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UPDATING THE CENSUS OF STAR CLUSTERS IN THE SMALL MAGELLANIC CLOUD

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ABSTRACT

Surveys using CCD detectors are retrieving bright and faint cataloged clusters and revealing new ones in the Magellanic Clouds. This paper discusses the contribution of the OGLE Survey to the overall census of star clusters in the Small Magellanic Cloud (SMC). A detailed cross-identification indicates that the new objects in the SMC OGLE catalog are 46. The increase in the number of cataloged clusters is ≈7%, the total sample being ≈700. This updated census includes embedded clusters in H II regions and a density range attaining loose systems.

Key words: catalogs — galaxies: star clusters — Magellanic Clouds

1. INTRODUCTION

The Magellanic Clouds contain rich star cluster systems (Hodge 1986, 1988). The distances of the Clouds and their rather high galactic latitudes make them ideal targets to probe total populations of extended objects.

It is becoming possible to map out the overall angular distributions of star clusters, associations, and H II regions (see, e.g., the revisions of previously cataloged and newly identified objects in the SMC and LMC Bica & Schmitt 1995; Bica et al. 1999). Such distributions help one better understand star formation mechanisms and the evolution of the Magellanic System. The homogeneous surveys above were carried out on ESO/SERC *R* and *J* Sky Survey Schmidt Plates.

CCD survey results are becoming available that provide deep images in particular areas. A sector of the LMC was studied by Zaritsky et al. (1997) using *UBVI* filters and they identified previous and new clusters. These objects were cross-identified in detail with the previous literature in Bica et al. (1999) and were included in that catalog. Recently, Pietrzyński et al. (1998) built a catalog of SMC clusters from the Optical Gravitational Lensing Experiment (OGLE) *BVI* database. The region covered by the OGLE Survey is ≈2.4 deg^2 in the central parts of the SMC. They reported 238 clusters and presented a cross-identification concluding that 72 clusters were newly cataloged.

In the present paper we perform a detailed cross-identification of the objects in the OGLE catalog with those in previous works, homogenizing classifications. We indicate intrinsically new objects which in turn have implications on the star cluster census. According to Hodge (1986) the total cluster population in the SMC would be ≈900 if it were surveyed entirely with 4 m telescope deep *B* plates as he did for a selection of fields. Considering incompleteness effects related to faint turnoffs he estimated a grand total of ≈2000. Since Hodge's (1986) study new objects have been identified in the SMC (Bica & Schmitt 1995; Pietrzyński et al. 1998) and it is important to update the census in view of shedding light on the SMC history of star cluster formation and dissolution. In § 2 we discuss the cross-identification procedures and present the results. In § 3 we compare the angular distribution of the SMC OGLE objects with that of all extended objects in the SMC, and discuss the impact of the new SMC OGLE objects on the SMC census of extended objects, in particular star clusters. In § 4 we give the concluding remarks.

2. CROSS-IDENTIFICATIONS

Pietrzyński et al. (1998) presented the catalog of OGLE objects in the SMC, together with *I*-band CCD images of each object. We used the information therein provided, particularly the coordinates and images, for the present cross-identification with the objects in Bica & Schmitt (1995, hereafter BS95).

We overplotted the 238 SMC OGLE objects on J2000.0 maps containing the objects in BS95. The objects resulting very close in position had their CCD images in Pietrzyński et al. (1998) compared with the corresponding fields in the ESO/SERC *R* and *J* Schmidt plates and Digitized Sky Survey (DSS) images in order to check equivalences, which as rule occurred. Isolated objects turned out to be new objects.

We measured diameters and position angles of the new SMC OGLE objects and classified them homogeneously with BS95 and Bica et al. (1999). The object types in the latter classifications are: C for star cluster, A for emissionless association, CA and AC for objects with intermediate properties, NA for H II regions and embedded associations, NC for H II regions and embedded star clusters or high surface brightness compact H II regions, N for supernova remnants; AN and CN are, respectively, associations and clusters that show traces of emission.

The results for all SMC OGLE objects following the BS95 and Bica et al. (1999) catalog format are given in Table 1. By columns: (1) Sky Survey field quadrant where the object is best seen; (2) object cross-identification in the different catalogs. Columns (3) and (4) are right ascension and declination, respectively, for the epoch 2000.0; (5) is object type. Columns (6) and (7) show major and minor diameters, respectively. (8) gives the position angle of the major axis (0° = north; 90° = east). Remarks appear in column (9): "mP," "mT," "m4,"..., indicate, respectively, a member of a pair, triple, etc., "&" indicates designations in addition to those in column (2).

We confirmed most of the cross-identifications by Pietrzyński et al. (1998) for the 166 objects therein indicated as having previous identifications. However, of the 72 SMC OGLE objects reported as newly found by Pietrzyński et al. (1998), we concluded that 26 had previous identifications in the literature, while 46 are intrinsically new objects. These 46 objects are relatively isolated, and their typical appearance on the DSS images is a few enhanced pixels, basically

TABLE 1

PRESENTLY CROSS-IDENTIFIED SMC OGLE CATALOG

Plate (1)	Name (2)	R.A. (3)	Decl. (4)	Type (5)	D_{max} (arcmin) (6)	D_{min} (arcmin) (7)	P.A. (deg) (8)	Remarks (9)
29nw......	H86-35, OGLE1	0 36 38	−73 05 09	C	0.35	0.35	...	
29nw......	HW11, OGLE2	0 37 33	−73 36 43	C	1.30	1.30	...	
29nw......	L19, OGLE3	0 37 42	−73 54 30	C	1.70	1.70	...	
29nw......	B10, OGLE4	0 37 44	−73 12 40	C	0.80	0.80	...	
29nw......	B14, OGLE162	0 38 37	−73 48 21	C	0.60	0.45	160	
29nw......	HW12, OGLE163	0 38 51	−73 22 27	C	0.80	0.80	...	
29nw......	H86-48, OGLE164	0 38 56	−73 24 32	C	0.50	0.40	30	
29nw......	BS14, OGLE165	0 39 12	−73 14 46	C	0.55	0.55	...	mP
29nw......	OGLE5	0 39 22	−73 15 28	CA	0.85	0.75	90	mP
29nw......	H86-55, OGLE167	0 39 26	−73 06 23	C	0.45	0.35	80	
29nw......	HW13, OGLE168	0 39 31	−73 25 26	C	0.75	0.60	80	
29nw......	OGLE6	0 39 33	−73 10 37	C	0.80	0.80	...	
29nw......	OGLE7	0 40 30	−73 13 50	CA	0.95	0.95	...	
29nw......	NGC 220, K18, L22, ESO29SC3	0 40 31	−73 24 10	C	1.20	1.20	...	mT, in H-A3 & OGLE8
29nw......	B26, OGLE169	0 40 45	−73 44 26	C	0.90	0.90	...	
29nw......	NGC 222, K19, L24, ESO29SC4	0 40 44	−73 23 00	C	1.20	1.20	...	mT, in H-A3 & OGLE9
29nw......	H86-62, OGLE10	0 40 48	−73 05 17	C	0.60	0.60	...	mT
29nw......	B23, OGLE170	0 40 55	−73 24 07	C	0.60	0.50	40	mT, in H-A3
29nw......	NGC 231, K20, L25, ESO29SC5	0 41 06	−73 21 07	C	1.80	1.80	...	mP, in H-A3 & OGLE11
29nw......	B21, OGLE171	0 41 15	−72 49 55	C	0.35	0.35	...	mP
29nw......	K21, L27, OGLE12	0 41 24	−72 53 27	C	2.50	2.50	...	
29nw......	OGLE172	0 41 48	−73 23 27	C	0.20	0.20	...	
29nw......	OGLE166	0 41 56	−73 29 16	C	0.60	0.50	80	
29nw......	OGLE173	0 42 12	−73 16 02	C	0.20	0.20	...	
29nw......	HW16, OGLE13	0 42 22	−73 44 03	CN	0.60	0.60	...	mP, in SMC-DEM7
29nw......	OGLE14	0 42 28	−73 32 50	AC	0.80	0.60	170	
29nw......	OGLE15	0 42 54	−73 17 37	CA	1.00	1.00	...	in? sup? H-A4
29nw......	BS16, OGLE16	0 42 58	−73 10 07	C	0.55	0.50	10	in H-A5
29nw......	BS17, OGLE174	0 43 14	−73 00 43	CA	0.80	0.65	60	
29nw......	NGC 241, K22w, L29w	0 43 33	−73 26 25	C	0.95	0.95	...	mP & ESO29SC6w, OGLE17
29nw......	NGC 242, K22e, L29e	0 43 38	−73 26 37	C	0.75	0.75	...	mP & ESO29SC6e, BH1, OGLE18
29nw......	B31, OGLE19, OGLE175	0 43 38	−72 57 31	C	0.50	0.40	150	mT
29nw......	BS20, OGLE20	0 43 38	−72 58 48	C	0.45	0.45	...	mT
29nw......	H86-70, OGLE21	0 43 44	−72 58 36	C	0.65	0.45	50	mT
29nw......	OGLE22	0 43 58	−73 09 08	CA	0.75	0.75	...	
29nw......	B33, OGLE23	0 44 13	−73 37 08	C	0.50	0.50	...	
29nw......	B34, OGLE176	0 44 52	−73 00 07	C	0.60	0.60	...	br* edge
29nw......	BS27, OGLE177	0 44 55	−73 10 27	C	0.40	0.35	80	mP, in H86-72
29nw......	OGLE24	0 45 01	−72 55 17	A	1.90	1.90	...	
29nw......	BS28, OGLE178	0 45 11	−72 52 31	CA	0.70	0.50	60	
29nw......	H86-74, OGLE25	0 45 14	−73 13 09	C	0.70	0.60	50	in SMC-DEM13
29nw......	OGLE179	0 45 21	−73 02 08	CA	0.50	0.50	...	
29nw......	NGC 248n, SMC-N13B, L61-67n	0 45 24	−73 22 34	NA	0.70	0.60	110	mP & SMC-DEM16n, ESO29EN8n, MA101, OGLE26n
29nw......	OGLE180	0 45 23	−72 55 43	C	0.25	0.25	...	
29nw......	NGC 248s, SMC-N13A, L61-67s	0 45 26	−73 23 04	NC	0.70	0.55	150	mP & SMC-DEM16s, ESO29EN8s, MA103, OGLE26s

TABLE 1—*Continued*

Plate (1)	Name (2)	R.A. (3)	Decl. (4)	Type (5)	D_{max} (arcmin) (6)	D_{min} (arcmin) (7)	P.A. (deg) (8)	Remarks (9)
29nw......	B39, OGLE27	0 45 26	−73 28 53	C	0.55	0.55	...	mP
29nw......	OGLE28	0 45 28	−72 49 10	C	0.40	0.40	...	
29nw......	OGLE181	0 45 28	−72 53 09	CA	0.70	0.50	60	
29nw......	NGC 249, B35, ESO29EN9	0 45 30	−73 04 43	NA	1.10	0.70	0	in SMC-N12B & OGLE29
29nw......	OGLE30	0 45 33	−73 06 27	CA	0.75	0.75	...	
29nw......	OGLE31	0 45 51	−72 50 25	CA	0.55	0.45	90	mP, not B36
29nw......	NGC 256, K23, L30, ESO29SC11	0 45 54	−73 30 24	C	0.90	0.90	...	& OGLE32
29nw......	H86-76, OGLE182	0 46 02	−73 23 44	C	0.45	0.45	...	mT, in SMC-DEM21
29nw......	H86-80, OGLE184	0 46 11	−72 49 03	C	0.35	0.35	...	
29nw......	H86-78n, OGLE33n	0 46 12	−73 23 27	CN	0.45	0.45	...	mT, in SMC-N16
29nw......	OGLE183	0 46 10	−73 03 56	CA	0.35	0.30	160	
29nw......	H86-78s, OGLE33s	0 46 12	−73 23 39	CN	0.45	0.40	60	mT, in SMC-N16
29nw......	NGC 261, B42, ESO29EN12	0 46 32	−73 05 55	NA	1.30	1.10	100	in SMC-N12A & OGLE34
29nw......	L31, OGLE36	0 46 35	−72 44 32	C	1.10	0.85	30	mT
29nw......	H86-83, OGLE35	0 46 34	−72 46 26	C	0.70	0.70	...	mT
29nw......	H86-84, OGLE185	0 46 34	−72 45 56	C	0.40	0.40	...	mT
29nw......	OGLE37	0 46 41	−73 00 00	C	0.80	0.70	10	
29nw......	H86-85, OGLE186	0 46 56	−73 25 25	C	0.60	0.50	150	in SMC-DEM29
29nw......	H86-86, OGLE40	0 47 01	−73 23 35	C	0.80	0.65	110	mP, in H-A9
29nw......	H86-89, OGLE38	0 47 06	−73 15 24	C	0.85	0.65	150	
29nw......	H86-87, OGLE187	0 47 06	−73 22 17	C	0.80	0.70	90	mP, in H-A9
29nw......	NGC 265, K24, L34, ESO29SC14	0 47 12	−73 28 38	C	1.20	1.20	...	& OGLE39
29nw......	L33, OGLE41	0 47 25	−72 50 27	C	1.00	0.80	130	
29nw......	H86-93, MA172, OGLE188	0 47 24	−73 12 20	CN	0.40	0.40	...	in H-A11
29nw......	BS35, OGLE42	0 47 50	−73 28 42	C	0.70	0.70	...	mP
29nw......	H86-97, OGLE43	0 47 52	−73 13 20	C	0.70	0.60	60	
29nw......	H86-98, OGLE44	0 47 55	−72 57 20	CA	0.90	0.65	60	
29nw......	K25, L35, OGLE45	0 48 01	−73 29 10	C	1.20	1.20	...	mP
29nw......	SMC-N25, L61-106, SMC-DEM38	0 48 09	−73 14 19	NA	0.85	0.85	...	mT & MA208, OGLE189
29nw......	H86-99, OGLE190	0 48 13	−72 47 35	CA	0.65	0.65	...	mP
29nw......	H86-100, OGLE191	0 48 20	−72 47 42	CA	0.75	0.75	...	mP
29nw......	NGC 269, K26, L37, ESO29SC16	0 48 21	−73 31 49	C	1.20	1.20	...	& OGLE46
29nw......	OGLE192	0 48 26	−73 00 26	C	0.35	0.35	...	
29nw......	OGLE47	0 48 28	−72 59 00	AC	1.20	1.20	...	
29nw......	B47, OGLE48	0 48 33	−73 18 25	C	1.00	1.00	...	
29nw......	B48, OGLE49	0 48 37	−73 24 53	CA	1.30	1.10	140	in H-A16
29nw......	OGLE193	0 48 37	−73 10 45	CA	0.50	0.50	...	
29nw......	OGLE50	0 48 59	−73 09 04	NC	0.75	0.75	...	in SMC-N30
29nw......	H86-103, OGLE51	0 49 05	−73 03 04	C	0.55	0.45	40	
29nw......	BS41, OGLE194	0 49 06	−73 21 10	C	0.55	0.55	...	mT
29nw......	H86-104, OGLE52	0 49 12	−73 06 31	C	0.40	0.40	...	
29nw......	BS42, OGLE195	0 49 16	−73 14 57	CA	1.00	1.00	...	in SMC-DEM49
29nw......	L39, OGLE54	0 49 18	−73 22 20	C	0.70	0.55	170	mT, in BS43
29nw......	OGLE53	0 49 18	−73 12 42	C	1.00	0.80	10	
29nw......	OGLE55	0 49 21	−73 11 02	C	0.60	0.60	...	
29nw......	OGLE196	0 49 27	−73 23 55	C	0.35	0.35	...	

TABLE 1—*Continued*

Plate (1)	Name (2)	R.A. (3)	Decl. (4)	Type (5)	D_{max} (arcmin) (6)	D_{min} (arcmin) (7)	P.A. (deg) (8)	Remarks (9)
29nw......	OGLE56	0 49 36	−72 50 13	CA	0.80	0.60	100	mT, in SMC-DEM46e
29nw......	B52, OGLE57	0 49 40	−73 03 32	C	1.10	1.10	...	in SMC-DEM51
29nw......	H86-109, OGLE58	0 49 45	−72 51 58	C	0.45	0.45	...	mT
29nw......	H86-107, OGLE61	0 50 00	−73 15 18	CA	1.20	0.75	130	in SMC-DEM49
29nw......	B53, OGLE197	0 50 04	−73 23 04	C	0.95	0.95	...	mP
29nw......	H86-112, OGLE198	0 50 08	−73 11 26	C	0.65	0.55	0	in H-A18
29nw......	OGLE199	0 50 15	−73 03 15	CA	0.25	0.25	...	mP, in? sup? SMC-DEM51
29nw......	BS45, OGLE59	0 50 16	−73 02 00	CA	1.00	0.90	70	mP, in SMC-DEM51
29nw......	B55, OGLE60	0 50 22	−73 23 16	C	0.70	0.60	110	mP
29nw......	B54, OGLE62	0 50 28	−73 12 12	C	0.65	0.65	...	
29nw......	H86-115, OGLE63	0 50 37	−73 03 28	AC	1.60	1.20	40	mP, in SMC-DEM51
29nw......	BS46, OGLE200	0 50 39	−72 58 44	C	0.50	0.45	60	mP, in L40
29nw......	H86-116, OGLE64	0 50 40	−72 57 55	C	0.50	0.50	...	mP, in L40
29nw......	BS48, OGLE201	0 50 42	−73 23 49	AC	0.85	0.55	80	mP, in SMC-DEM53
29nw......	L41, OGLE67	0 50 56	−72 43 40	C	0.65	0.65	...	in H-A25
29nw......	OGLE65	0 50 55	−73 03 27	C	0.65	0.65	...	mP
29nw......	B56, OGLE66	0 50 55	−73 12 11	C	0.45	0.45	...	
29nw......	BS40, OGLE68	0 50 56	−73 17 21	CA	0.90	0.80	140	in H-A24
29nw......	H86-105, OGLE202	0 50 59	−73 30 13	C	0.45	0.45	...	
29nw......	NGC 290, L42, ESO29SC19	0 51 14	−73 09 41	C	1.10	1.10	...	in BS51 & OGLE69
29nw......	H86-113, OGLE203	0 51 10	−73 35 24	C	0.40	0.40	...	
29nw......	H86-121, OGLE204	0 51 21	−73 08 19	C	0.55	0.55	...	in BS51
29nw......	BS251, OGLE70	0 51 26	−73 17 00	CA	0.40	0.35	140	
29nw......	H86-124, OGLE205	0 51 32	−72 58 45	C	0.85	0.65	80	
29nw......	B57, OGLE71	0 51 32	−73 00 38	C	1.20	1.20	...	
29nw......	SMC-N45, L61-189, B60	0 51 42	−73 13 47	NC	0.75	0.75	...	in H-A26 & SMC-DEM60, MA485, OGLE72
29nw......	B59, L61-183, MA488	0 51 44	−72 50 25	CN	0.80	0.60	80	mP & OGLE73
29nw......	H86-123, OGLE206	0 51 44	−73 10 01	C	0.55	0.55	...	in BS51
29nw......	H86-127, OGLE207	0 51 49	−72 32 28	C	0.60	0.40	20	in B-OB9
29nw......	K29, L44, OGLE74	0 51 53	−72 57 14	C	0.95	0.95	...	
29nw......	H86-126, OGLE75	0 51 54	−73 05 53	C	0.50	0.50	...	
29nw......	H86-128, OGLE208	0 52 03	−72 49 04	C	0.45	0.45	...	
29nw......	H86-129, OGLE76	0 52 12	−72 31 51	C	0.65	0.45	40	in SMC-DEM64
29nw......	BS56, OGLE77	0 52 13	−73 00 12	C	0.70	0.55	90	mP
29nw......	BS253, OGLE209	0 52 15	−72 45 58	AC	0.60	0.40	10	
29nw......	H86-125, OGLE79	0 52 17	−73 22 32	CA	0.75	0.50	80	in SMC-DEM70n
29nw......	H86-130, OGLE78	0 52 17	−73 01 04	C	0.75	0.60	0	mP
29nw......	B64, OGLE210	0 52 30	−73 02 59	C	0.70	0.70	...	mP, in H-A29
29nw......	BS57, OGLE211	0 52 32	−73 02 10	C	0.65	0.45	60	mP, in H-A29
29nw......	H86-133, OGLE81	0 52 34	−72 40 54	C	0.75	0.75	...	in H-A31
29nw......	H86-132, OGLE80	0 52 31	−72 37 46	C	0.50	0.40	70	in SMC-N50
29nw......	BS60, OGLE82	0 52 42	−72 55 32	C	0.80	0.80	...	
29nw......	H86-134w, OGLE212	0 52 45	−72 59 24	C	0.50	0.50	...	mT, in H-A30
29nw......	B65, OGLE83	0 52 44	−72 58 48	C	0.75	0.75	...	mT
29nw......	B66, OGLE85	0 52 48	−72 47 46	C	0.60	0.45	40	
29nw......	H86-134e, OGLE213	0 52 48	−72 59 22	C	0.50	0.45	0	mT, in H-A30

TABLE 1—*Continued*

Plate (1)	Name (2)	R.A. (3)	Decl. (4)	Type (5)	D_{max} (arcmin) (6)	D_{min} (arcmin) (7)	P.A. (deg) (8)	Remarks (9)
29nw......	BS63, OGLE84	0 52 47	−73 24 25	C	0.50	0.40	150	mP, in SMC-DEM73
29nw......	B67, OGLE87	0 52 49	−73 24 43	C	0.65	0.50	110	mP, in SMC-DEM73
29nw......	H86-735, OGLE86	0 52 48	−72 30 38	C	0.55	0.55	...	
29nw......	K31, L46, OGLE88	0 53 01	−72 53 49	C	2.80	2.80	...	sup SMC-DEM69
29nw......	B69, OGLE89	0 53 07	−72 37 28	C	0.65	0.65	...	in H-A33
29nw......	NGC 294, L47, ESO29SC22	0 53 06	−73 22 49	C	1.70	1.70	...	& OGLE90
29nw......	H86-140, OGLE214	0 53 09	−72 49 58	C	0.45	0.40	50	mP
29nw......	H86-138, OGLE91	0 53 10	−72 34 25	C	0.45	0.45	...	in H-A36
29nw......	BS256, OGLE215	0 53 17	−72 44 03	C	0.50	0.45	80	
29nw......	B71, OGLE92	0 53 18	−72 46 00	C	0.85	0.85	...	
29nw......	H86-143, OGLE93	0 53 31	−72 40 04	C	0.80	0.80	...	m6, in H-A35
29nw......	SMC-N52A, L61-243	0 53 40	−72 39 35	NC	0.50	0.50	...	m6, in HA35& DEM77sw, MA696, OGLE94
29nw......	SMC-N52B, L61-244, B73	0 53 42	−72 39 15	NC	0.50	0.50	...	m6, in HA35& DEM77ne, MA699, OGLE96
29nw......	BS68, OGLE95	0 53 42	−73 21 32	CA	0.90	0.75	130	mP
29nw......	H86-147, OGLE216	0 53 50	−72 53 47	C	1.20	1.20	...	in SMC-DEM69
29nw......	BS69, OGLE217	0 53 56	−72 51 24	CA	0.60	0.40	45	mP
29nw......	BS72, OGLE97	0 54 11	−72 51 54	CA	0.75	0.60	20	mP
29nw......	H86-152, OGLE218	0 54 23	−72 41 41	C	0.45	0.45	...	in B-OB11
29nw......	B80, OGLE98	0 54 47	−73 13 25	C	0.80	0.65	150	
29nw......	B79, OGLE99	0 54 48	−72 27 58	C	0.80	0.60	100	in H-A38
29nw......	B76, OGLE219	0 54 52	−72 54 59	C	0.40	0.40	...	
29nw......	H86-159, OGLE102	0 55 12	−72 41 00	C	0.50	0.40	130	mP, in BS260
29nw......	H86-158, OGLE100	0 55 09	−72 48 40	C	0.65	0.65	...	in B-OB12
29nw......	H86-155, OGLE101	0 55 12	−73 17 48	C	0.50	0.50	...	
29nw......	OGLE220	0 55 14	−72 36 04	CA	0.35	0.35	...	
29nw......	B83, OGLE103	0 55 30	−73 04 17	C	0.55	0.55	...	
29nw......	K34, L53, OGLE104	0 55 33	−72 49 58	C	1.20	1.20	...	
29nw......	H86-165, OGLE105	0 55 43	−72 52 48	A	1.10	1.10	...	
29nw......	H86-164, OGLE221	0 55 45	−72 42 18	C	0.45	0.35	70	in BS262
29nw......	OGLE106	0 56 09	−73 12 22	CA	0.85	0.85	...	
29nw......	NGC 330, K35, L54, ESO29SC24	0 56 19	−72 27 50	C	2.80	2.50	120	& OGLE107 in H-A40, sup? SMC-DEM87
29nw......	B86, OGLE222	0 56 16	−72 30 59	C	0.65	0.65	...	
29nw......	BS81, OGLE223	0 56 26	−72 29 45	C	0.60	0.55	0	mP, in H-A40
29nw......	H86-172, OGLE108	0 56 34	−72 30 08	C	0.55	0.55	...	mP, in H-A40
29nw......	OGLE224	0 56 46	−72 45 06	CA	0.40	0.40	...	
29nw......	H86-174, OGLE225	0 57 18	−72 56 01	C	0.45	0.45	...	
29nw......	L56, SMC-S26, OGLE109	0 57 31	−72 15 52	C	0.95	0.95	...	
29nw......	H86-178, OGLE110	0 57 46	−72 42 21	C	0.55	0.50	70	
29nw......	BS88, OGLE111	0 57 50	−72 56 37	C	0.55	0.50	135	
29nw......	H86-175, OGLE227	0 57 50	−72 26 24	C	0.40	0.40	...	mP
29nw......	H86-177, OGLE226	0 57 50	−72 30 29	C	0.75	0.75	...	mP, in B-OB13
29nw......	H86-179, OGLE112	0 57 57	−72 26 42	C	0.40	0.40	...	mP
29nw......	SMC-N63, L61-331, SMC-DEM94	0 58 16	−72 38 47	NA	0.60	0.60	...	mT, in H-A42 & MA1065, OGLE113
29nw......	H86-181, OGLE228	0 58 19	−72 17 57	C	0.65	0.65	...	in H-A43
29nw......	SMC-N64A, L61-335, SMC-DEM95	0 58 26	−72 39 57	NC	0.80	0.65	70	mT, in N64 & H86-182, MA1071, OGLE114
29nw......	H86-183, OGLE115	0 58 34	−72 16 52	C	0.55	0.55	...	

TABLE 1—*Continued*

Plate (1)	Name (2)	R.A. (3)	Decl. (4)	Type (5)	D_{max} (arcmin) (6)	D_{min} (arcmin) (7)	P.A. (deg) (8)	Remarks (9)
29nw......	BS272, OGLE229	0 58 38	−72 14 04	NC	0.65	0.65	...	mP, in SMC-DEM98
29nw......	OGLE116	0 59 05	−72 47 12	AC	1.00	0.70	90	
29nw......	B96, OGLE117	0 59 14	−72 36 29	C	1.00	0.90	80	att SMC-DEM114
29nw......	IC1611, K40, L61, ESO29SC27	0 59 48	−72 20 02	C	1.50	1.50	...	m4 & OGLE118
29nw......	H86-186, OGLE119	0 59 57	−72 22 24	C	0.60	0.60	...	m4, att SMC-DEM114
29nw......	IC1612, K41, L62, ESO29SC28	1 00 01	−72 22 08	C	1.20	0.80	20	m4, att SMC-DEM114 & OGLE120
29nw......	H86-188, OGLE121	1 00 13	−72 27 44	AC	1.30	0.70	50	in SMC-DEM114
29nw......	B99, OGLE122	1 00 27	−73 05 12	C	0.75	0.75	...	
29nw......	H86-189, OGLE123	1 00 33	−72 14 23	C	0.40	0.40	...	mP
29nw......	H86-190, OGLE230	1 00 33	−72 15 31	C	0.40	0.40	...	mP
29nw......	K42, L63, OGLE124	1 00 34	−72 21 56	C	0.85	0.85	...	m4, att SMC-DEM114
29nw......	OGLE125	1 00 47	−72 55 41	CA	0.80	0.70	10	
29nw......	H86-191, OGLE231	1 00 58	−72 32 25	C	0.80	0.80	...	mP, in? SMC-DEM114
29nw......	L65, H86-192, OGLE126	1 01 02	−72 45 05	C	1.10	1.10	...	
29nw......	H86-194, OGLE232	1 01 14	−72 33 03	C	0.85	0.85	...	mP, in? SMC-DEM114
29nw......	H86-193, OGLE127	1 01 18	−72 13 42	C	0.55	0.55	...	in B-OB19
29nw......	B105, OGLE128	1 01 37	−72 24 25	C	0.75	0.75	...	in? SMC-DEM114
29nw......	L66, OGLE129	1 01 45	−72 33 52	C	1.10	1.10	...	att SMC-DEM114
29nw......	B108, OGLE130	1 01 52	−72 10 58	C	0.80	0.80	...	in B-OB19
29nw......	OGLE131	1 02 03	−72 31 19	CA	0.70	0.70	...	
29nw......	OGLE132	1 02 13	−72 57 59	C	0.65	0.65	...	
29nw......	OGLE133	1 02 31	−72 19 06	C	0.80	0.80	...	
29nw......	BS106, OGLE233	1 02 40	−72 23 50	NC	0.55	0.55	...	in SMC-DEM118, mP
29nw......	B114, OGLE234	1 02 53	−72 24 53	NC	0.85	0.85	...	in SMC-DEM118, mP
29nw......	K47, L70, OGLE134	1 03 12	−72 16 21	C	0.75	0.75	...	
29nw......	OGLE135	1 03 17	−72 44 27	AC	1.45	1.45	...	
29nw......	OGLE136	1 03 22	−72 27 57	CA	0.80	0.50	100	
29nw......	B115, OGLE137	1 03 23	−72 39 06	C	0.90	0.80	100	in H-A52
51se.......	OGLE138	1 03 53	−72 06 11	CA	0.60	0.60	...	mP, in H-A53
29nw......	NGC 376, K49, L72, ESO29SC29	1 03 53	−72 49 34	C	1.80	1.80	...	mP & OGLE139
29nw......	BS114, OGLE235	1 03 59	−72 48 18	AC	0.70	0.50	110	mP
29nw......	OGLE144, OGLE236	1 04 05	−72 07 15	CA	0.60	0.60	...	mP
29nw......	BS118, OGLE140	1 04 14	−72 38 49	A	1.30	0.90	120	
29nw......	BS121, OGLE237	1 04 22	−72 50 52	C	1.60	1.30	140	
29nw......	B121, OGLE141	1 04 30	−72 37 09	C	0.65	0.65	...	
51se.......	K50, L74, ESO51SC15	1 04 36	−72 09 38	C	1.00	1.00	...	in H-A54 & OGLE142
29nw......	BS125, OGLE143	1 04 40	−72 33 00	A	1.60	0.85	30	
51se.......	SMC-N78B, L61-439	1 05 04	−71 59 25	NC	0.40	0.30	100	m5, in NGC 395 & MA1508/1514, OGLE145
51se.......	MA1520, OGLE147	1 05 08	−71 59 45	NC	0.50	0.45	130	m5, in NGC 395
29nw......	OGLE148	1 05 10	−72 36 08	CA	0.95	0.95	...	
51se.......	OGLE146	1 05 13	−71 59 42	NA	0.45	0.45		m5, in NGC 395
51se.......	IC1624, K52, L76, ESO51SC17	1 05 22	−72 02 35	C	0.90	0.90	...	in SMC-N78 & OGLE149
29nw......	BS131, OGLE150	1 06 00	−72 20 29	C	0.55	0.50	150	in B-OB29
29nw......	OGLE151	1 06 13	−72 47 39	AC	1.20	1.20	...	
29nw......	OGLE152	1 06 21	−72 49 48	CA	0.65	0.65	...	
29nw......	K54, L79, ESO29SC31	1 06 48	−72 16 25	C	0.90	0.90	...	in B-OB29 &OGLE153

TABLE 1—*Continued*

Plate (1)	Name (2)	R.A. (3)	Decl. (4)	Type (5)	D_{max} (arcmin) (6)	D_{min} (arcmin) (7)	P.A. (deg) (8)	Remarks (9)
29nw......	B129, OGLE154	1 07 02	−72 37 18	CA	1.10	1.10	...	
29ne	K56, OGLE155	1 07 28	−72 29 36	C	1.10	0.90	130	
29ne	L80, OGLE156	1 07 28	−72 46 10	C	1.20	1.20	...	
29ne	K55, L81, OGLE157	1 07 32	−73 07 11	C	0.95	0.95	...	
29ne	OGLE238	1 07 52	−72 31 55	CA	0.35	0.35	...	
29ne	NGC 416, K59, L83, ESO29SC32	1 07 59	−72 21 20	C	1.70	1.70	...	& OGLE158
29ne	NGC 419, K58, L85, ESO29SC33	1 08 19	−72 53 03	C	2.80	2.80	...	& OGLE159
29ne	OGLE160	1 08 37	−72 26 21	CA	0.65	0.65	...	
29ne	K61, OGLE161	1 09 03	−73 05 12	C	0.95	0.95	...	

NOTE.—Units of right ascension are hours, minutes, and seconds, and units of declination are degrees, arcminutes, and arcseconds.

TABLE 2

Distribution of OGLE Objects in Different Catalogs

Acronym	Reference	Entries: Pietrzyński et al. (1998)	Entries: This Paper
NGC	Dreyer (1888)	16	18
IC..................	Dreyer (1895)	3	3
K	Kron (1956)	12	12
SMC-N	Henize (1956)	...	7
L....................	Lindsay (1958)	8	9
L61	Lindsay (1961)	7	...
HW................	Hodge & Wright (1974)	3	4
B....................	Brück (1976)	33	37
H86................	Hodge (1986)	60	69
BS	Bica & Schmitt (1995)	24	32
MA	Meyssonnier & Azzopardi (1993)	...	1
SMC OGLE......	Pietrzyński et al. (1998)	72	46

unresolved. Thus they are objects that indeed required deep CCD images to be recognized as clusters.

Two OGLE objects are duplicated, SMC OGLE236 = SMC OGLE144 and SMC OGLE175 = SMC OGLE19 (Table 1). Two single objects in the OGLE catalog, SMC OGLE26 and SMC OGLE33, were considered to be pairs in BS95 (the north and south components of NGC 248 and H86-78). Adopting the latter separations, the total number of objects with SMC OGLE designation remains 238 as in Pietrzyński et al. (1998). One case of a close position between an SMC OGLE object (SMC OGLE31) and one in BS95 (B36) resulted in two different objects. The coordinates of SMC OGLE166 in Pietrzyński et al. (1998) did not correspond to the cluster image; the correct coordinates were kindly provided by Prof. Pietrzyński.

Table 2 shows the distribution of SMC OGLE objects in different catalogs, considering the first chronological designation. Column (1) shows the acronym; column (2) the catalog reference; column (3) counts made in Pietrzyński et al.'s (1998) Table 2; finally, in column (4) are counts made in Table 1 of the present work. This comparison basically shows the distribution of the difference between the 72 objects initially reported as new and the 46 intrinsically new SMC OGLE objects. This difference arises mainly from faint clusters in *B* (Brück 1976), H86 (Hodge 1986), and BS (BS95) catalogs.

Concerning the distributions in Table 2, note that the L61 (Lindsay 1961) and MA (Meyssonier & Azzopardi 1993) catalogs deal with emission stellar sources, but contain some extended objects which were included in BS95. These extended emission-line objects are H II regions and embedded star clusters. The L61 designations given to seven SMC OGLE objects in Table 2 of Pietrzyński et al. (1998) have SMC-N (Henize 1956) as the first chronological identification in BS95. Note also that one SMC OGLE object has a counterpart in the MA catalog.

2.1. *Updated Electronic Version of the BS95 Catalog*

We provide in Table 3 the first five lines of an updated electronic version of the revised and extended catalog of star clusters, associations, and emission nebulae in the SMC/bridge (BS95). This incorporates the present results concerning the SMC OGLE objects (Table 1), in particular the 46 new entries. We note that the equatorial coordinates in the present version are J2000.0, while in BS95 they were B1950.0. As pointed out by BS95 an updated catalog condensing the literature results is very useful for future surveys.

Outside the OGLE survey area we include three objects which were previously in the list of excluded catalog entries of BS95 (their Table 3) because they were not clearly interpreted as clusters in the ESO/SERC Schmidt plates. These objects are: (1) B133 (Brück 1976), which appears to be a physical system (Kontizas 1980; Hodge 1983), and (2) H86-95 and H86-96, indicated as a cluster pair in Hatzidimitriou & Bhatia (1990), which are probably clusters as seen in the second generation DSS images.

The SMC/bridge catalog now totals 1237 objects: 595 classified as clusters (C + CA + CN), 350 as associations (A + AC + AN) and 292 related to emission nebulae

TABLE 3

Updated SMC/Bridge Catalog Including SMC OGLE Objects

Plate (1)	Name (2)	R.A. (3)	Decl. (4)	Type (5)	D_{max} (arcmin) (6)	D_{min} (arcmin) (7)	P.A. (deg) (8)	Remarks (9)
28nw......	AM-3, ESO28SC4	23 48 59	−72 56 43	C	0.90	0.90	...	
28ne	L1, ESO28SC8	0 03 54	−73 28 19	C	4.60	4.60	...	
28ne	L2	0 12 55	−73 29 15	C	1.20	1.20	...	
28ne	HW1	0 18 25	−73 23 38	CA	0.95	0.85	0	
28ne	L3, ESO28SC13	0 18 25	−74 19 07	C	1.00	1.00	...	
28ne	BS1	0 18 55	−73 24 52	CA	0.90	0.90	...	

Note.—Table 3 is presented in its entirety in the electronic edition of the Astronomical Journal. A portion is shown here for guidance regarding its form and content. Units of right ascension are hours, minutes, and seconds, and units of declination are degrees, arcminutes, and arcseconds.

(N + NC + NA). Considering also the recent LMC catalog (Bica et al. 1999) the number of extended objects in the Magellanic System is now 7895.

3. ANGULAR DISTRIBUTION AND CENSUS

In the following discussions we adopt the updated BS95 catalog (Table 3), which incorporates that of the OGLE survey (Table 1). We consider as SMC objects those with right ascension less than 2^h, thus excluding the bridge region.

Figure 1 shows the angular distribution of all SMC OGLE objects compared to that of all extended objects in the updated BS95 catalog. The OGLE survey covers the central regions of the SMC, including the very dense bar region to the southwest and the dense extension to the northeast. Note that there are moderately dense fields around the OGLE survey area in which future CCD surveys will certainly detect new objects. Also the low density outer zones and the SMC wing region to the southeast are important to be surveyed.

Figure 2 superposes the angular distribution of the 46 intrinsically new SMC OGLE objects to that of all (238) objects in the SMC OGLE catalog. The new objects are more frequent in the bar region, but they are also numerous in the northeast extension.

In Table 4 we show distributions of object types in the SMC for different spatial extractions in the updated BS95 and OGLE catalogs. In column (2) (whole SMC) there are 1122 objects distributed among (clusters:associations: nebulae) as (584:252:286). The 46 new OGLE objects and the three catalog additions outside the OGLE region (§ 2.1) increased the number of SMC objects by ≈5%.

We also show in Table 4 object type counts occurring in the OGLE survey area: in column (3) all objects from the updated BS95 catalog, in column (4) all objects in the revised OGLE catalog (Table 1), and, finally, in column (5) the intrinsically new OGLE objects. We compute 631 extended objects in the OGLE survey area as compared to 238 SMC OGLE objects. The large OB associations and nebular complexes explain this difference in part (mostly included in the A and NA types), but there occur many clusters (C type) in the OGLE survey area not included in the OGLE catalog. The classification C, CA, to AC is one of decreasing density (Bica et al. 1999), and most of the new OGLE objects (col. [5]) were classified in the CA type. Finally we point out that two new OGLE objects are related to emission (NC and NA types), and ≈10% of the objects in the OGLE catalog (col. [4]) are related to emission or have traces of emission (CN type). The emission is better seen in ESO/SERC *R* plates, owing to Hα, than in the *I*-band CCD images.

We show in column (6) of Table 4 the counts for all objects outside the OGLE survey area, and in column (7) a crude prediction of objects that may be detected by similar CCD surveys. For each object type we computed the fraction of new OGLE objects (col. [5]) with respect to all objects of the same type in the area (col. [3]). It is expected that the average age in the outer parts is greater than in the inner parts. This effect would increase the number of new CCD objects in the outer parts, since the turnoffs would be fainter and also because crowding effects are less important. On the other hand, the latter point does not favor new detections, because many of these relatively old objects would have already been detected in previous photographic surveys. It is also worth noting that the older age effect

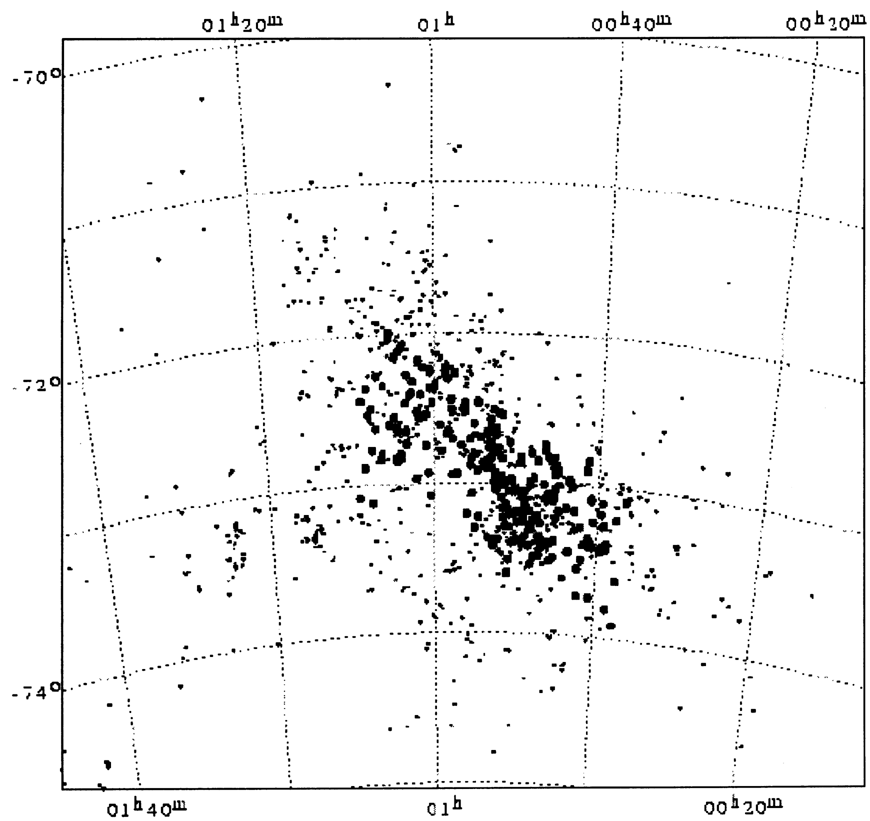

FIG. 1.—Angular distribution (J2000.0, α, δ) of the 238 SMC OGLE objects (*large dots*) superposed on that of the SMC objects (*small dots*) from BS95

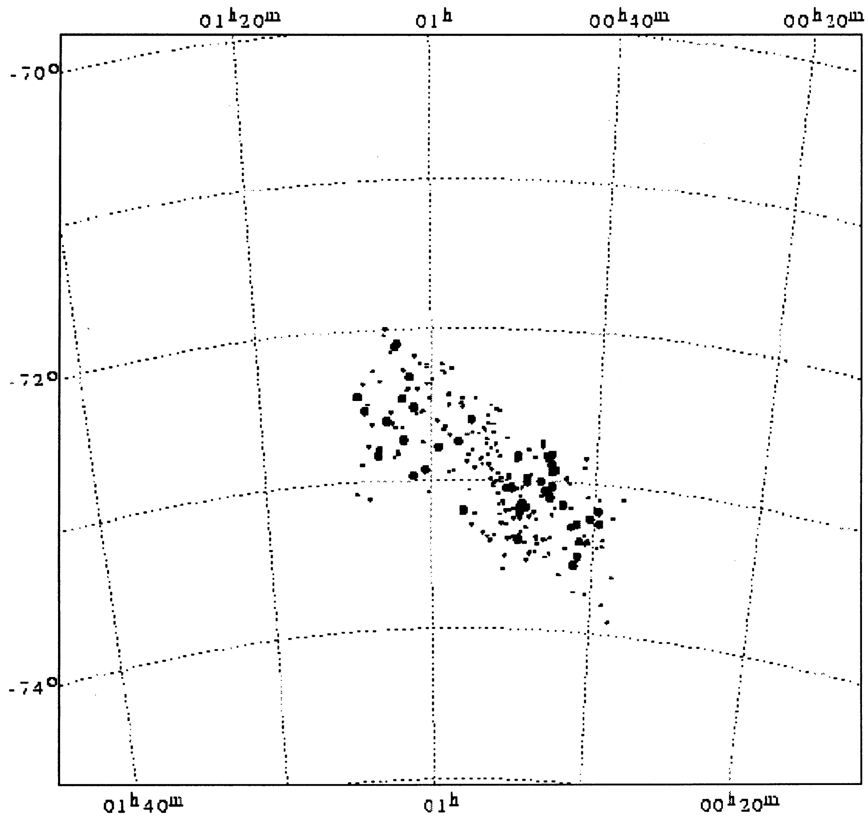

FIG. 2.—Angular distribution (J2000.0, α, δ) of the 46 intrinsically new SMC OGLE objects (*large dots*) superposed on that of the 238 SMC OGLE objects (*small dots*).

toward outer regions is not isotropic, since young clusters certainly occur to the southeast (wing and bridge regions), which favors more previous detections. Under the assumption that such effects tend to compensate, the number of new objects in the outer region would be ≈42 (col. [7]).

A cluster census depends on the definition of cluster itself. One can include embedded clusters in H II regions and extend the density range to loose systems, as done for the LMC (Bica et al. 1999). Considering the census of SMC star clusters by including a density range (C, CA, and AC types), the actual number is 633 and, including predictions, 672. Considering also the clusters related to emission (NC and CN types) the actual cataloged number is 719 and including predictions 759. With respect to a cluster population of 719 the new objects in the OGLE catalog imply an increase of ≈7%.

Hodge (1986) carried out a similar analysis by comparing the number of clusters cataloged in deep 4 m telescope B plates in selected areas to that of known clusters in SMC catalogs at that time. He predicted ≈900 clusters if all the SMC were surveyed with similarly deep plates and ≈2000 clusters if small older clusters were detectable. The plate limits in Hodge (1986) are $B = 23$ and $B = 22$, respectively in the outer and core SMC regions, while in the OGLE

TABLE 4

CENSUS OF OBJECT TYPES IN THE UPDATED SMC CATALOG

TYPES	ENTIRE SMC	OGLE SURVEY AREA			OUTSIDE OGLE AREA	
(1)	(2)	(3)	(4)	(5)	(6)	(7)
C........	460	251	162	14	209	12
CA......	115	64	40	24	51	19
CN......	9	6	5	...	3	...
A........	154	75	4	1	79	1
AC......	58	22	10	5	36	8
AN......	40	26	...	...	14	...
NC......	77	51	11	1	26	1
NA......	198	126	6	1	72	1
N........	11	10	...	...	1	...
Total:	1122	631	238	46	491	42

NOTE.— Columns: (1) object type, (2) all objects up to = 2^h, (3) all objects in the OGLE area, (4) all objects in the OGLE catalog (according to Table 1), (5) all intrinsically new OGLE objects, (6) all objects outside the OGLE region, (7) predicted CCD objects outside the OGLE region (see assumptions in the text).

survey they are slightly less deep with $B \approx 21.2$, $V \approx 21.5$, and $I \approx 21.0$ (Udalski et al. 1998). The present number of cataloged clusters in Table 3 (719) is still short ≈ 180 with respect to Hodge's prediction for the detection level of the 4 m plates (900), but it is considerably larger than that actually known at that time (≈ 600).

Hodge's (1986) 4 m telescope photographic survey is to date still the deepest one in selected areas in the SMC. Note that 53 faint cluster candidates (indicated by Hodge as probable or questionable clusters) remain in Table 3 of BS95 owing to limitations in the ESO/SERC Schmidt plates. This number excludes H86-95 and H86-96 (now in the present catalog in Table 3—see § 2.1) and the duplications H86-131 = 128, 137 = 133, 161 = 158 and 168 = 165 (now also in Table 3). Such faint clusters may turn out to be crucial to infer the rate whereby intermediate age and old clusters formed in possible bursts and/or dissolved in the SMC and also LMC (Geisler et al. 1997). The brightest star in these faint clusters is mostly in the range $18 \leq B \leq 22$ (Hodge 1986) which places them as candidate intermediate/old age clusters since some bright red giant/clump stars may be present or not in such underpopulated objects. The turnoff magnitude for old clusters in the SMC is B $\approx$ 22–23 (Hodge 1986). Assuming the faint objects as clusters the updated sample would be 772 (719 + 53), still short of ≈ 130 with respect to the 4 m *B*-plate survey predictions for the whole SMC with comparable plate limits.

We conclude that deep CCD surveys like OGLE will certainly reveal new clusters in the SMC intermediate and outer parts, and deeper surveys would be necessary (especially in the central regions) to attain ≈ 900 objects. As an example of detection of very faint clusters by means of deep localized images, see the recent discovery of two clusters in crowded LMC fields with *HST* (Santiago et al. 1998). Finally, deep field CCD surveys would be necessary to check the existence of small old (and intermediate age) clusters in order to attain a total population of ≈ 2000. One possibility is that most or part of such older low-mass objects have dissolved.

4. CONCLUDING REMARKS

The updating of the SMC extended object catalog by including the OGLE survey and some additional results was carried out. The 46 new OGLE objects increase the number of extended objects in the SMC by $\approx 5\%$ and star clusters themselves by $\approx 7\%$. If a similar CCD survey were to carried out in the whole SMC area, a simple estimate suggests that ≈ 40 additional objects could be detected. The present number of star clusters (considering also those related to emission and loose systems) is 719, still short by ≈ 180 with respect to Hodge's (1986) prediction for a global survey in the SMC attaining $B = 23$ and $B = 22$ in the outer parts and core respectively. Deeper field CCD surveys would be necessary to check the existence of small old (and intermediate age) clusters in order to attain a grand total population of ≈ 2000. However it is possible that most or part of such older low-mass objects have dissolved.

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REFERENCES

Bica, E., & Schmitt, H. R. 1995, ApJS, 101, 41
Bica, E., Schmitt, H. R., Dutra, C. M., & Luz Oliveira, H. 1999, AJ, 117, 238
Brück, M. 1976, Occas. Rep. R. Obs. Edinburg, 1
Dreyer, J. L. E. 1888, MmRAS, 49, 1
———. 1895, MmRAS, 51, 185
Geisler, D., Bica, E., Dottori, H., Clariá, J. J., & Piatti, A. E. 1997, AJ, 114, 1920
Hatzidimitriou, D., & Bhatia, R. K. 1990, A&A, 230, 11
Henize, K. G. 1956, ApJS, 2, 315
Hodge, P. W. 1983, ApJ, 264, 470
———. 1986, PASP, 98, 1113
———. 1988, PASP, 100, 1051
Hodge, P. W., & Wright, F. W. 1974, AJ, 79, 858
Kontizas, M. 1980, A&A, 40, 151
Kron, G. E. 1956, PASP, 68, 125
Lindsay, E. M. 1958, MNRAS, 118, 172
———. 1961, AJ, 66, 169
Meyssonnier, N., & Azzopardi, M. 1993, A&AS, 102, 451
Pietrzyński, G., Udalski, A., Kubiak, M., Szymański, M., Woźniak, P., & Zebruń, K. 1998, Acta Astron., 48, 175
Santiago, B. X., Elson, R. A. W., Sigurdsson, S., & Gilmore, G. F. 1998, MNRAS, 295, 860
Udalski, A., Szymański, M., Kubiak, M., Pietrzyński, G., Woźniak, P., & Zebruń, K. 1998, Acta Astron., 48, 147
Zaritsky, D., Harris, J., & Thompson, I. 1997, AJ, 114, 1002