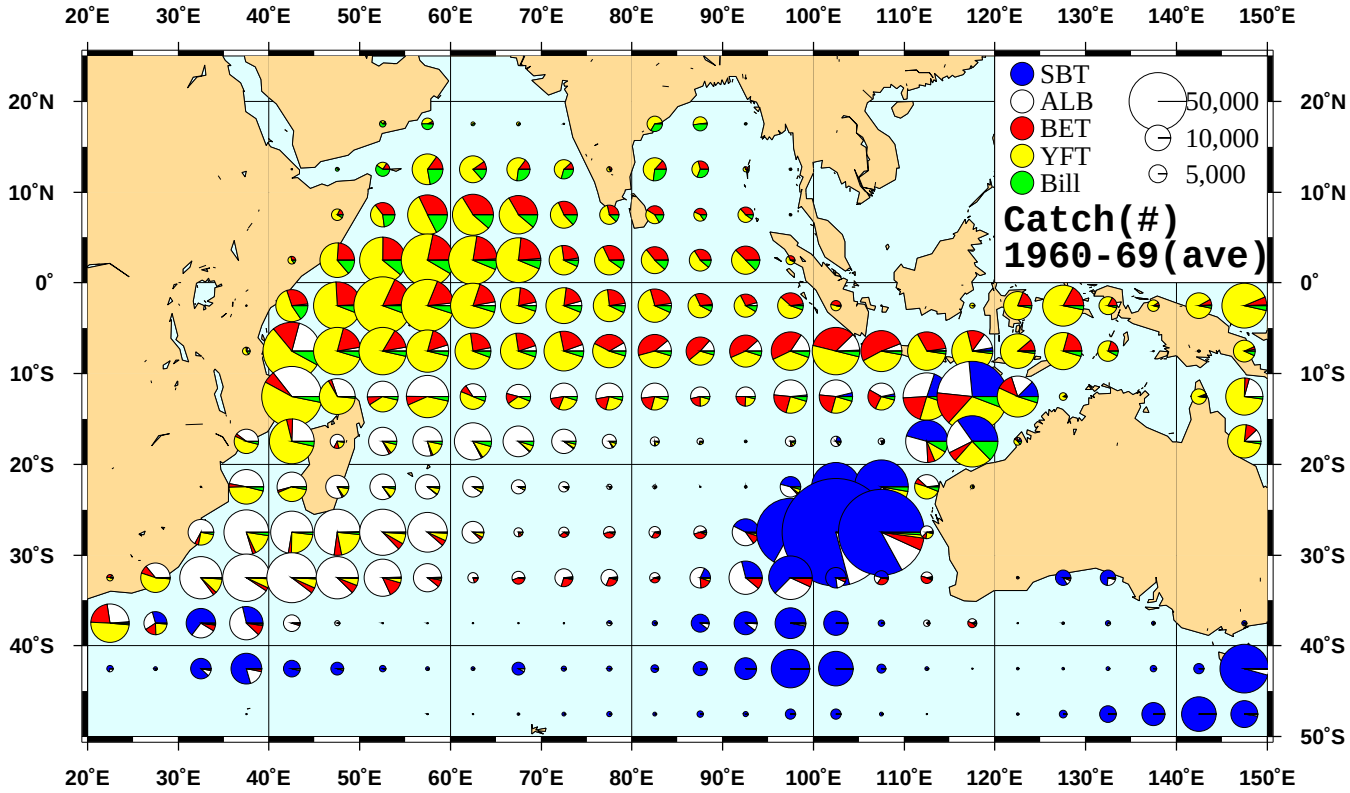
40°E
50°E
60°E
70°E
80°E
90°E
100°E
110°E
120°E
130°E
140°E
150°E
20°N
10°N
0°
10°S
20°S
30°S
40°S
50°S
SBT
ALB
BET
YFT
Bill
50,000
10,000
5,000
Catch(#)
1956-59(ave)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30°E
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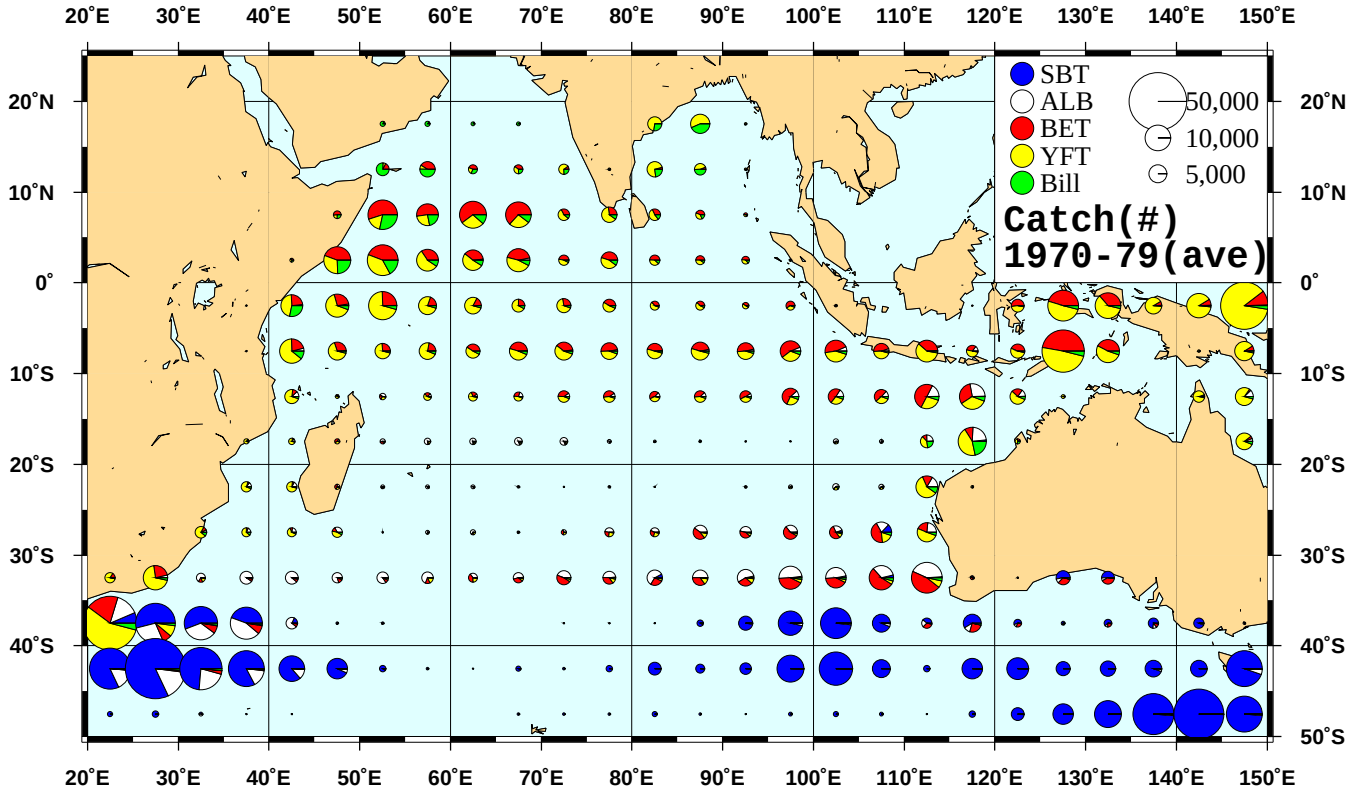
90°E
100°E
110°E
120°E
130°E
140°E
150°E
20°N
10°N
0°
10°S
20°S
30°S
40°S
50°S
SBT
ALB
BET
YFT
Bill
50,000
10,000
5,000
Catch(#)
1960-69(ave)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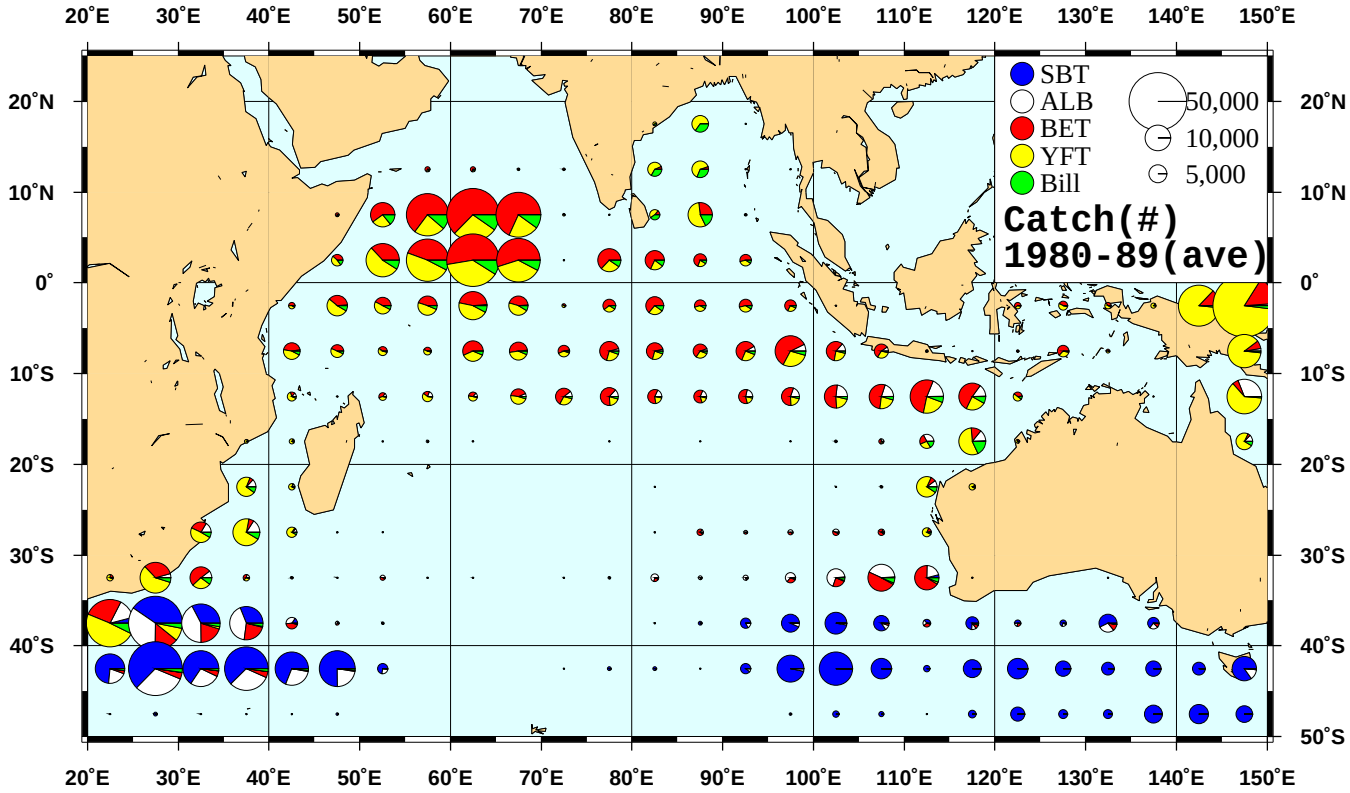
120°E
130°E
140°E
150°E
20°N
10°N
0°
10°S
20°S
30°S
40°S
50°S
SBT
ALB
BET
YFT
Bill
50,000
10,000
5,000
Catch(#)
1970-79(ave)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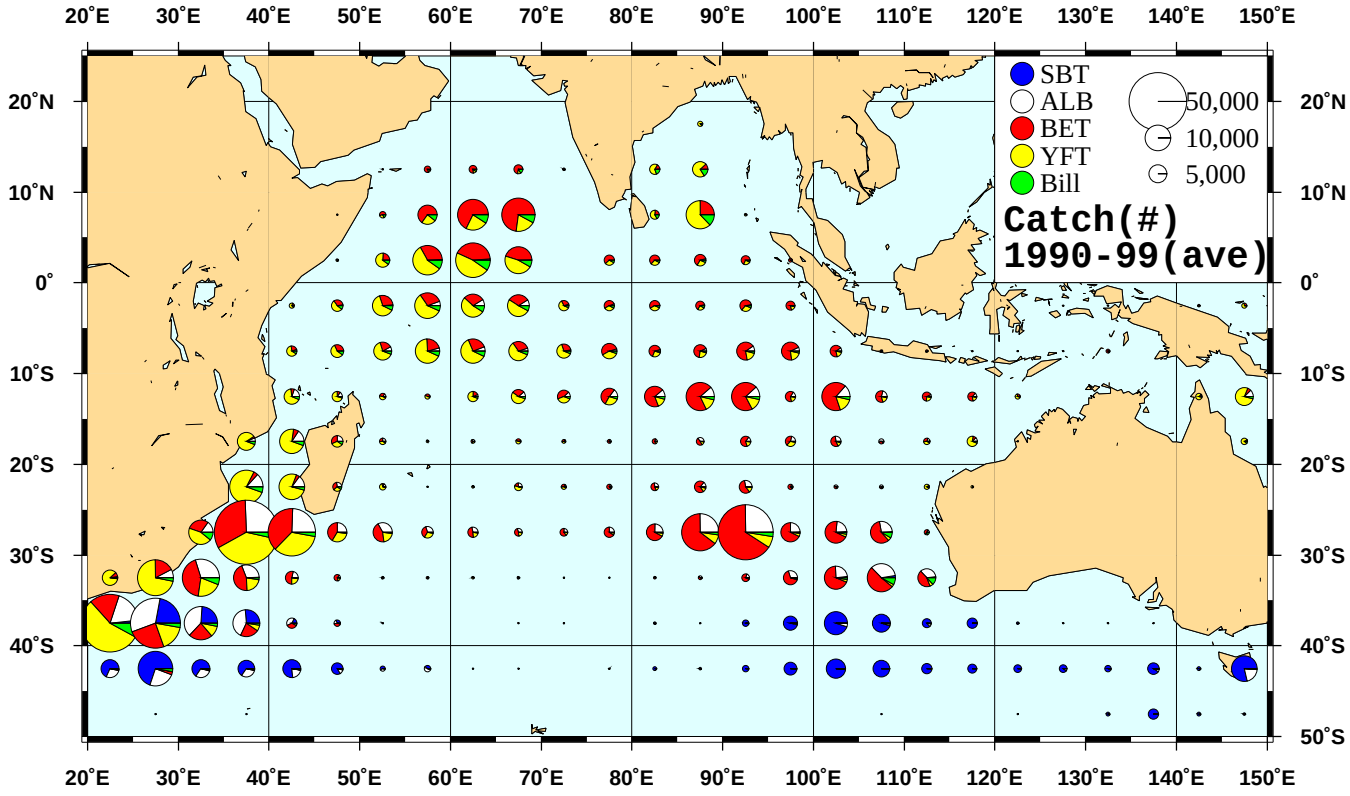
30˚E
40˚E
50˚E
60˚E
70˚E
80˚E
90˚E
100˚E
110˚E
120˚E
130˚E
140˚E
150˚E
20˚N
10˚N
0˚
10˚S
20˚S
30˚S
40˚S
50˚S
SBT
ALB
BET
YFT
Bill
50,000
10,000
5,000
Catch(#)
1980-89(ave)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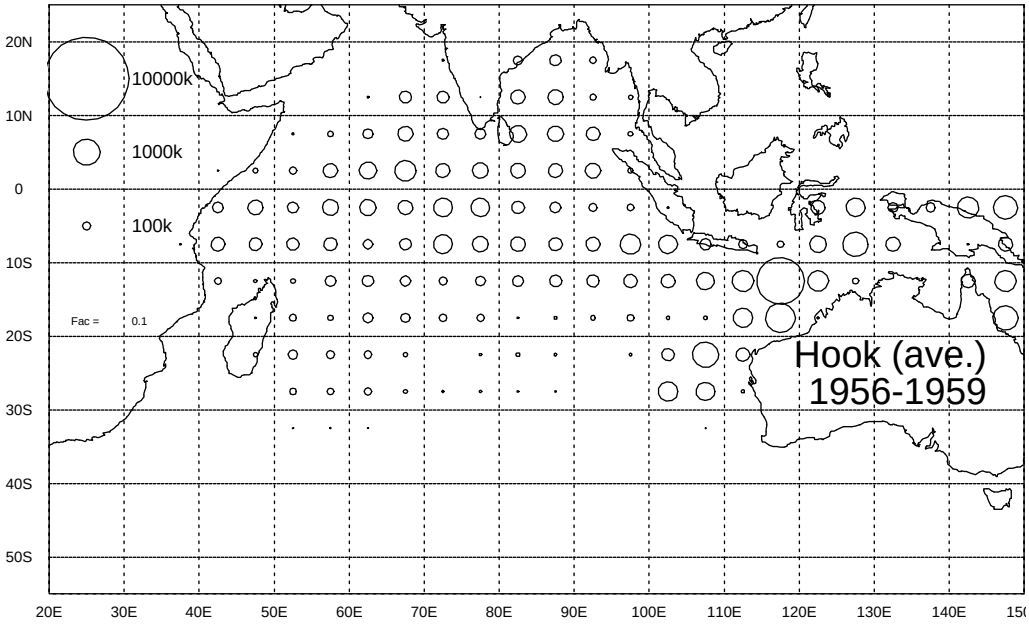
140°E
150°E
20°N
10°N
0°
10°S
20°S
30°S
40°S
50°S
SBT
ALB
BET
YFT
Bill
50,000
10,000
5,000
Catch(#)
1990-99(ave)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1000k
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Hook (ave.)
1956-1959
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10N
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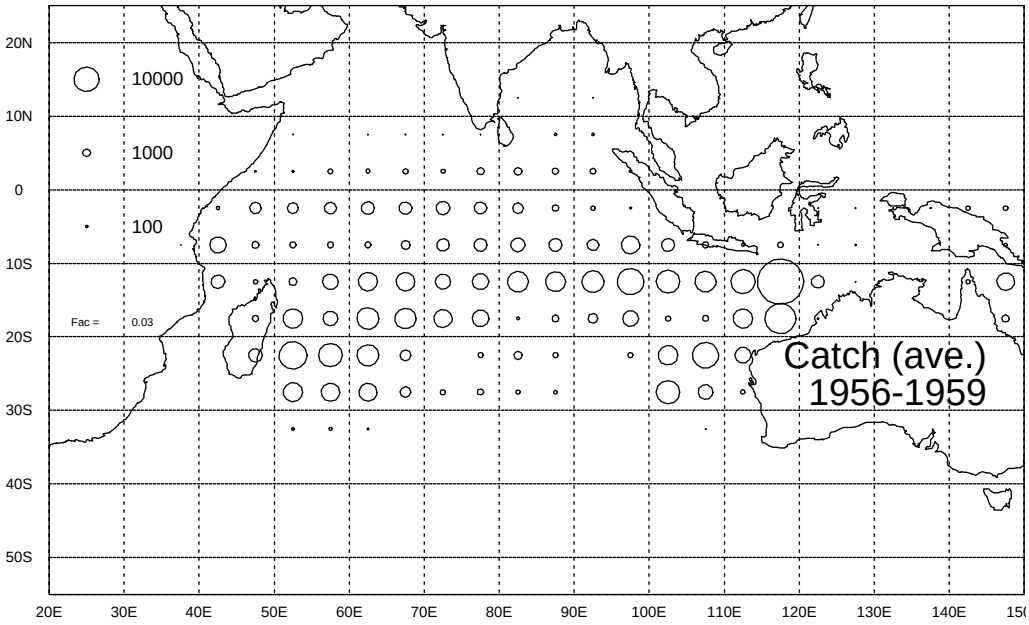
10S
20S
30S
40S
50S
20E
30E
40E
50E
60E
70E
80E
90E
100E
110E
120E
130E
140E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30E
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90E
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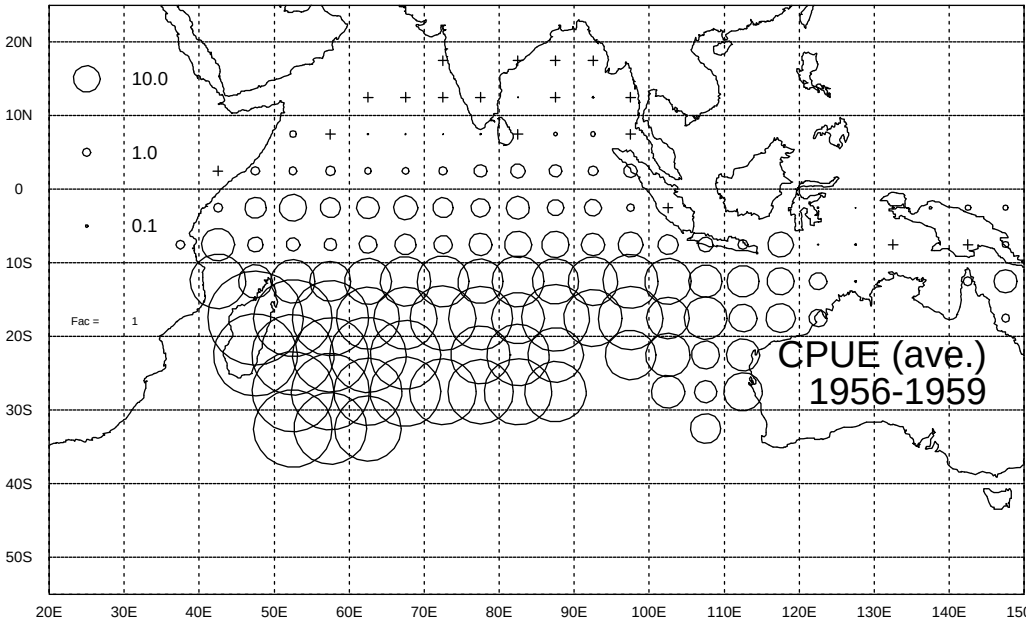
130E
140E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40E
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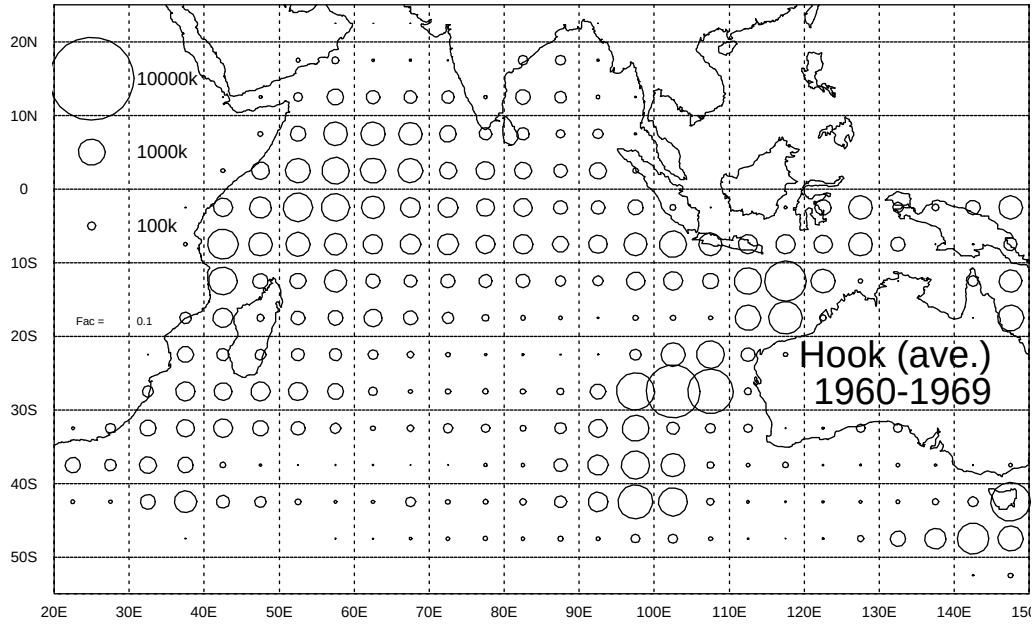
90E
100E
110E
120E
130E
140E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10S
20S
30S
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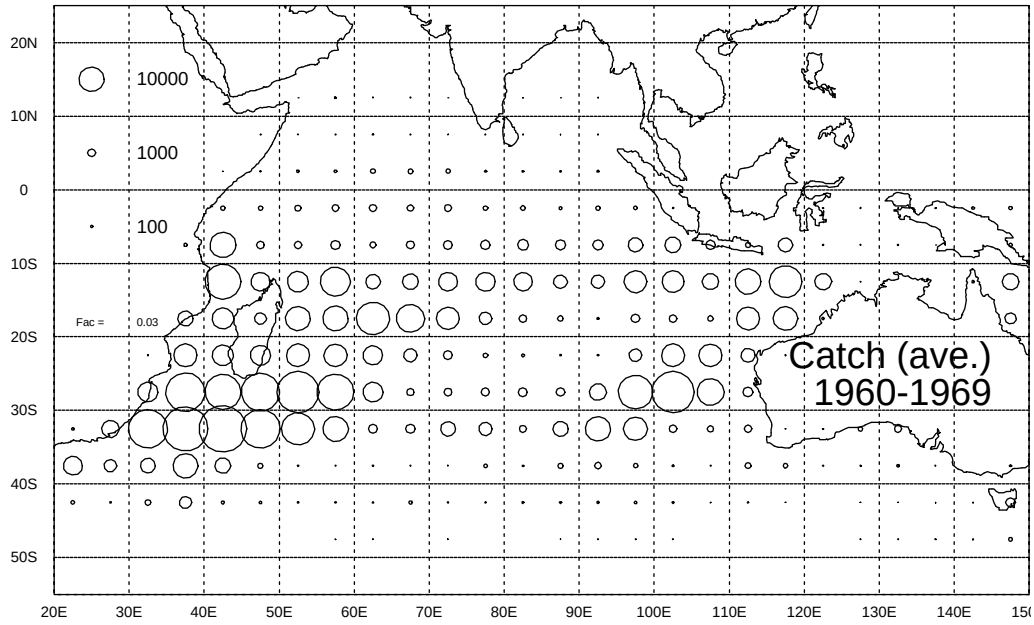
30E
40E
50E
60E
70E
80E
90E
100E
110E
120E
130E
140E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10S
20S
30S
40S
50S
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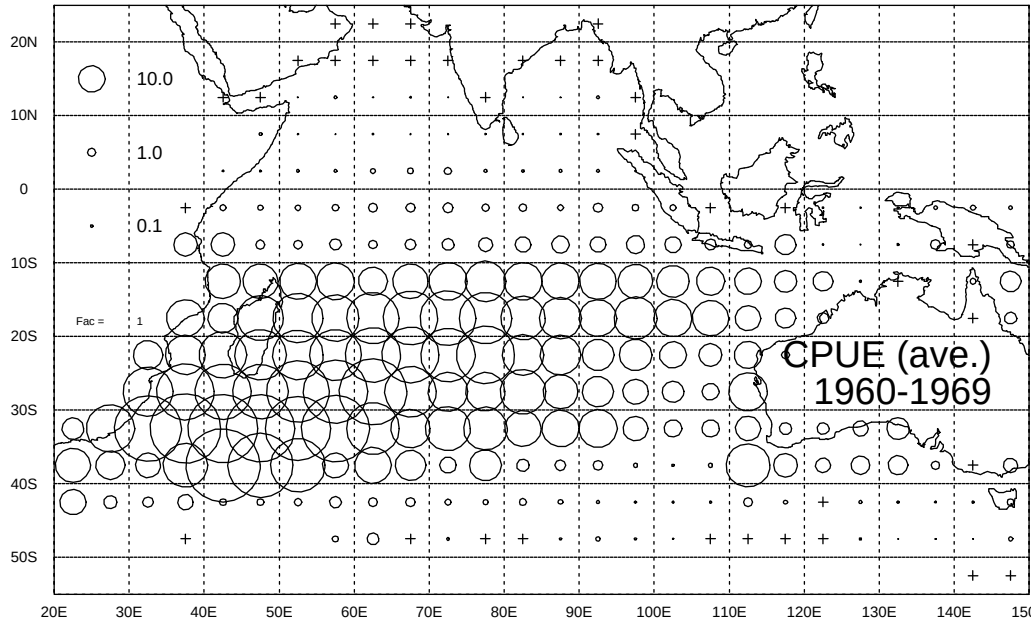
30E
40E
50E
60E
70E
80E
90E
100E
110E
120E
130E
140E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1960-1969
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10S
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30S
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50S
20E
30E
40E
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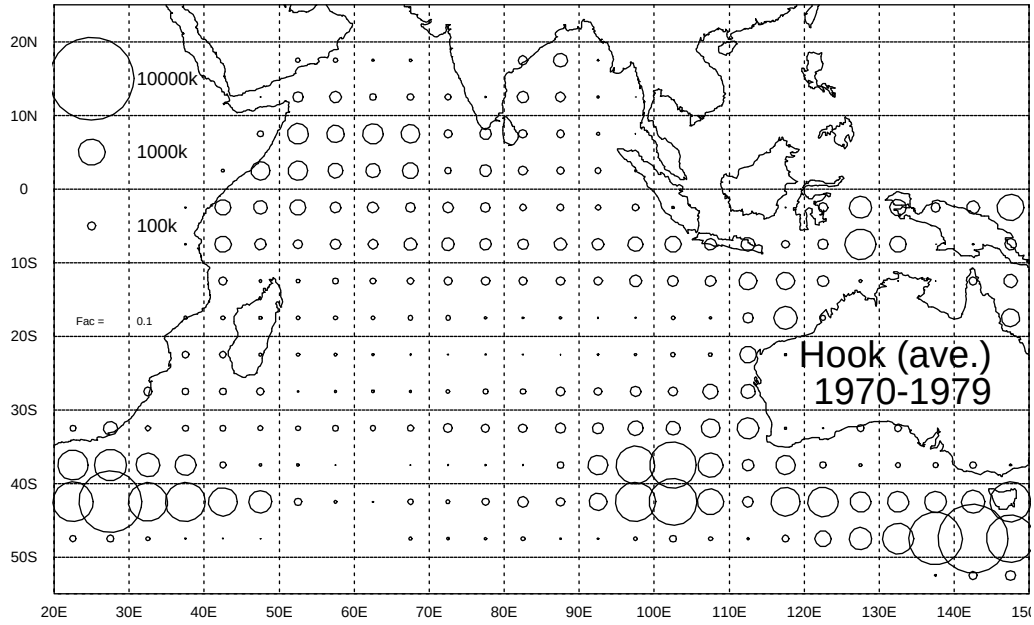
60E
70E
80E
90E
100E
110E
120E
130E
140E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Hook (ave.)
1970-1979
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10S
20S
30S
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30E
40E
50E
60E
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90E
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120E
130E
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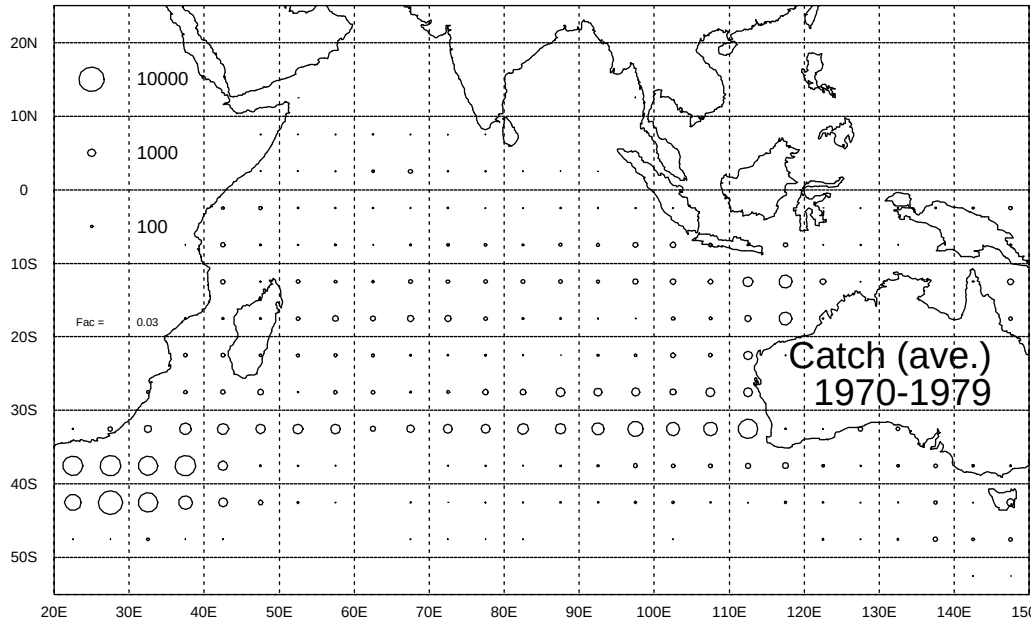
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Catch (ave.)
1970-1979
20N
10N
0
10S
20S
30S
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50S
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30E
40E
50E
60E
70E
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90E
100E
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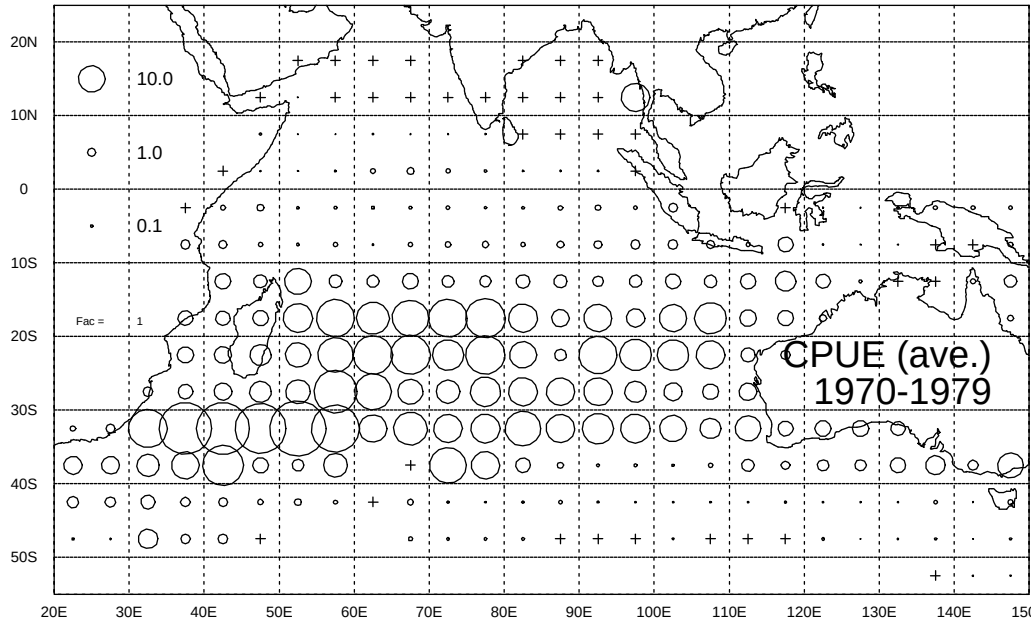
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CPUE (ave.)
1970-1979
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10N
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20S
30S
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30E
40E
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70E
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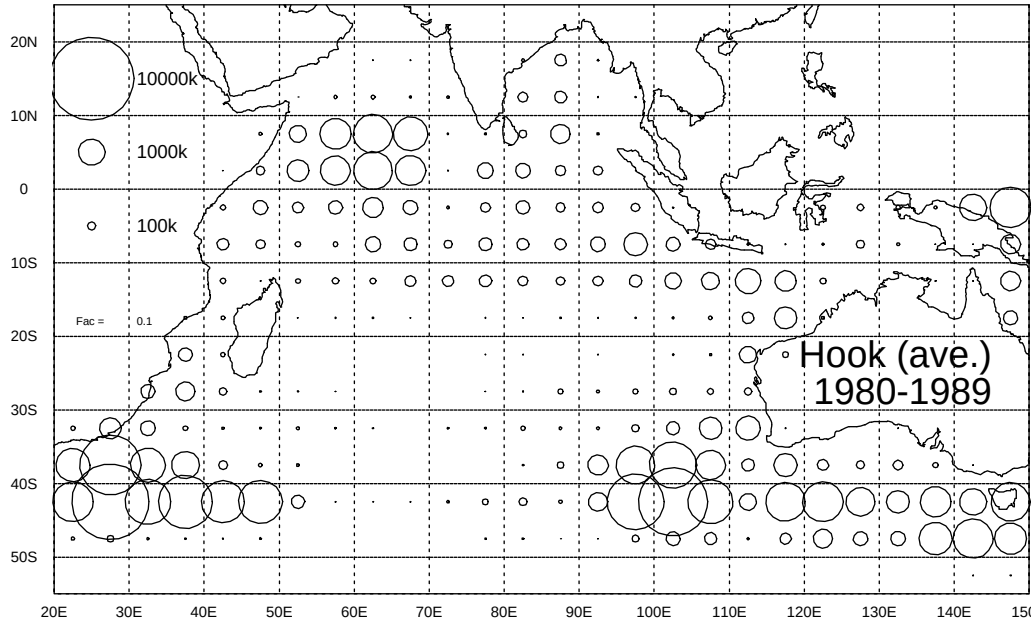
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Hook (ave.)
1980-1989
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10S
20S
30S
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40E
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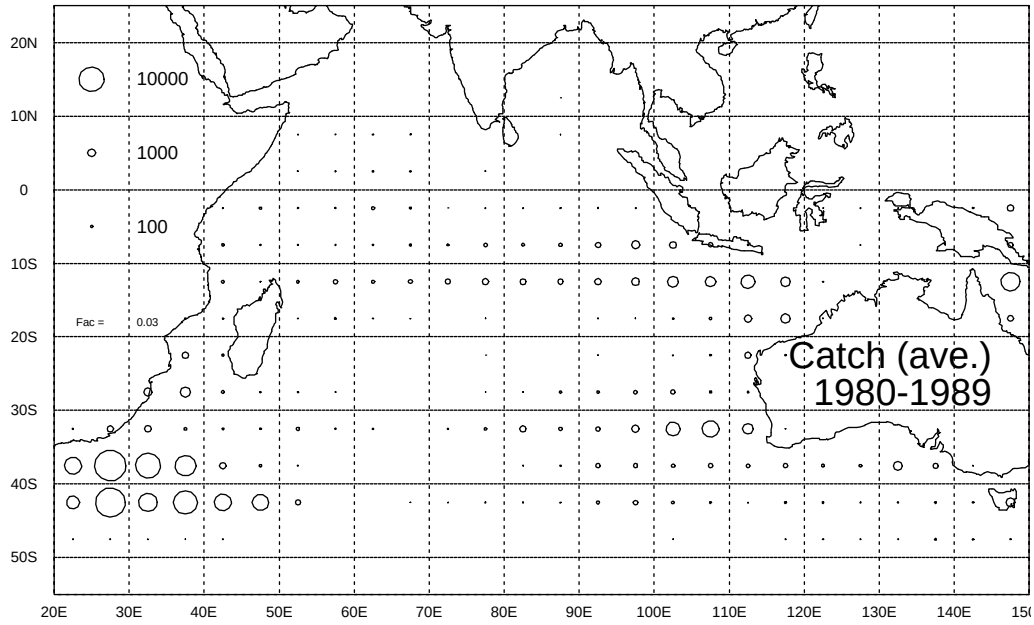
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1980-1989
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10S
20S
30S
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20E
30E
40E
50E
60E
70E
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90E
100E
110E
120E
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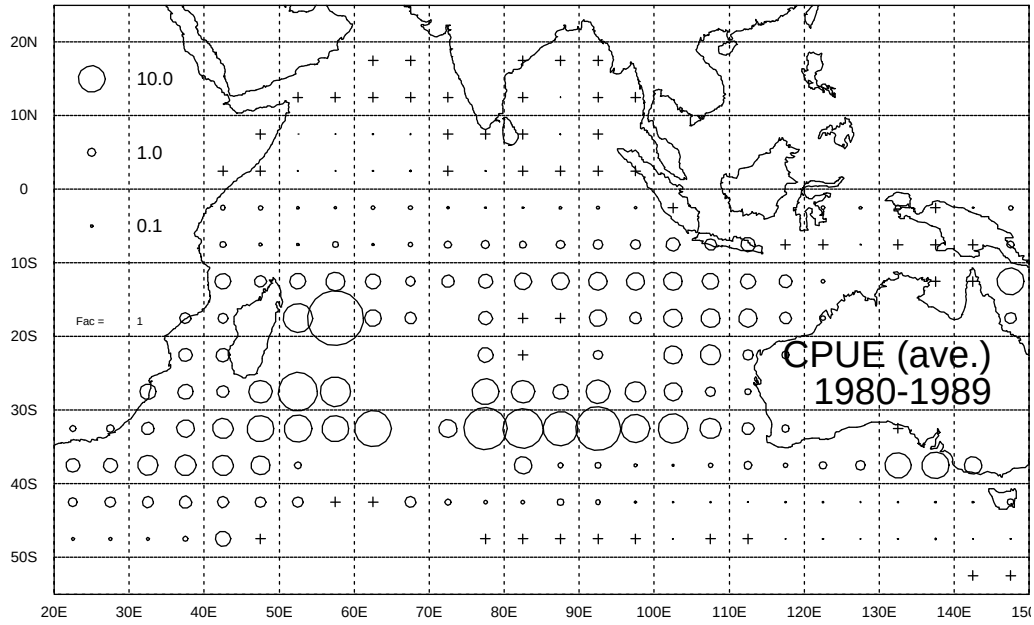
140E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CPUE (ave.)
1980-1989
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0
10S
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30E
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60E
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100E
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120E
130E
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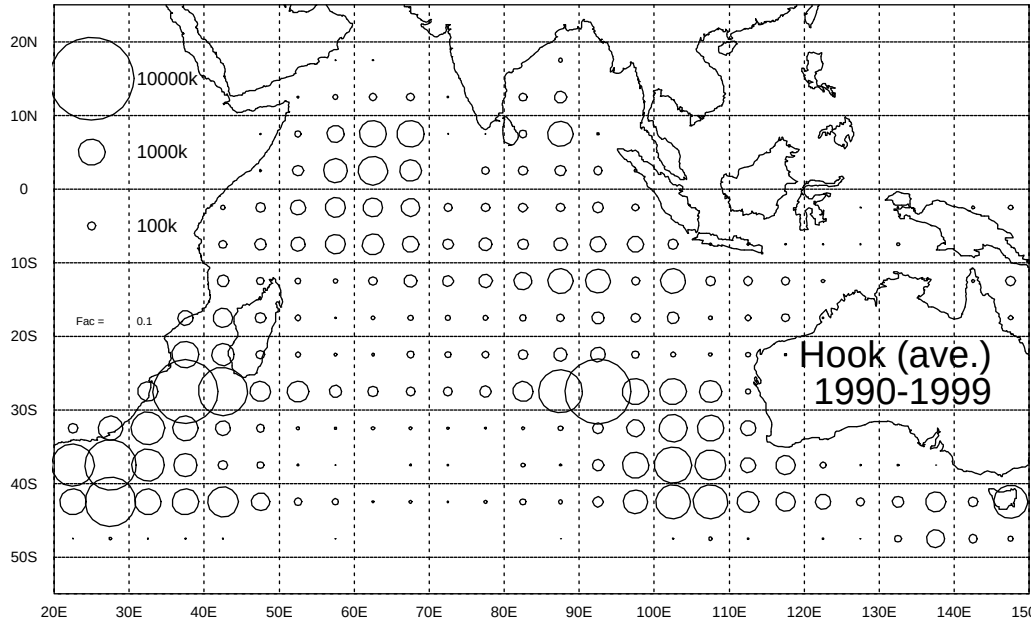
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Hook (ave.)
1990-1999
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30S
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40E
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60E
70E
80E
90E
100E
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120E
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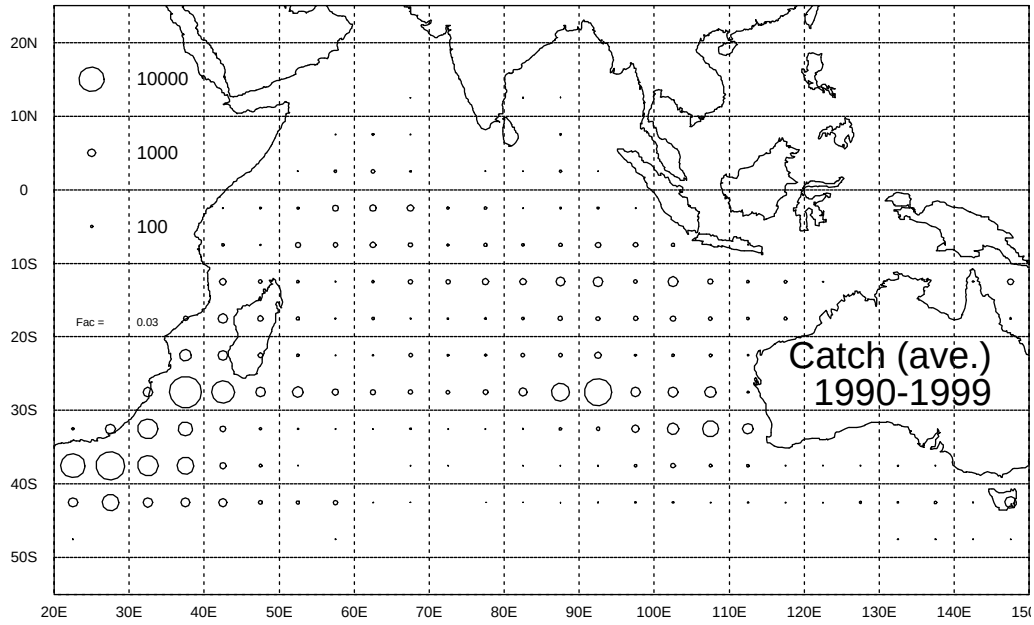
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Catch (ave.)
1990-1999
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40E
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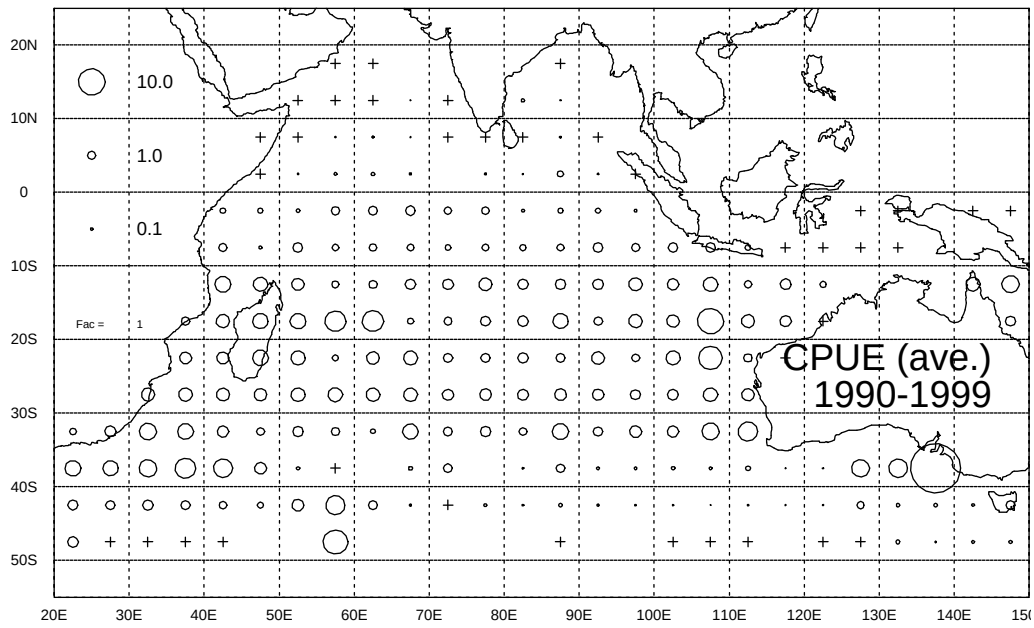
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1990-1999
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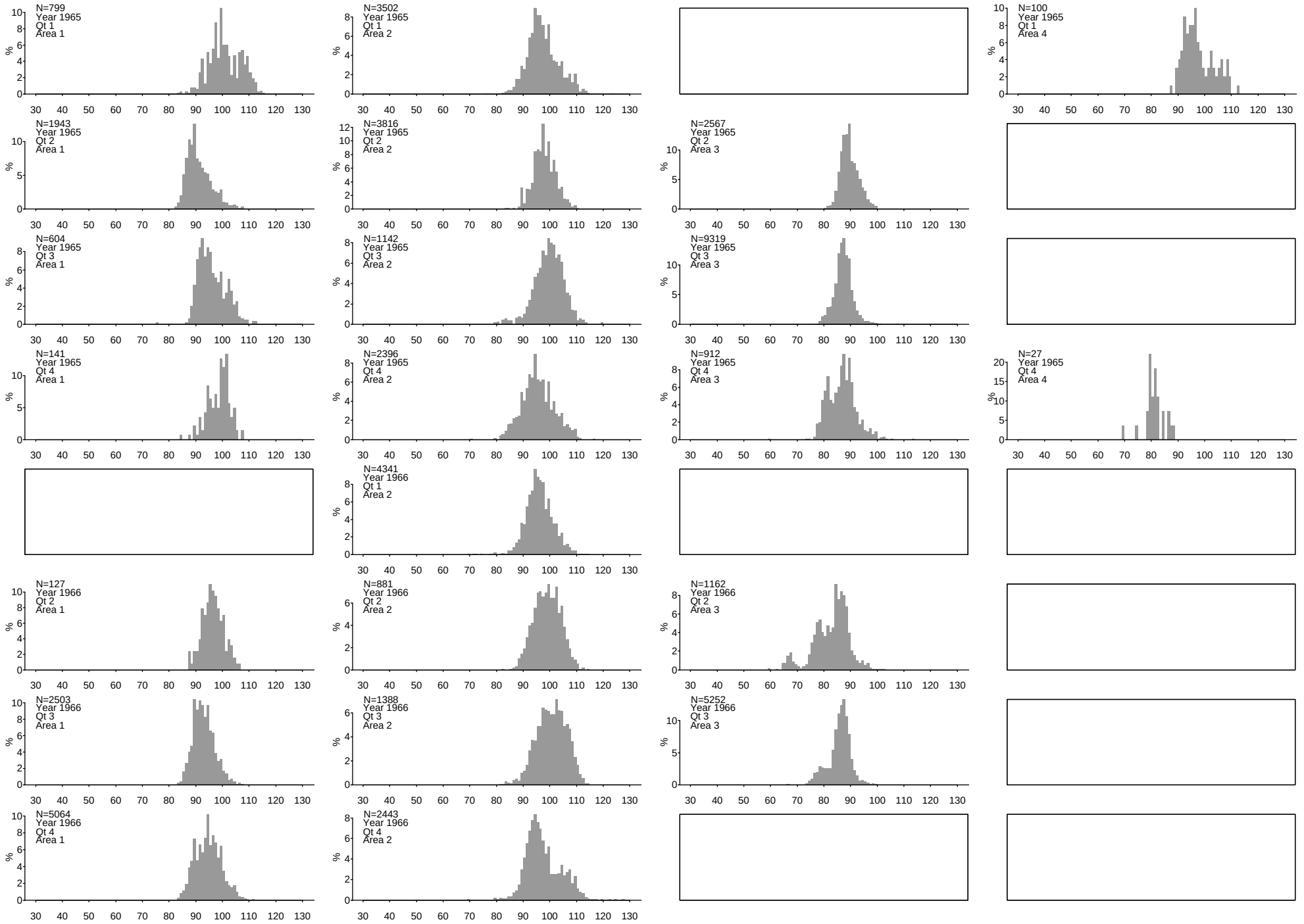
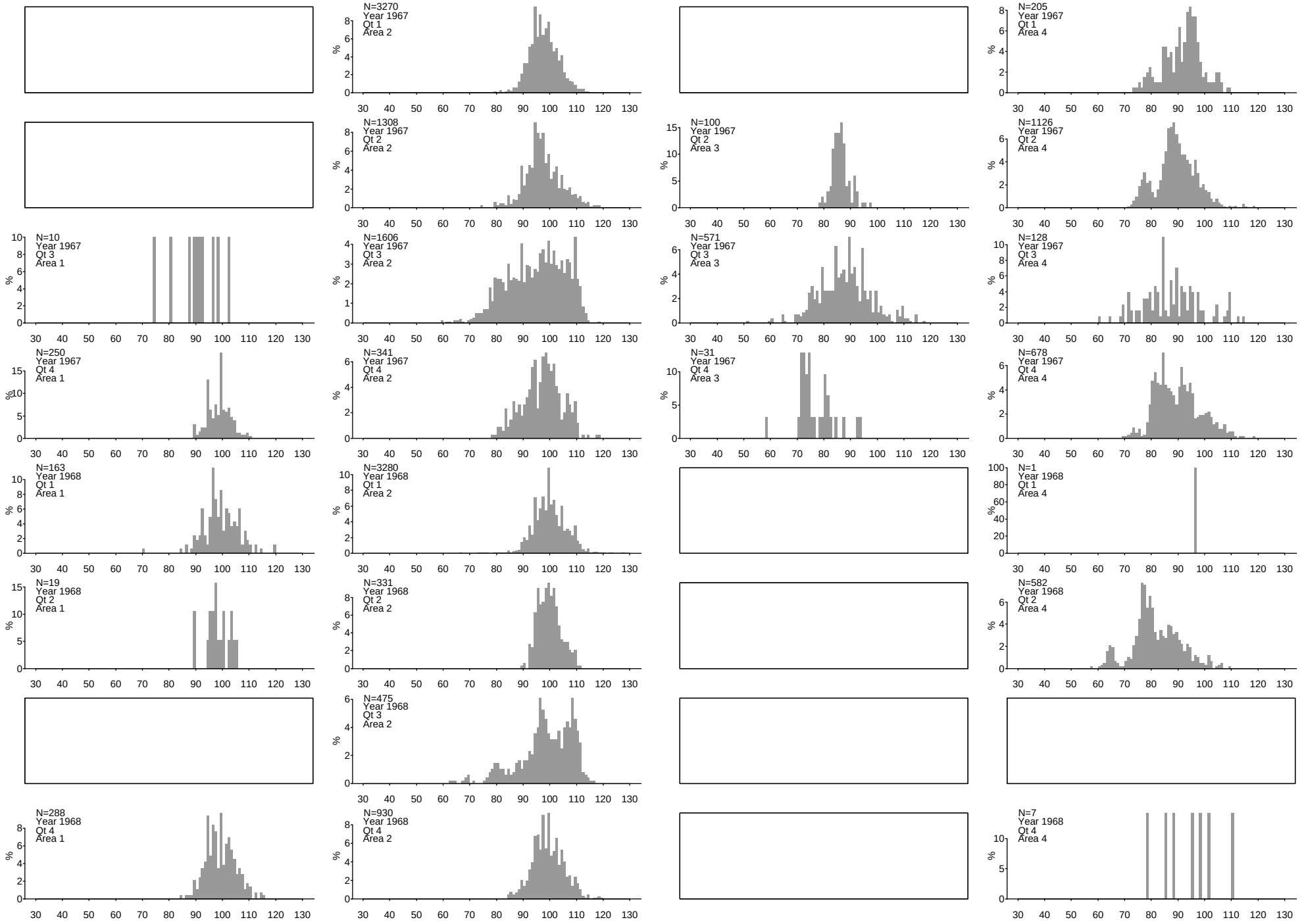
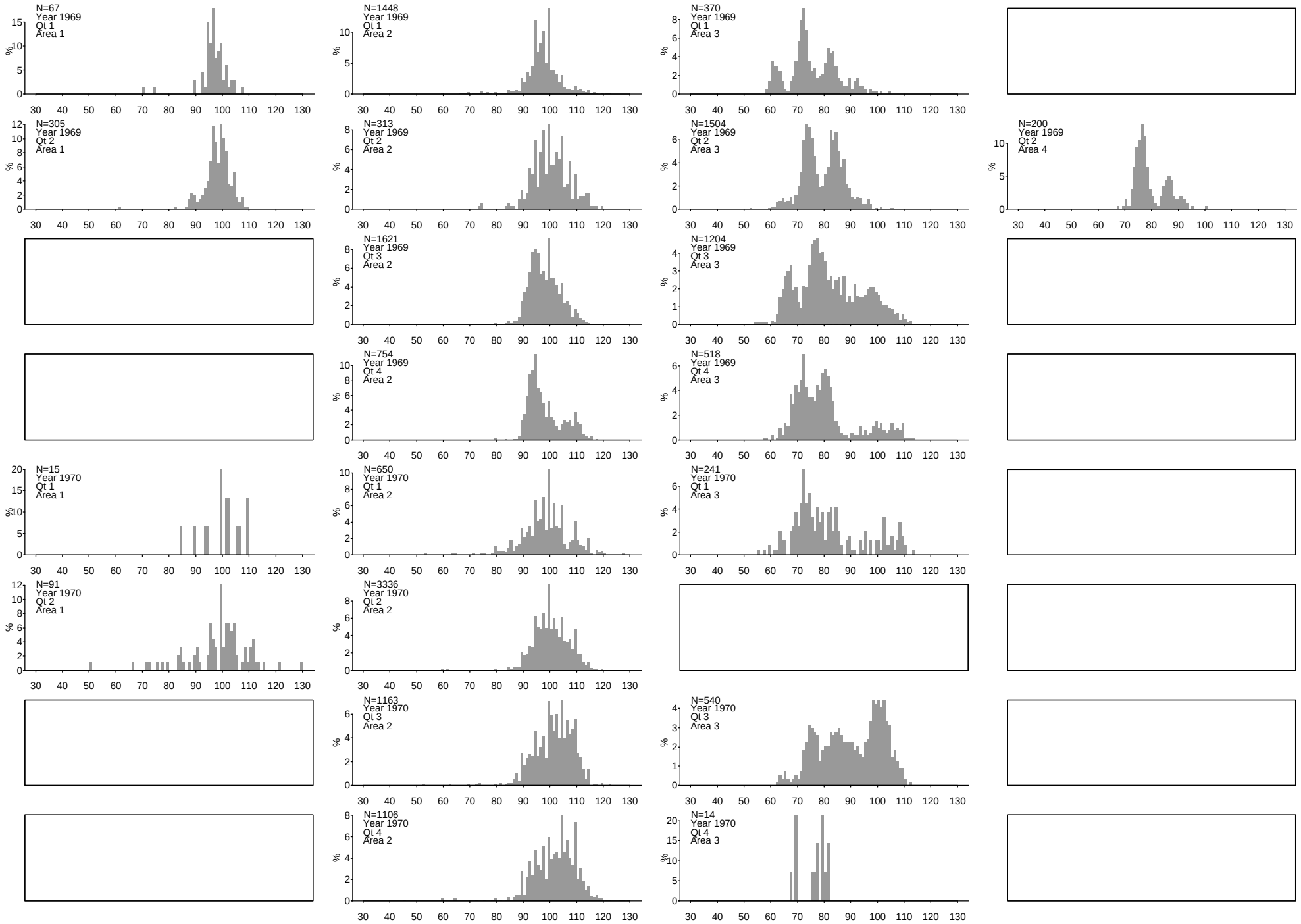


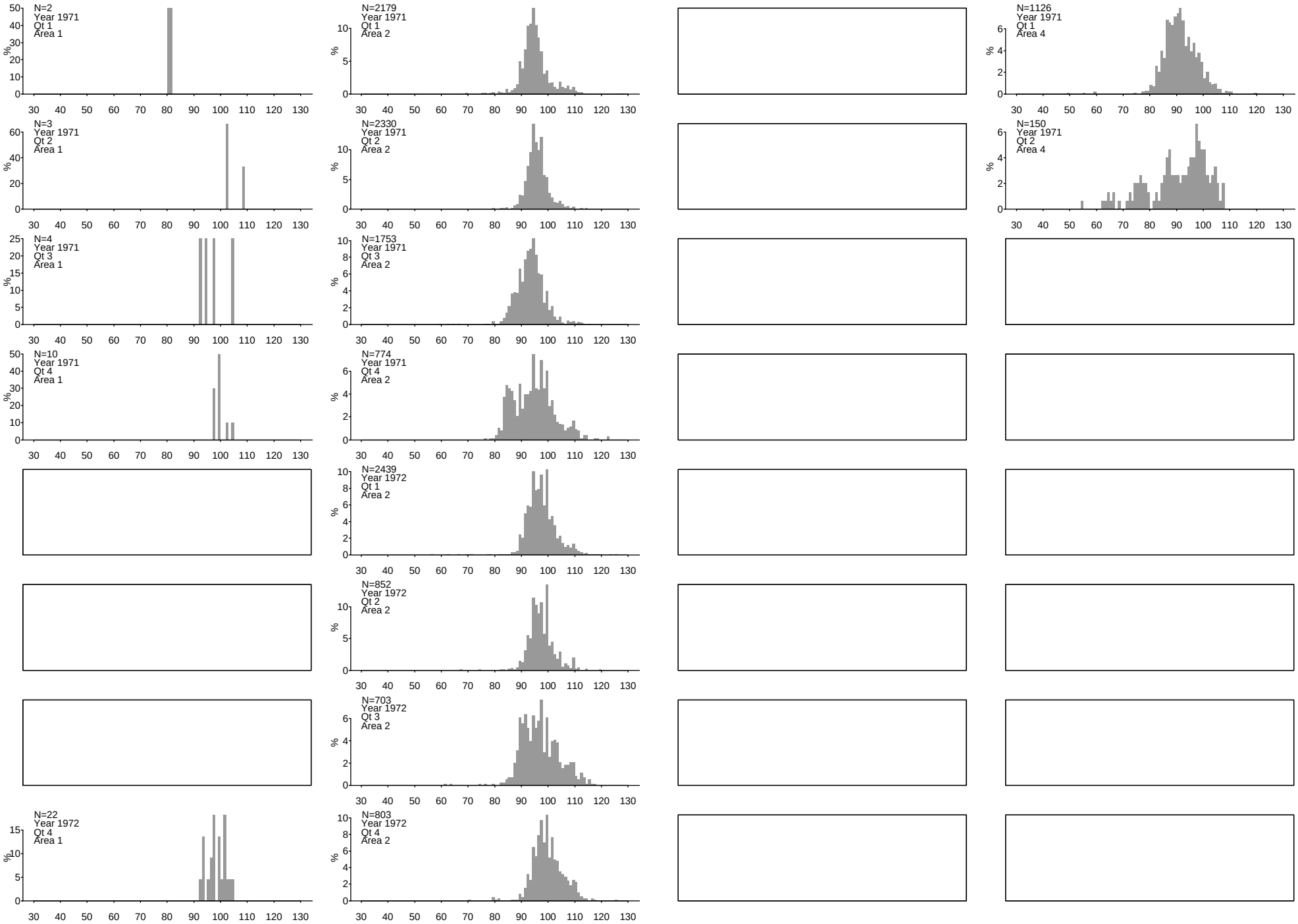
Appendix 1. Length frequencies for the Indian albacore caught by the Japanese longline fishery by quarter and area.



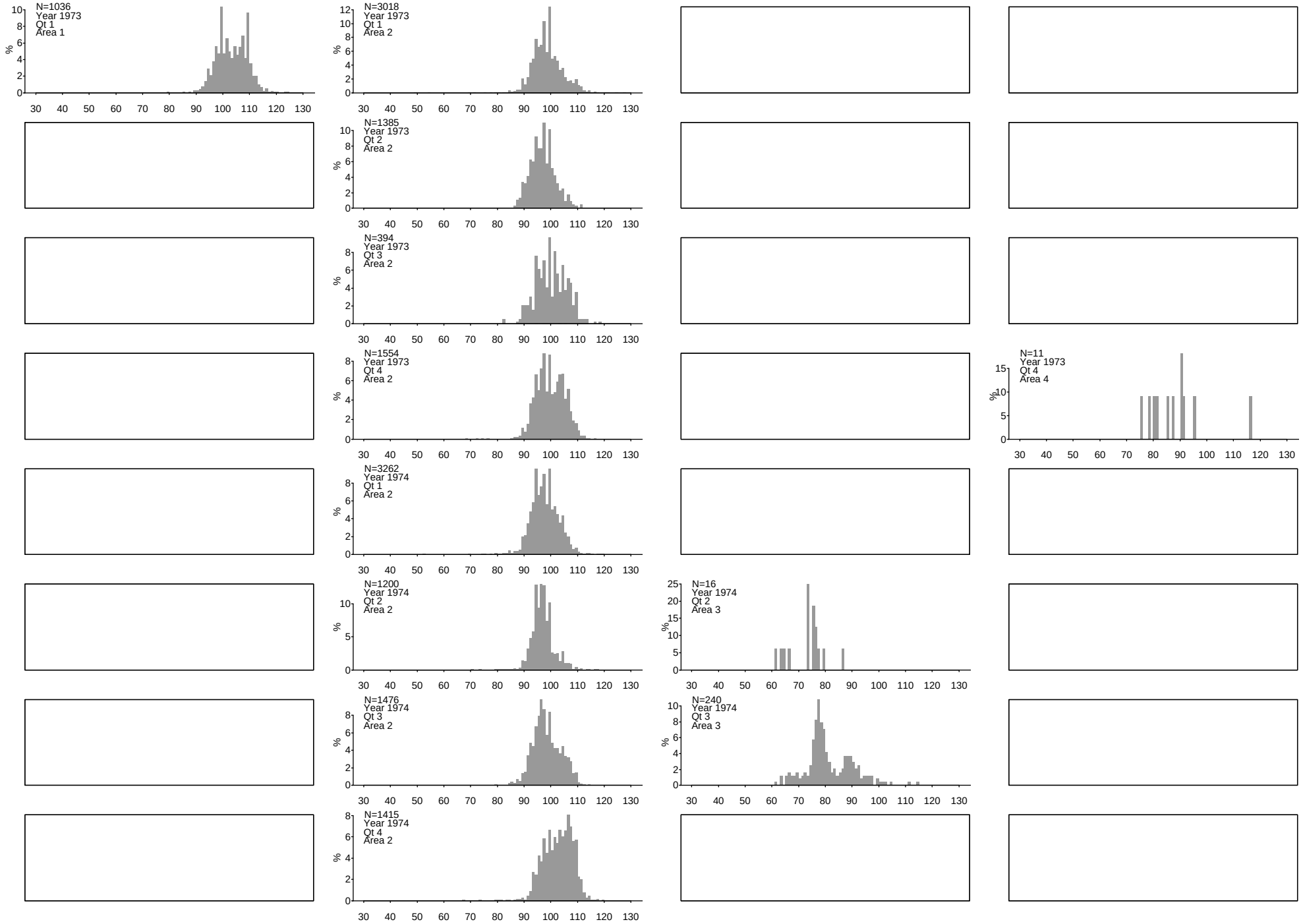
Appendix 1. Length frequencies for the Indian albacore caught by the Japanese longline fishery by quarter and area.



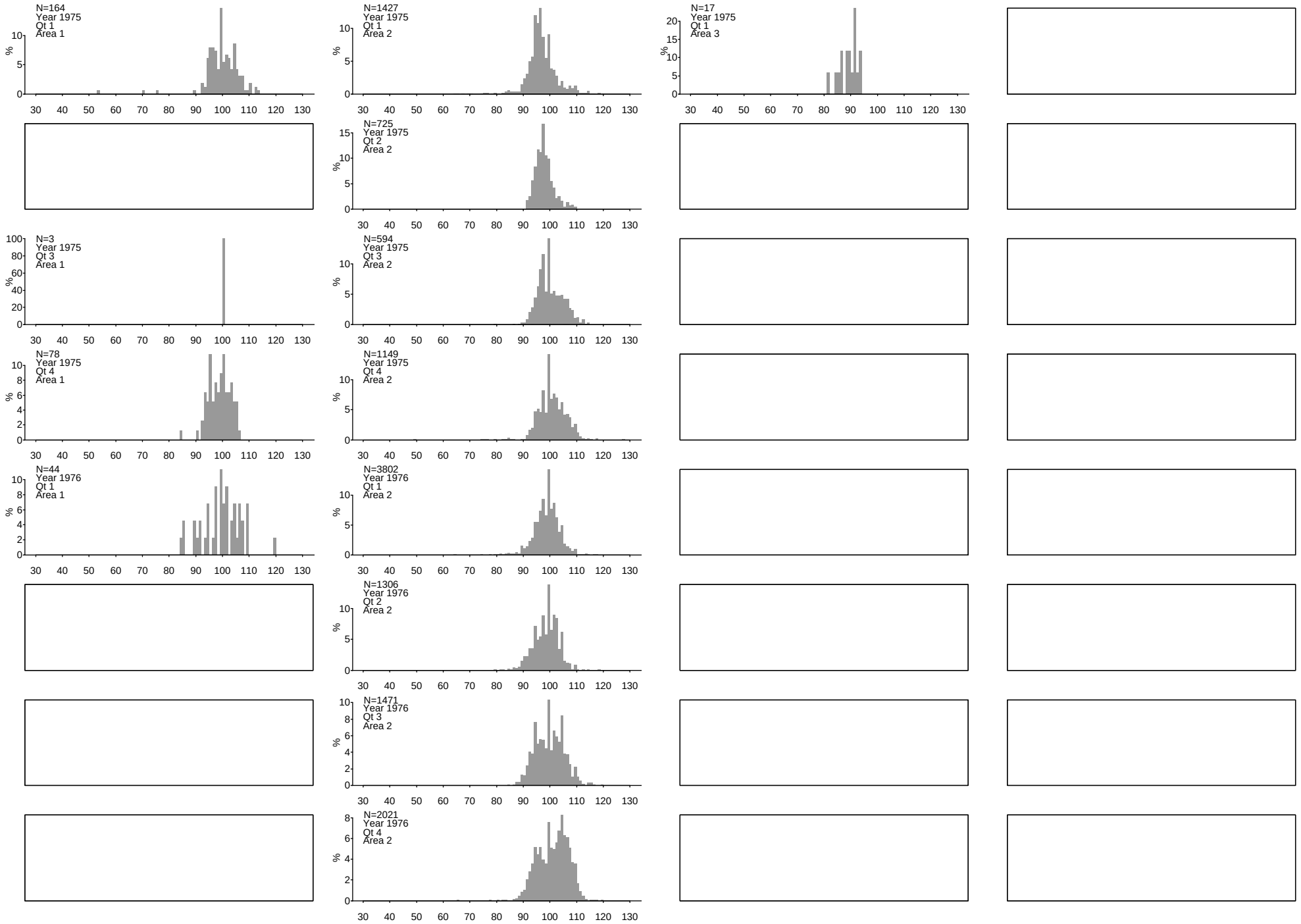
Appendix 1. Length frequencies for the Indian albacore caught by the Japanese longline fishery by quarter and area.



Appendix 1. Length frequencies for the Indian albacore caught by the Japanese longline fishery by quarter and area.

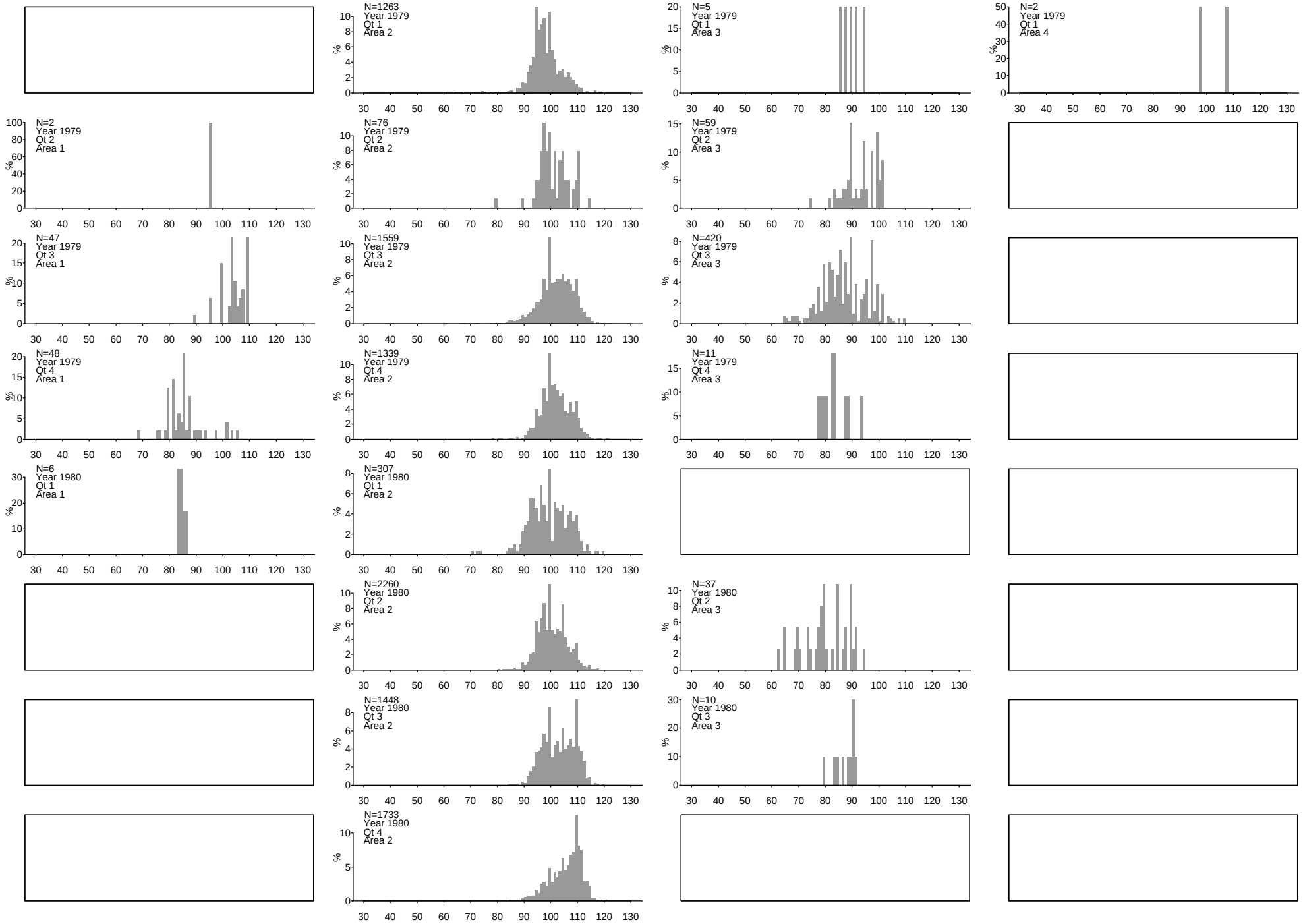


Appendix 1. Length frequencies for the Indian albacore caught by the Japanese longline fishery by quarter and area.

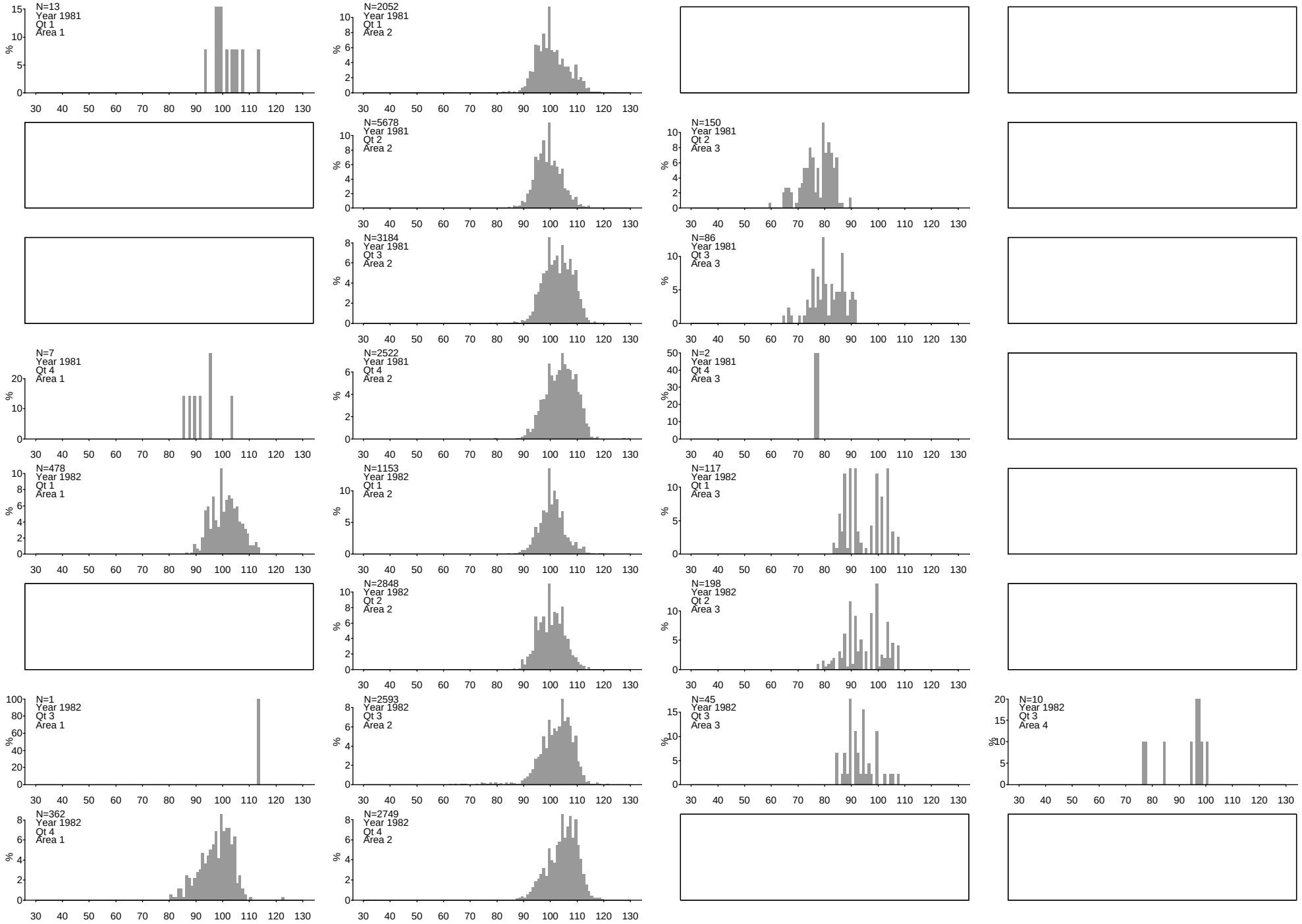


Appendix 1. Length frequencies for the Indian albacore caught by the Japanese longline fishery by quarter and area.

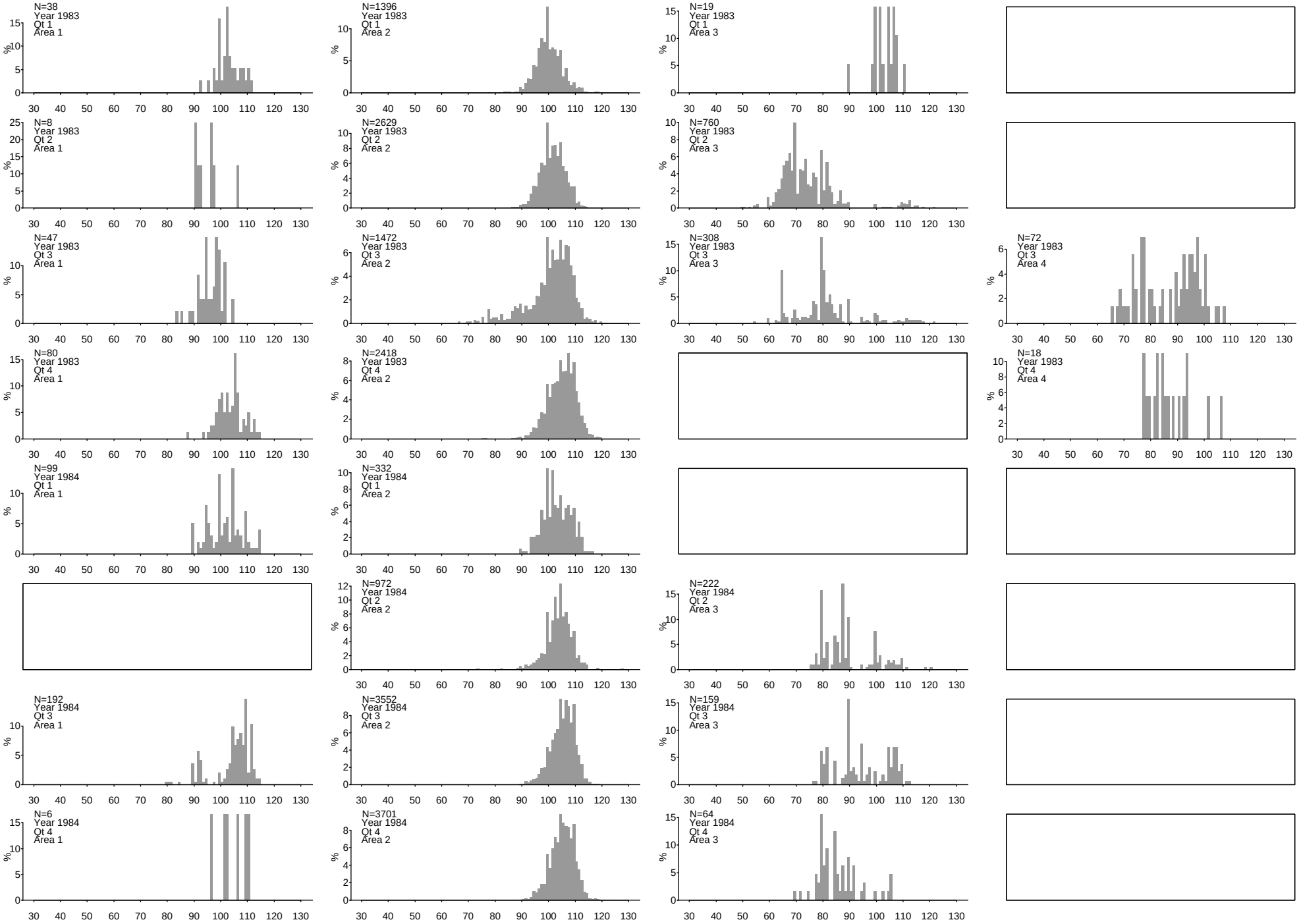
Appendix 1. Length frequencies for the Indian albacore caught by the Japanese longline fishery by quarter and area.



Appendix 1. Length frequencies for the Indian albacore caught by the Japanese longline fishery by quarter and area.



Appendix 1. Length frequencies for the Indian albacore caught by the Japanese longline fishery by quarter and area.



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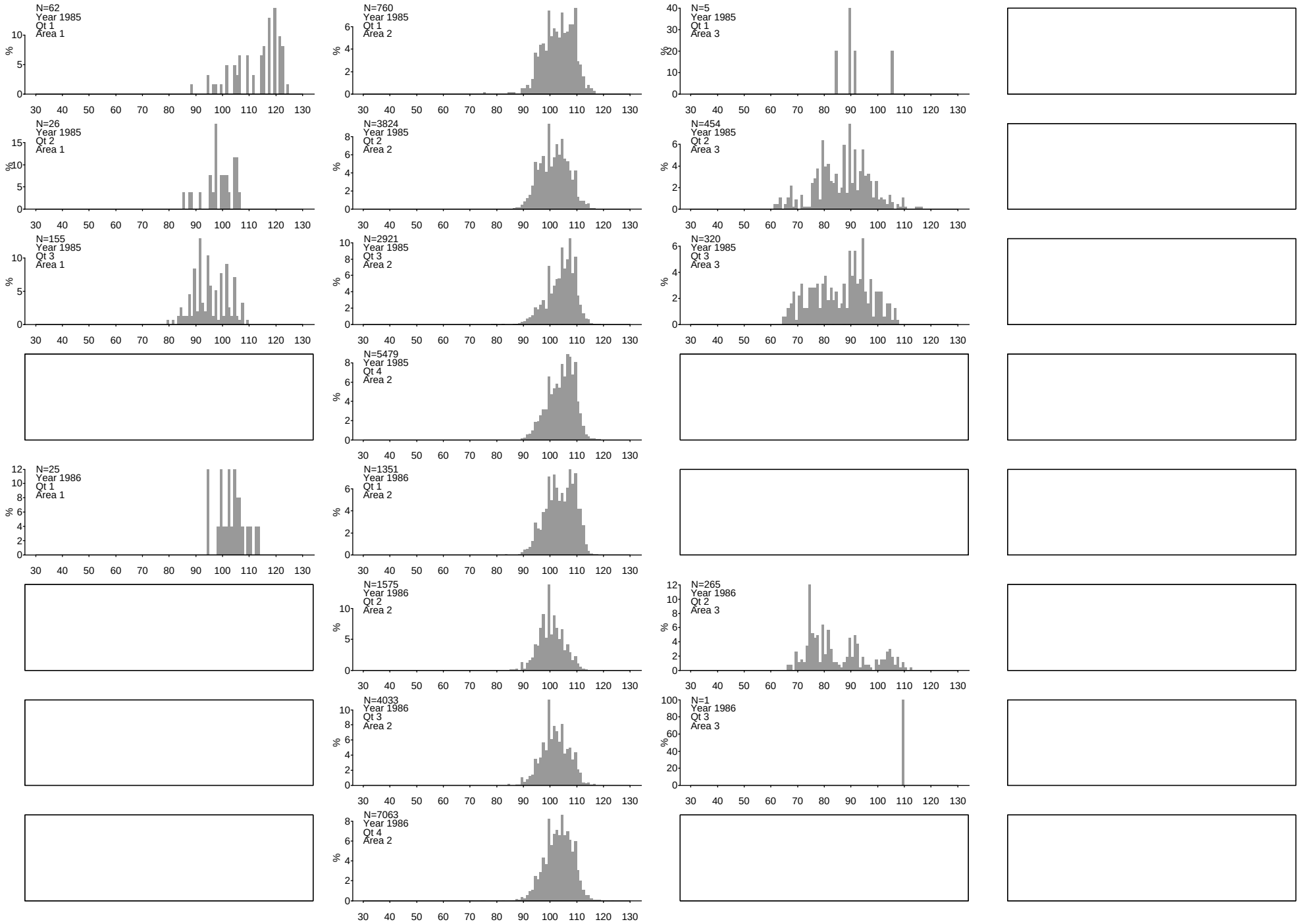

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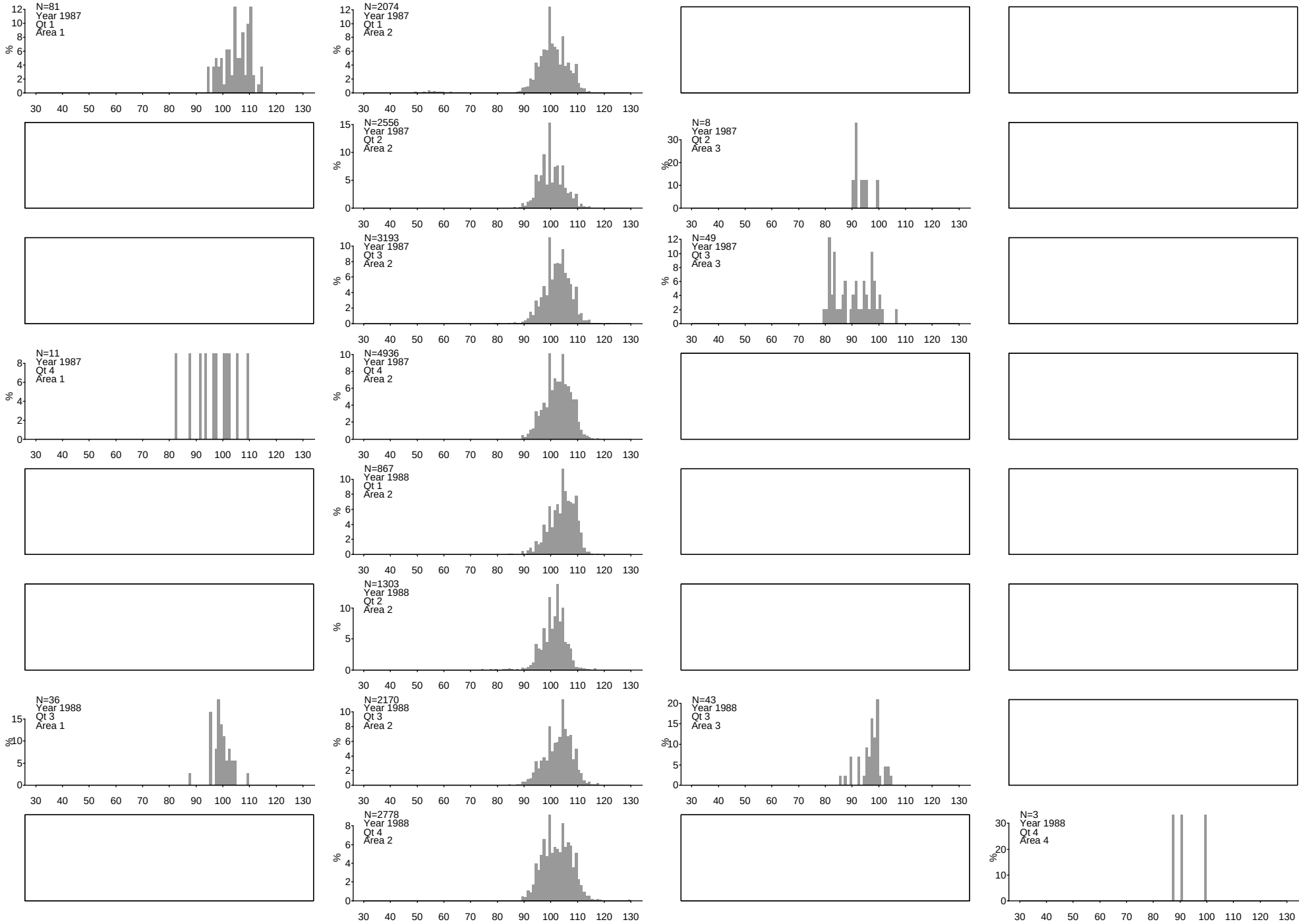

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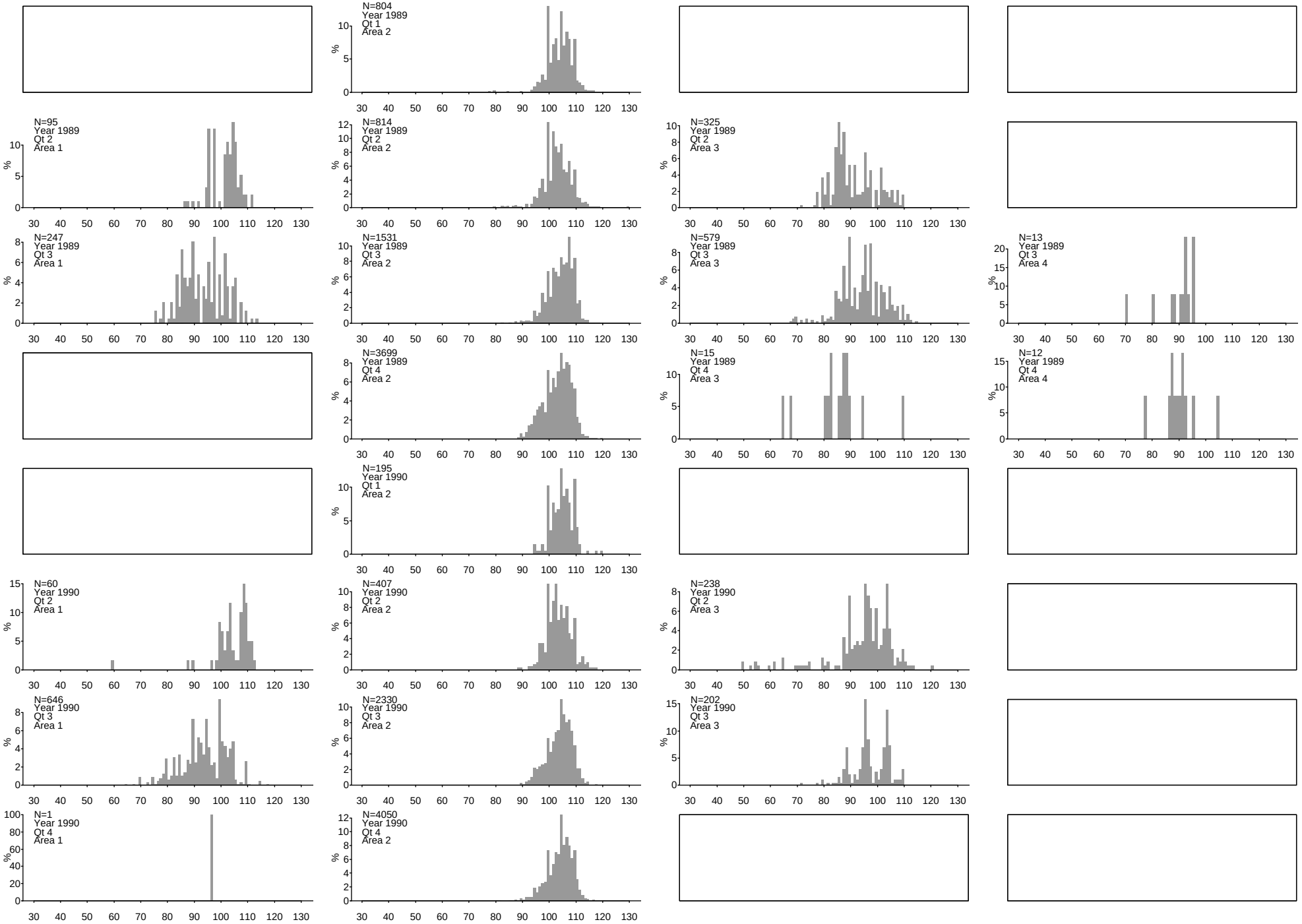

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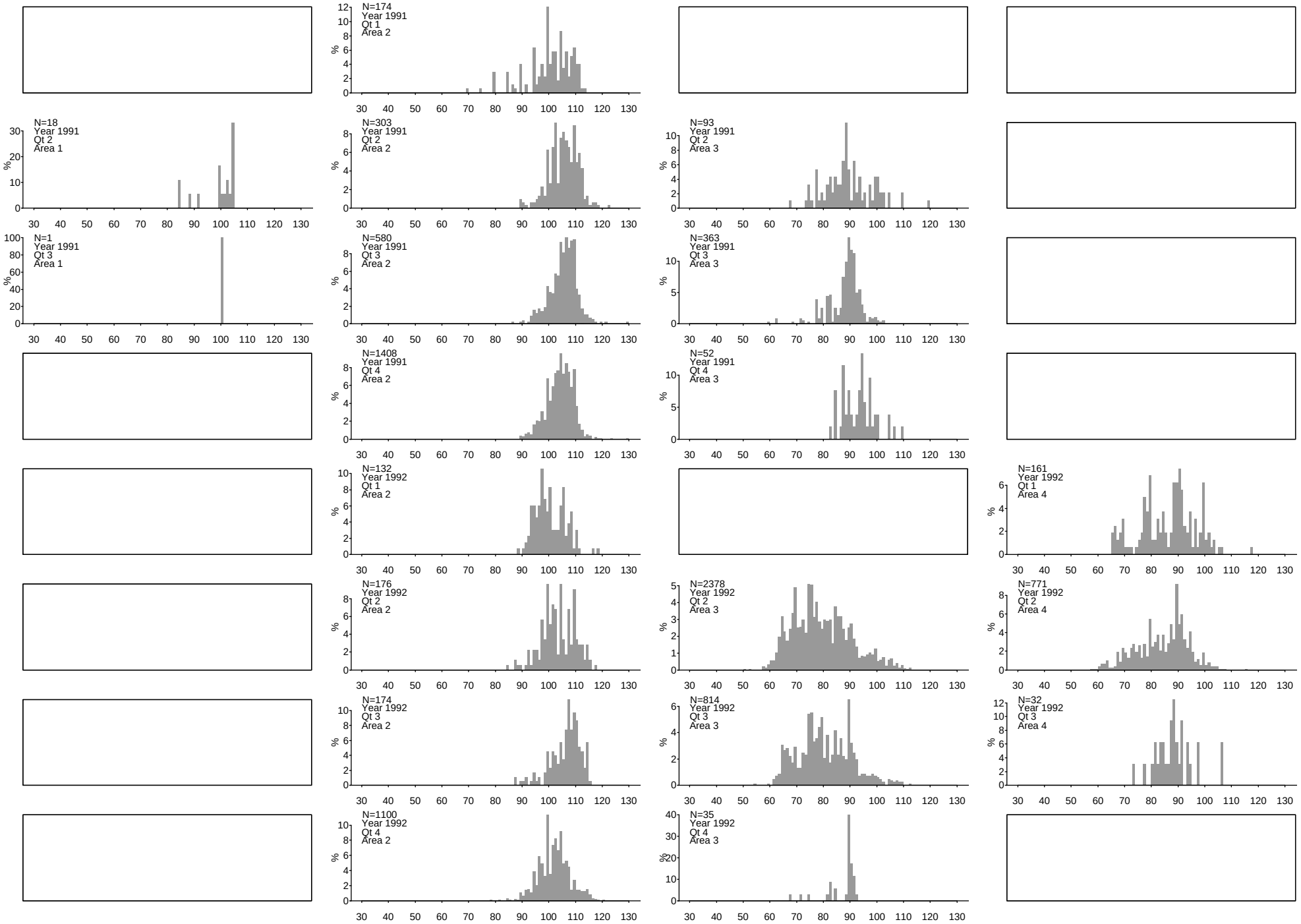

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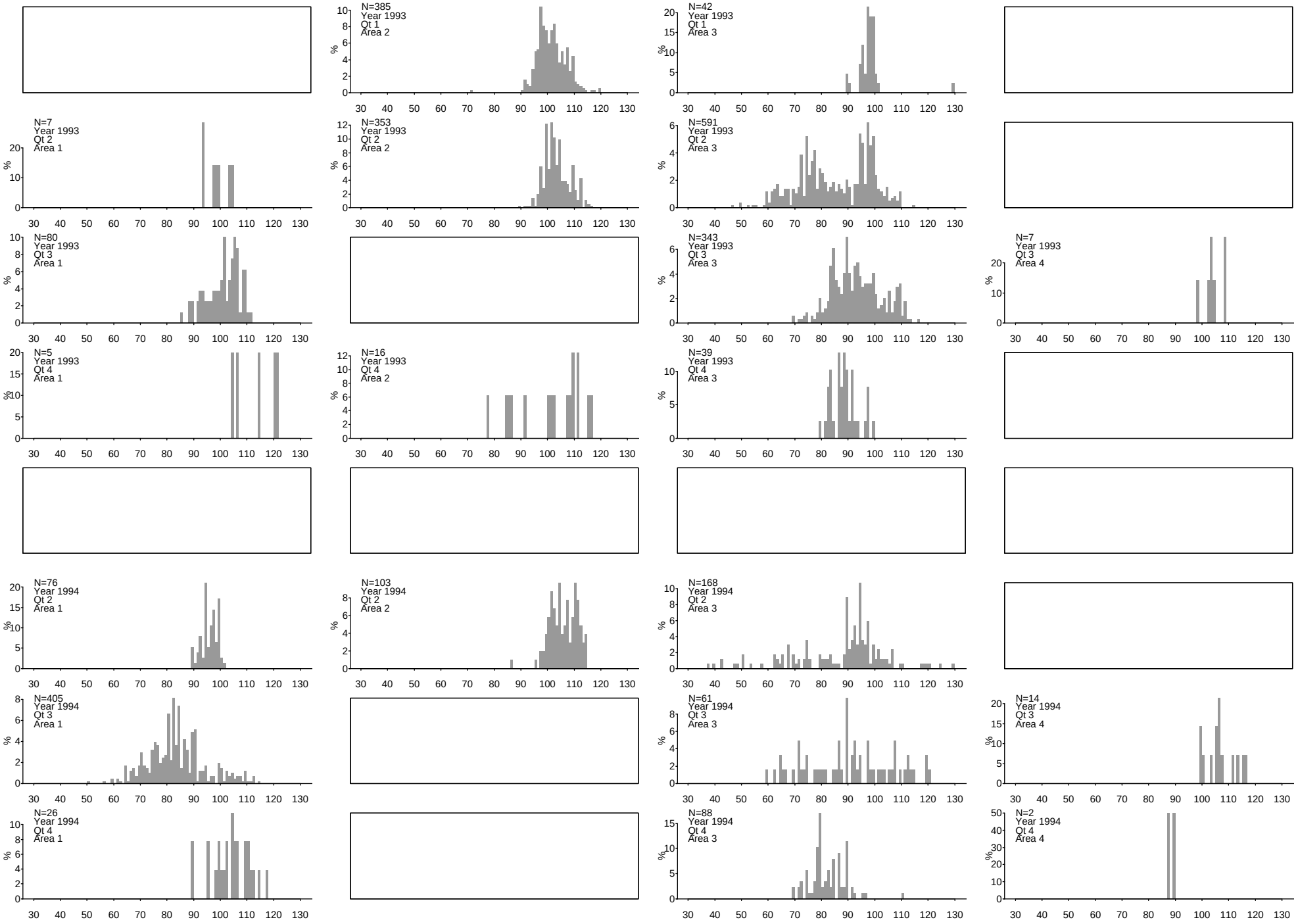

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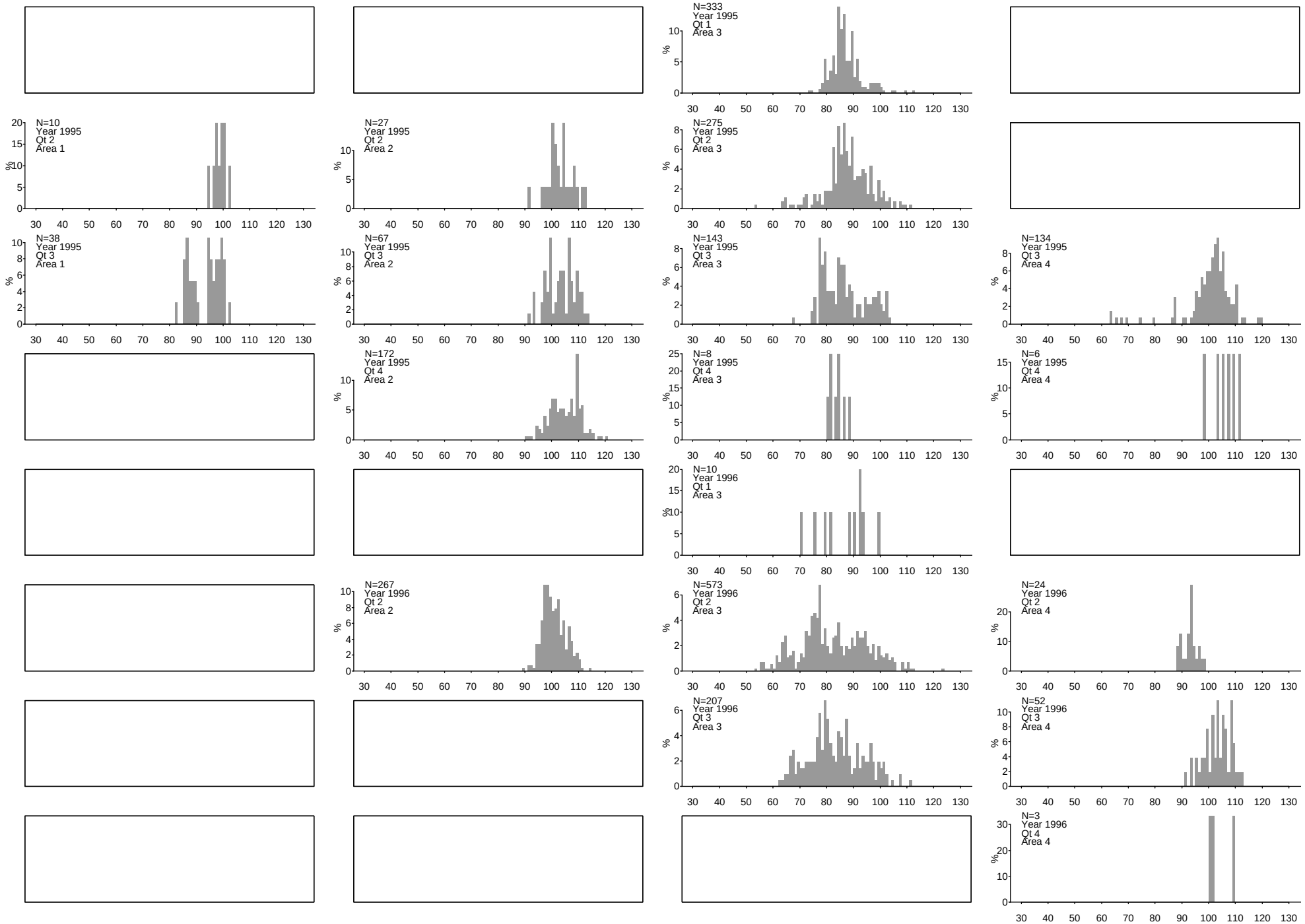

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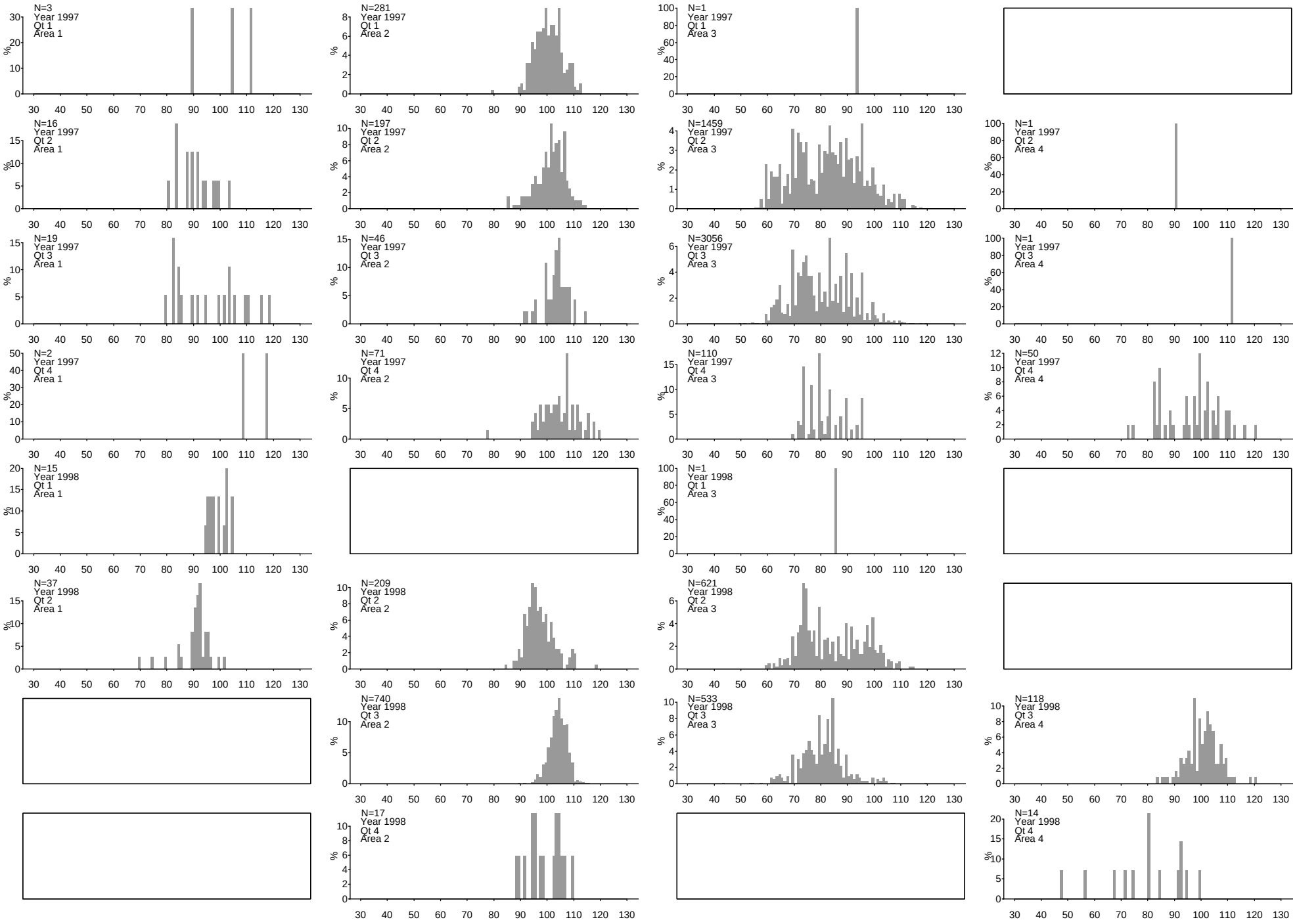

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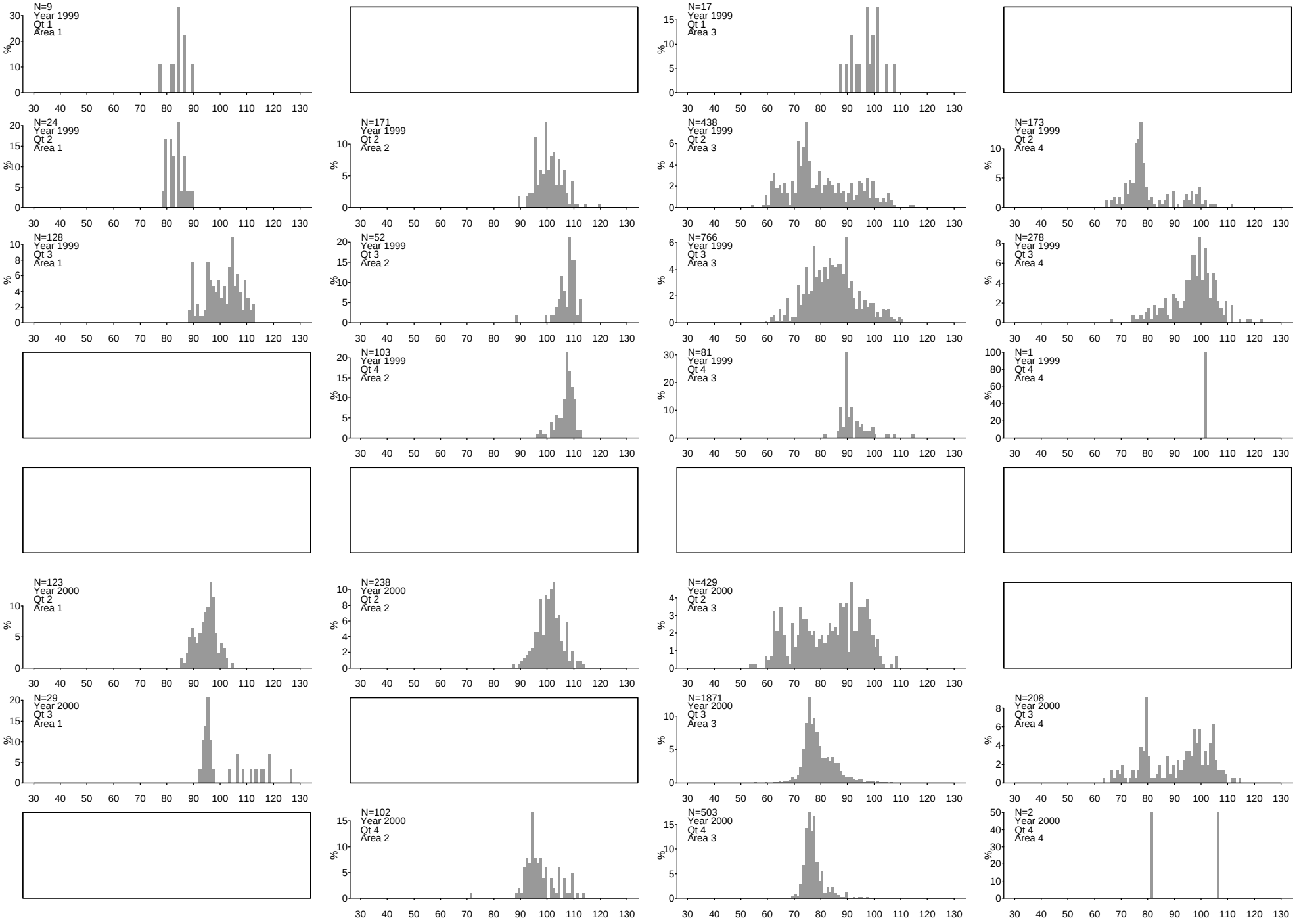

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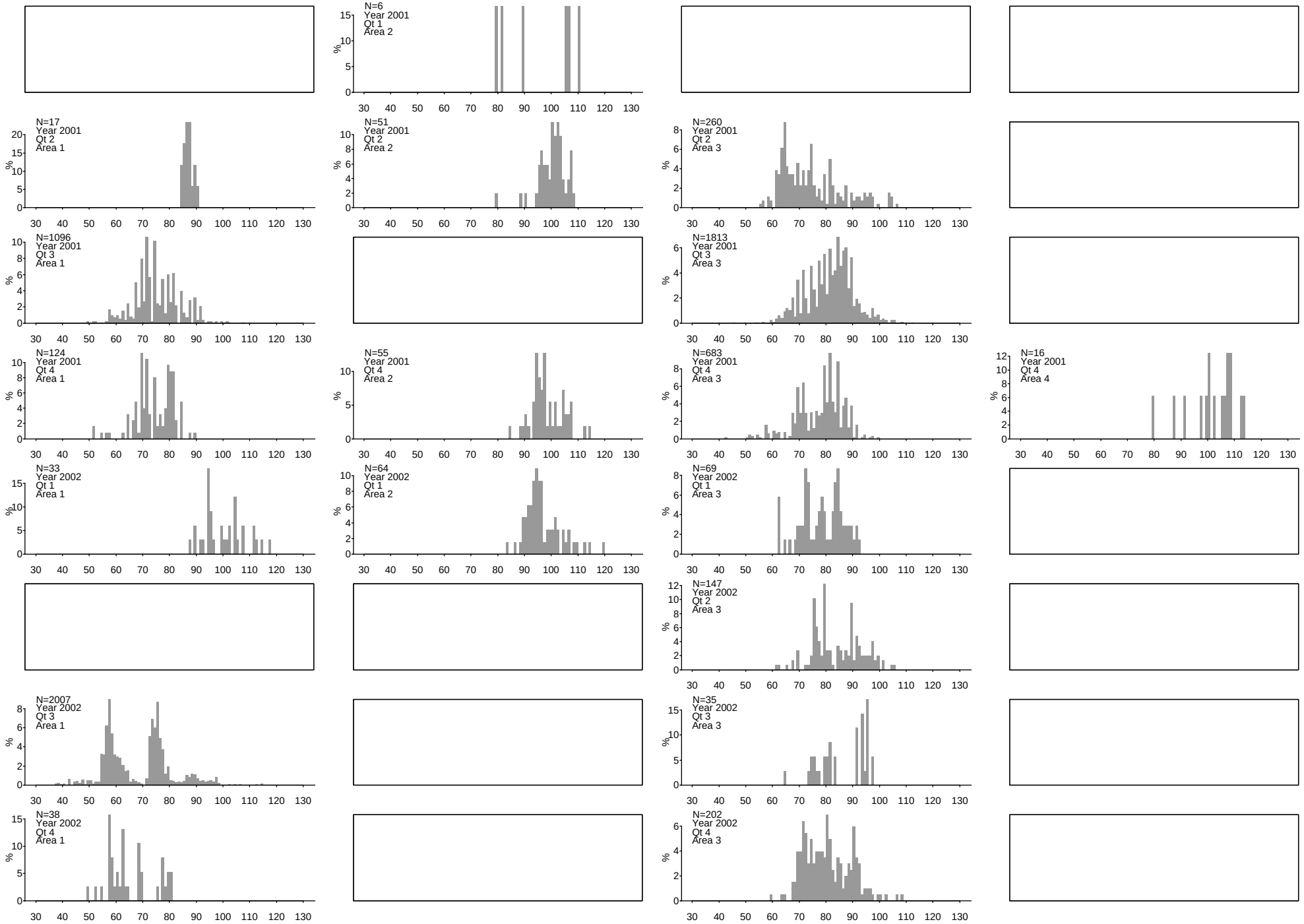

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