Final Report – Canola Council of Canada CARP Project 2009-6
Potential Flea Beetle Species Composition Shift in Prairie Canola

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Executive Summary

The crucifer flea beetle *Phllotreta cruciferae* (Goeze), most frequently found in the southern Canadian prairie regions, and *Phyllotreta striolata* (Fab.), the striped flea beetle, which has traditionally been found in greatest numbers along the northern Parkland of the prairies and in the Peace River Region of Alberta, are the two most common flea beetles in Canadian canola fields. *Psylliodes punctulata* Melsh., the hop flea beetle, occurs on low numbers across the prairies, while several other flea beetle species are found in prairie canola in minor amounts. When insecticides for the control of flea beetles in canola were developed, they were tested primarily against the crucifer-feeding flea beetle *P. cruciferae*, historically the most numerous of the three principal flea beetle species. Laboratory tests have shown that the nicotinoid insecticides that have replaced lindane seed treatments may not be as effective in controlling *P. striolata* as they are against *P. cruciferae*. In the current study, in 2007 a preliminary survey was conducted at 25 locations across the Canadian prairies to determine the numbers and distribution of the flea beetle species most commonly found in prairie canola fields. The survey was expanded in 2008 to include 34 sites, in 2009 to survey 44 sites, in 2010 to survey 98 sites, and in 2011 to include 99 sites across the Canadian prairies and North Dakota. Flea beetles were monitored using series of 13.0x7.5cm yellow sticky traps placed in or near canola fields and changed regularly for periods ranging from one week in spring to the entire summer, but averaging three to four weeks in May-June, starting at the time of canola emergence. Traps were examined and the number and species of flea beetles on the traps were identified.

In total, over the five years 11,180 traps were retrieved from 300 site-years and examined for flea beetle species and numbers. While population development, flea beetle peak numbers and species were site-specific and varied with location, in general flea beetle species distribution tended to follow traditional patterns. *P. striolata* was common in northern areas of Canada, and *P. cruciferae* was the main beetle captured near the 49th parallel. However, compared to results from surveys conducted in the 1970s, the magnitude of *P.striolata* numbers in northern areas has increased dramatically, especially in the Peace River region, and population shifts have occurred. *Ps. punctulata* has been displaced by *P. striolata* as the most common flea beetle in the Peace River region of British Columbia/Alberta. *P. striolata* has displaced *P. cruciferae* as the most frequently encountered flea beetle in central Alberta, central Saskatchewan, and much of Manitoba. And once rarely encountered in the rape/canola fields of southern Canada, *P. striolata* is now found there in increasing numbers. Although the survey found that *P. striolata* is expanding its range of occurrence across the prairies, *P. cruciferae* still remains the predominant flea beetle in fields with high numbers of flea beetles. Several species of *Chaetocnema*, a flea beetle not recognized as a pest of Canadian canola, were found in increasing locations and numbers in the survey.

Introduction

Crucifer-feeding flea beetles, principally *Phyllotreta cruciferae* and *P. striolata*, are the most economically damaging insect pests of canola on the Canadian prairies (Lamb and Turnock 1982; Knodel and Olson 2002). Although both *P. cruciferae* and *P. striolata* are Eurasian in origin, *P. striolata* has been present in North America much longer than has *P. cruciferae*. Specimens of *P. striolata* were found in New York City dating back to the 1770s (Bain and LeSage 1998). The beetle gradually spread throughout the continent, and is now found in most provinces of Canada. The first North American record of *P. cruciferae* was from Agassiz, British Columbia in 1921 (Beirne 1971). Despite this relatively recent appearance, by 1956 *P. cruciferae* was the most abundant flea beetle on rape in Manitoba (Westdal and Romanow 1972), and it soon became the

dominant flea beetle species across the prairies. The primary means of flea beetle management in canola is insecticidal seed treatments, most of which were developed and tested against *P. cruciferae*. Recent research has shown that *P. striolata* has lower mortality and higher feeding levels on canola seedlings grown from seed treated with neonicotinoid insecticides than does *P. cruciferae* (Tansey et al. 2008; Elliott, personal communication). The implications of this differential efficacy for management of flea beetles in canola are serious, given that over 90% of the 6 million ha of canola seeded annually is planted with a neonicotinoid seed dressing (Soroka et al. 2008). Concomitantly, anecdotal reports have appeared of increased numbers of *P. striolata* in canola fields in widely separated regions. This study was undertaken to determine the current distribution of crucifer and striped flea beetles across the prairies in order to discover if striped flea beetles numbers are increasing over historical levels, indicating a major s shift in flea beetle species in Canadian canola fields.

Experimental Plan

A network of entomologists and agrologists from AAFC, provincial departments of agriculture, universities in Alberta and North Dakota, the Canola Council of Canada, and industry, including Viterra, Cargill, Monsanto, BASF, Agri-Trends, Lantic Inc. (Rogers Sugar), and Winfield Solutions (LandOLakes), volunteered their time to set out traps for flea beetle collection and return them for examination. Initially, in 2007 surveyors placed traps in the Peace River region of British Columbia/Alberta, and central and southern regions of Saskatchewan and Manitoba (Table 1). In 2008 and later, attempts were made to sample in all the principal vegetative zones of the prairies – the Peace River Lowlands and the boreal transition and aspen parkland vegetative zones ("North" in Saskatchewan and Alberta, "Central" in Manitoba), moist mixed grassland ("Central" in Alberta and Saskatchewan), mixed grasslands ("South" in Alberta and Saskatchewan), and the Interlake Plain ("North") and Lake Manitoba Plain ("South") in Manitoba. In 2010 and 2011 sites from North Dakota were also added to the survey, designated by geographical distance from the international border into North, Central and South locations. Five, or at a few sites 10 or 20, yellow sticky card traps (ConTech, Delta, BC) per field, 13.0x7.5 mm in dimensions and coated on both sides with an adhesive, were attached to wire or wooden stakes and placed in or near newly-seeded canola fields at the time of seeding in spring. The traps were oriented running parallel to a convenient perimeter of a field, at the edge of or about 10 m into the field and 25 m apart, so that one flat side of the trap faced into the field and the other side of the card faced the field edge. The bottom edge of each trap was set 1-2 cm above soil level or at the level of the seedlings as these grew. Traps were changed at intervals ranging from 3 to 30 days, but usually weekly. They were maintained for periods from one to 26 weeks, but usually four weeks or four sampling intervals. Some co-operators identified the flea beetles and sent data reports to the principal researcher and some did not. At the end of the sampling period cards were returned to the laboratory for species and number confirmation.

Traps were examined under a magnifier or stereomicroscope in the laboratory and the number of flea beetles captured per trap per day recorded. The species composition percentage of the three most commonly occurring flea beetles *P. striolata*, *P. cruciferae*, and *Psylliodes punctulata* Melsh., the hop flea beetle, were determined for each site. From 2009 onward the number and, if possible, identification of flea beetles other than these three was also recorded. These "other" specimens were identified from the descriptive key of Fauske (2003) to at least genus level. In the case of traps already assessed by co-operators, the numbers that the co-operators compiled were checked against our results. Cards were also examined for the presence of *Microctonus vittatus* Mues., a small wasp parasitoid of flea beetles.

Growing Conditions, Flea Beetle Numbers and Population Development

Although local exceptions occurred, in general spring weather conditions in the years of the survey were not conducive to the development of high flea beetle populations, especially in 2010 and 2011, when cold and wet conditions predominated over much of the northern Grain Belt and most populations of flea beetles were very low. In 2010 and 2011 several surveyors in eastern Saskatchewan and western Manitoba had difficulty placing or maintaining traps out of water, as field flooding was common. The Peace River area of northern Alberta was

the only region that was consistently dry in the spring during the years of the survey. These conditions were reflected in reports by the provincial entomologists to the Western Committee on Crop Pests annual meetings 2007-2011. Except for sporadic, isolated foliar spraying for flea beetle control elsewhere, the Peace River region was the only region that required widespread foliar application, for 6 years in a row according to Meers (2010).

The number of flea beetles caught on traps in the survey reflected the prevalent spring weather conditions. Flea beetle numbers generally were low in each year; over all the years two thirds of the locations surveyed had maximum flea beetle densities lower than five per trap per day (Table 2), with 86 of the 300 locations surveyed (28.7%) having densities of 1 flea beetle caught per trap per day or less. In each year and over all the years the greatest numbers of flea beetles caught were found in areas closest to the 49th parallel (Table 2). Numbers greater than 10 per trap per day were found at 46 sites in the five year study, principally near the 49th parallel (Tables 2, 3). Manitoba had the greatest number of sites with the highest flea beetle numbers – 16 of 46 or 35% of the sites sampled there (Table 3). North Dakota was second, surprising since it was surveyed for only 2 years. The highest number of flea beetles trapped per day in the survey, 91.2, was recorded at Brandon, MB, in 2011.

Flea Beetle Species Distribution Patterns

The number and location of sites surveyed varied from year to year, as did the timing and duration of sampling period at each location. Additionally, because *P. striolata* adults emerge from overwintering sites earlier than *P.cruciferae* adults, and *Ps. punctulata* adults emerge earlier than those of *P. striolata*, a chronological comparison of flea beetle species at different locations was problematic. Therefore, the unit of comparison utilized to determine species distribution patterns was the proportion of particular flea beetle species at the time of maximum flea beetle numbers at a location in the spring. Table 4 summarizes the number of locations that had a particular flea beetle species as the largest proportion of the population, Table 5 summarizes the percent of each of the three principal species of flea beetles found at the height of flea beetle populations, tabulated by province/state and by region within province/state, and Tables 7-20 list the results from the individual locations sampled during the length of the survey.

By province, Alberta had the most locations and greatest proportion of *P. striolata* striped flea beetles over the survey period (Tables 4, 5a, Fig. 1). The high proportion of *P. striolata* beetles - 85% of all flea beetles collected at population peak - found in Alberta in 2007 was confounded by the fact that only areas in the Peace River were surveyed in the province in that year. In 2010 and 2011, when numbers and locations of survey sites were approximately similar over the province, species proportions had stabilized, with about 63.5% of the populations being striped flea beetles. Similarly, only sites in central and southern Saskatchewan were surveyed in 2007, which skewed the proportion of *P. cruciferae* beetles. However, in contrast to the situation in Alberta, numbers of *P. striolata* increased and *P. cruciferae* decreased in Saskatchewan, Manitoba, and North Dakota over the duration of the survey (Table 5a, Fig. 1).

An examination of species distribution by region revealed that *P. striolata* predominated in the Peace River region of Alberta and British Columbia, and the northern areas of Saskatchewan and Manitoba over the length of the survey (Table 5b). Most locations in Central Alberta also had high proportions of *P. striolata* over the four years of surveying in the region. It is in the Southern Alberta, Central Saskatchewan, and Central and Southern Manitoba regions that proportions changed over the years, with the proportion of *P. striolata* increasing and *P. cruciferae* decreasing. This change in proportions is most clearly seen in the Central Saskatchewan and Manitoba regions (Table 5). Populations of *P. striolata* increased in southern Manitoba over the duration of the survey, but irregularly so. *P. cruciferae* was the only flea beetle found in South Saskatchewan traps in 2007 (Table 5b); species proportions many have been biased by the paucity of locations, the extremely low numbers of flea beetles present, and the brevity of the sampling period in that year. Proportions of *P. cruciferae* and *P. striolata* remained stable in South Saskatchewan from 2008-2011, with *P. striolata* comprising just under 10% of the flea beetle species proportion during that time. And although only

two years of surveying were undertaken in North Dakota, *P. striolata* proportions rose while that of other flea beetles decreased in the northern part of the state in 2011 over 2010.

P. punctulata, the hop flea beetle, was found in many sites early in the spring, but rarely reached significant numbers at the time of population peaks. *Ps. punctulata* occurred at levels greater than 10% in some years in the Peace River region, in Central Saskatchewan, and, in 2011, in locations in North and South Manitoba (Table 5). *P. punctulata* comprised the principal flea beetle species at three site years in the survey – Worsley, Alberta in 2009 (Peace River region -76.4% of 9.0 flea beetles/ trap/day from June 3-10), Hays, Alberta in 2011 (South Alberta - 57.1% of 0.21 flea beetles/trap/day from May 13-30), and Swan River, Manitoba in 2011 (North Manitoba - 63.5% of 0.4 flea beetles/trap day from May 18-26).

Other flea beetle species appear to be increasing in proportion relative to *P. cruciferae*, especially in North and Central Alberta and Saskatchewan (Table 5, Fig. 1). In 2010 species in this category outnumbered *P. striolata* and *Ps. punctulata* in all areas of North Dakota. Several species of *Chaetocnema* were the main components of the Other category, especially in North Dakota. In 2010 traps near Charlson, Max, and Regan, ND, and in 2011 traps near Regent, ND contained *Chaetocnema* spp. as the principal flea beetle at the time of the population peak. Six Canadian sites had other species as the largest component of the flea beetle mix. A St. Albert, AB, location had *Chaetocnema* sp. as the principal flea beetle at the population peak on June 15-22, 2010. In 2011 a site near Halcourt, AB, in the Peace River region, had *Chaetocnema* sp. as the dominant flea beetle species at the time of population peak from May 31-June 9; a site near St Albert, AB had a mixture of flea beetles other than the standard three species comprising the largest category of flea beetles from May 30-June 6, while a site near Vegreville had *Chaetocnem*a sp. as the dominant flea beetles on May 11-19; a site near Prince Albert, SK, had *Crepidodera nana* (Say), as the dominant flea beetle species at the flea beetle peak Jun 7-17; and a site near Burr, SK, had *Chaetocnema* sp. as the principal flea beetle species from Jun 3-10.

In order to trace possible species population shifts more accurately than in the general survey, where locations and sampling periods varied, we considered locations that were surveyed at the same site or very close to the same site over the years. In total, 19 locations representing 80 site years were identified as sampling the same local flea beetle populations through time (Table 6). The results concurred with the conclusions drawn from the general survey – sites in the Peace River region, Central Alberta and North Saskatchewan had *P. striolata* as the main flea beetle present throughout the survey. South Alberta and Central Saskatchewan had populations shifted (Table 5). This is most dramatically illustrated in Fig. 2, which depicts proportions of flea beetles collected from the exact same location at the Saskatoon Research Centre Farm (Saskatoon1) over a 7 year period. Surveys of flea beetles at the same four locations in South Saskatchewan indicate *P. striolata* proportions were not increasing there. Populations of flea beetles were variable at four sites in Central and South Manitoba (Table 5); however, 10 of 17 site years had *P. striolata* higher than 20% of the flea beetle population maximum. While these generalizations held true for most sites, exceptions did occur; the proportion of *P. striolata* at the Cardiff sit decreased through time for reasons unknown.

Despite the increase in *P. striolata* and Other flea beetle proportions found during the course of the survey, *P. cruciferae* was the most frequently collected species at locations with high flea beetle numbers. This species predominated at 40 of 46 sites where numbers were greater than 10/trap/day at the population peak (Table 3). Of the six site-years where high numbers of *P. striolata* predominated, four occurred in Alberta in 2011.

Microctonus specimens, parasitic wasps of flea beetles, were identified from 36 location-years sampled across the three Prairie Provinces and North Dakota, indicating a general distribution wherever flea beetles were found. In 20 sites from which *Microctonus* spp. were collected, *P. striolata* was the most numerous flea beetle surveyed at the site. At 14 sites, *P. cruciferae* predominated, at one Alberta site adults of *Ps. punctulata* were the most numerous flea beetle caught on the traps, and in one site in North Dakota other flea beetles (*Chaetocnema* spp.) were most numerous. Proportions of parasitoid to flea beetle were low, although this may have been a reflection of the relative attractiveness of the yellow sticky trap to the wasp. Accurate determination of parasitism levels requires rearing of flea beetles and parasitoids, not trapping.

Appendix Figures 1 to 18 graphically portray the number of flea beetles caught per trap per day by species and the proportion of flea beetles caught over the sampling period, or, for the case of sites that had traps over the entire season, from the commencement of sampling until the first week of July. The graphs are arranged by year and geographically from the north and west to the south and east of each province or state.

Discussion

Results from the current investigation both corroborate and contradict those from historic studies. When flea beetles first became a problem in rapeseed production in the early 1970s, several surveys were conducted to determine flea beetle species composition and biology on the prairies. In a 1971-1974 investigation of flea beetles in prairie rapeseed fields, Burgess (1977) found that *P. cruciferae* was by far the most abundant and serious pest species, followed in order by *Ps. punctulata* and *P. striolata*. Geographically, *P. cruciferae* was commonly found throughout Manitoba, Saskatchewan, and central and southern Alberta; few *P. cruciferae* were present in collections of flea beetles in the Peace River region in 1973, with *Ps. punctulata* the most common species there (Burgess 1977). Burgess (1977) collected *P. striolata* across the parkland agricultural area from southern Manitoba to north of the Peace River in Alberta, usually in fewer numbers than *P. cruciferae* or *Ps. punctulata*. *P. striolata* was not found in 1973 and1974 in the Lethbridge region of southern Alberta. Wylie (1979) found that *P. cruciferae* comprised 80-90% of the flea beetle populations on rapeseed crops in the Red River Valley, *P. striolata* comprised less than 10%, and *Ps. punctulata* comprised most of the remainder. Populations near Portage, Brandon, Virden, Birtle and Neepawa had similar compositions, while Interlake populations around Dauphin, Grandview, and Roblin had *P. cruciferae* numbers in the 50-70% range, with *P. striolata* comprising most of the remainder (Wylie 1979). Burgess (1977) found *Ps. punctulata* to be present in a large number of rape fields across the agricultural area from southern Manitoba to northern Alberta, but only occasionally was it the most common flea beetle found in a field, and never at economic levels. Over time *P. striolata* was noted to be more abundant than in the past, especially in the northern parkland area of the prairies (Wylie 1979, Burgess 1984, Burgess and Spurr 1984).

In contrast to the findings of Burgess (1977), in the current survey *P. striolata* was the predominant flea beetle in 46 of 50 site years from the Peace River region of Alberta and British Columbia, with *P. cruciferae* most abundant in only two fields, and *Ps. punctulata* and other flea beetles most abundant in each of the two remaining fields. The results indicate that *P. striolata* has supplanted *Ps. punctulata* as the main flea beetle in the region, but it should be noted that levels of *Ps. punctulata* were not high in the region to begin with. Because *P. cruciferae* was found infrequently in the region in both studies, it is likely that the current increase in occurrence of *P. striolata* is not so much a displacement of the niche previously occupied by *P. cruciferae*, but simply an expansion of populations of *P. striolata* in the area. This expansion occurred concomitantly with the amount and frequency of rapeseed/canola grown in the region. Burgess (1982) predicted problems with *P. striolata* could occur if rapeseed (canola) production was extended northward into the boreal forest zone.

Similar to the Peace River region, the current study found *P. striolata* to be the principal flea beetle in 43 of the 50 canola fields sampled in Central Alberta, with four fields having *P. cruciferae*, three fields having Other flea beetles, and no fields having *Ps. punctulata* as the principal flea beetle. This is in direct contrast to the results of Burgess (1977) 38 years earlier when *P. cruciferae* predominated, and may represent a true species shift. However, if a shift has occurred, it happened previous to the start of the current survey, and possibly previous to the widespread use of neonicotinoid seed treatments that began in 2004. The fact that sites near Cardiff, AB, have decreasing proportions of *P. striolata* during the survey while surrounding areas had high numbers of the species points out that flea beetle species dominance is site specific. Reasons for such location anomalies within regions are unknown, but may be related to site variation, field history, and/or changing agronomic practices.

In the current study most sites in southern Alberta had very low numbers of *P. striolata*. Results from the Lethbridge area, where very low numbers of *P. striolata* were found, are similar to those of Burgess (1977),

who did not collect any *P. striolata* in irrigated rape fields near the city. The results from Brooks, where *P. striolata* proportions increased from 0.4% in 2008 to 70.6% in 2011, are an interesting exception, and may represent the front of the *P. cruciferae:P. striolata* population reversal. This front may be influenced by latitude; thus, Chestomere and Strathmore, at latitudes of 51º3' and 51º 2'N lat., respectively, are in the *P. striolata* zone; Vauxhall, Taber, and Lethbridge, at 50º 4', 49º 47', and 49º 44' N lat., respectively, are in the *P. cruciferae* zone, and Brooks, at 50º 34'N lat., has a flea beetle species dominance that is changing through time.

Previous surveys (Burgess 1977, Burgess 1984, Wylie 1979) found that *P. striolata* numbers were greater in northern Saskatchewan and Manitoba than in southern areas. This was also true in the current survey, but currently the proportion of the striped beetle is much greater in northern and central areas than previously recorded, especially in years and locations when overall numbers of flea beetles are low. *P. striolata* is more shade tolerant the *P. cruciferae* (Tahvanainen 1972), and Burgess (1984) speculated that this may be a principal reason why *P. striolata* occurs in greater numbers in the northern Parkland zone than in more southerly prairies. While this factor may have had merit in the time of vast areas of land clearing, it is less pertinent today. Burgess (1984) suggested that results may have been skewed because sweep nets catch more *P. cruciferae* than *P. striolata*, which, being shade-tolerant, could occur lower down in the canopy and under leaves, making collection by sweeping difficult. This factor is not applicable to current results which are based on sticky traps and not sweep samples. While we did not evaluate the relative attractiveness of the yellow trap to each species encountered, this attractiveness should not have changed over the course of the survey, and thus changes in population proportions in the five years of the survey are likely valid.

Current results from southern Saskatchewan are similar to those from previous surveys, with *P. cruciferae* predominating; we found flea beetle species distributions in southern Manitoba, on the other hand, to be extremely variable and site specific. Thus, it is hard to interpret what figures of 5, 76, 6, and 72% *P. striolata* for the years 2008-2011, respectively, mean in terms of population trends of flea beetles near Carman, MB. In broad regional terms, by 2011 all three geographic regions of Manitoba had *P. striolata* as the most frequently occurring flea beetle at the time of population peak, indicating that, if not specifically, generally the striped flea beetle is the species most frequently encountered in Canadian canola fields.

The investigation found *P. cruciferae* to be the principal flea beetle in North Dakota canola fields; in 2010, 20 of 23 fields had *P. cruciferae* as their principal flea beetle species, and this ratio was 18 of 21 fields in 2011. While no North Dakota fields in 2010 had *P. striolata* as the main species (the remaining three fields had other flea beetles, chiefly *Chaetocnema* sp., as the most frequently caught flea beetle), further surveying would be required to determine if the two fields in 2011 in which *P. striolata* occurred in the greatest proportion are merely a blip or the beginning of a trend in species change.

A diverse group of other flea beetles was found in the current survey; the numbers of some of which increased through time. Small numbers of several *Phyllotreta* species other than *P. cruciferae* and *P. striolata* were found to occur near crucifers in both previous studies (Burgess 1977, Wylie 1979) and the current study. However, the numbers of *P. albionica*, *P. armoraceae*, *P. robusta*, and *P. pusilla* found in the current study were low and not any greater than found previously, suggesting that the population ecology of such species on the prairies is stable. Flea beetle species such as *Crepidodera nana*, *Epitrix tuberus*, *Mantura chrysanthemi*, and *Aphthona lacertosa* found in this survey do not feed on crucifers, and they may merely have been attracted to the yellow colour of the sticky traps. Numbers of the several species in the genus *Chaetocnema*, which were found in sites from the northern Peace River region to southern North Dakota, increased during the current survey. *Chaetocnema* species have a broad host range, including plants in the Brasssciacea family, and can sometimes cause significant economic damage to a variety of cultivated crops (White 1996).There may be several reasons for the apparent increase in the number of *Chaetocnema* flea beetles caught in the survey. Higher numbers of such other species may indicate a greater care in identification as the survey wore on, they may be a reflection of specific site or geographic conditions such as high moisture conditions in eastern Saskatchewan or western Manitoba more amenable to other flea beetle species, or they may represent a true

increase in numbers of these other flea beetles. If the latter is the case, then, depending on their host range, they could have the potential of replacing *P. cruciferae* as an economic pest of canola production. The amount of canola grown in North Dakota, where *Chaetocnema* numbers were higher relative to other sites, is proportionately much less than on the Canadian prairies, and the crucifer specialist species may not have had the opportunity to proliferate as fast as in Canada. The economic impact of the *Chaetocnema* species found in the North Dakota traps is unknown. Likewise, the efficacy of neonicotinoid seed dressings on *Chaetocnema* beetles is also uncertain.

Despite the increasing occurrence of *P. striolata* and other flea beetle species found in this survey, *P. cruciferae* continues to comprise the greatest proportion of flea beetles in fields with high numbers of the pest. The reasons for this are not clear. Most sites with high flea beetle numbers were located in the south (or in the north, in the case of North Dakota). In such locations *P. striolata* may have less optimum levels of developmental parameters than *P. cruciferae*. Investigations on interactions between the two species could answer some of the questions surrounding flea beetle species development in prairie canola fields.

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Table 1. Regions and number of locations that were surveyed with yellow sticky traps for crucifer-feeding flea beetles across the prairies 2007-2011.

Province/state	Region	2007	2008	2009	2010	2011
Alberta	Peace River	7	3	14	13	13
	Central	-	12	7	13	16
	South	-	4	3	6	10
Saskatchewan	North	-	2	3	10	9
	Central	9	2	3	4	6
	South	2	4	6	12	11
Manitoba	North	-	-	2	7	6
	Central	3	4	3	6	5
	South	4	3	3	4	2
North Dakota	North	-	-	-	10	11
	Central	-	-	-	5	2
	South	-	-	-	8	8
Total		**25**	**34**	**44**	**98**	**99**

Table 2. Number of survey locations with maximum flea beetle numbers less than, equal to, or greater than 5-10 per yellow sticky trap per day, 2007-2011.

		2007				2008			
Area	**Region**	**No. sites**	**<5**	**5-10**	**>10**	**No. sites**	**<5**	**5-10**	**>10**
AB	Peace R.	7	3	3	1	3	3	0	0
	Central	-	-	-	-	12	10	2	0
	South	-	-	-	-	4	0	2	2
SK	North	-	-	-	-	2	2	0	0
	Central	9	8	0	1	2	2	0	0
	South	2	2	0	0	4	3	1	0
MB	North	-	-	-	-	-	-	-	-
	Central	3	2	1	0	4	0	0	4
	South	4	3	0	1	3	0	2	1
Total		**25**	**18**	**4**	**3**	**34**	**20**	**7**	**7**

		2009				2010			
Area	**Region**	**No. sites**	**<5**	**5-10**	**>10**	**No. sites**	**<5**	**5-10**	**>10**
AB	Peace R.	14	12	2	0	13	13	0	0
	Central	9	4	5	0	13	11	2	0
	South	1	1	0	0	6	4	0	2
SK	North	3	3	0	0	10	10	0	0
	Central	3	3	0	0	4	3	1	0
	South	6	1	3	2	12	5	3	4
MB	North	2	0	1	1	7	5	1	1
	Central	3	1	1	1	6	3	2	1
	South	3	0	2	1	4	2	1	1
ND	North	-	-	-	-	10	5	3	2
	Central	-	-	-	-	5	4	0	1
	South	-	-	-	-	8	7	0	1
Total		**44**	**25**	**14**	**5**	**98**	**72**	**13**	**13**

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Table 2, continued. Number of survey locations with maximum flea beetle numbers less than, equal to, or greater than 5-10 per yellow sticky trap per day, 2007-2011.

		2011				All years			
Area	**Region**	**No. sites**	**<5**	**5-10**	**>10**	**No. sites**	**<5**	**5-10**	**>10**
AB	Peace R.	13	12	1	0	50	43	6	1
	Central	16	9	4	3	50	36	11	3
	South	10	5	2	3	21	10	4	7
SK	North	9	8	1	0	24	23	1	0
	Central	6	5	1	0	24	21	2	1
	South	11	6	3	2	35	17	10	8
MB	North	6	4	2	0	15	9	4	2
	Central	5	0	2	3	21	6	6	9
	South	2	1	0	1	16	6	5	5
ND	North	11	3	3	5	21	8	6	7
	Central	2	1	0	1	7	5	0	2
	South	8	8	0	0	16	15	0	1
Total		**99**	**62**	**19**	**18**	**300**	**199**	**55**	**46**
North*						105	90	11	4
Central						100	66	19	15
South*						95	43	25	27
Total						**300**	**199**	**55**	**46**

* Because ecoclimatic index values for *P. cruciferae* on a north-south grid of North Dakota are highest (most favourable) closest to the Canadian border (Olfert, unpublished data), flea beetle numbers from North Dakota geographical regions were included in the "mirror image" of numbers from Canada, that is, those from northern North Dakota were included with numbers from southern Canada, and numbers from southern North Dakota were included with northern Canadian numbers.

Table 3. Locations across the Prairies where maximum flea beetle numbers per sticky trap at the population peak exceeded 10 per day and the species that predominated at the population peak.

Year	Trap location	Maximum flea beetle numbers/trap/day	Predominant flea beetles	
			Species	Proportion (%)
2007	Saskatoon2, SK	30.3	*P. cruciferae*	97.6
	Rosenfeld, MB	20.2	*P. cruciferae*	99.7
	Sweetwater, BC	15.7	*P. striolata*	98.0
2008	Griswald, MB	48.3	*P. cruciferae*	96.3
	Oakville, MB	28.1	*P. cruciferae*	94.2
	Portage la Prairie, MB	25.4	*P. cruciferae*	77.7
	Lethbridge2, AB	18.4	*P. cruciferae*	98.8
	Lethbridge1, AB	16.1	*P. cruciferae*	98.1
	Carman, MB	13.9	*P. cruciferae*	93.6
	Rignold, MB	12.3	*P. cruciferae*	70.9
2009	Oakville, MB	37.9	*P. cruciferae*	76.0
	Avonlea2, SK	28.6	*P. cruciferae*	99.6
	Avonlea1, SK	28.0	*P. cruciferae*	98.6
	Teulon, MB	25.5	*P. striolata*	55.0
	Lowe Farm, MB	12.7	*P. cruciferae*	96.0
2010	Avonlea1, SK	58.8	*P. cruciferae*	99.3
	Bottineau, ND	44.8	*P. cruciferae*	97.2
	Oakville, MB	41.3	*P. cruciferae*	91.4
	St. Pierre, MB	37.2	*P. cruciferae*	77.6
	Ethelbert, MB	23.7	*P. cruciferae*	71.9
	LethbridgeE AB	20.3	*P. cruciferae*	99.8
	Moose Jaw SK	18.0	*P. cruciferae*	95.3
	Mott3 ND	12.5	*P. cruciferae*	96.8
	Langdon ND	11.5	*P. cruciferae*	99.1
	LethbridgeW AB	11.6	*P. cruciferae*	99.4
	Indian Head2, SK	11.2	*P. cruciferae*	75.0
	Norwich ND	10.6	*P. cruciferae*	95.8
	Richardson SK	10.3	*P. cruciferae*	93.2
2011	Brandon, MB	91.2	*P. cruciferae*	81.6
	Antler, ND	40.0	*P. cruciferae*	94.5
	Bottineau, ND	37.5	*P. cruciferae*	99.7
	Rugby, ND	29.6	*P. cruciferae*	99.9
	Portage la Prairie, MB	28.1	*P. cruciferae*	86.8
	Simcoe, ND	22.1	*P. cruciferae*	99.4
	Oakville, MB	20.7	*P. cruciferae*	74.7
	Lethbridge1, AB	19.1	*P. cruciferae*	99.6

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Swift Current, SK	14.2	*P. cruciferae*	84.7
Rowatt, SK	14.1	*P. cruciferae*	98.1
Barrhead, AB	13.5	*P. striolata*	98.3
LethbridgeTP1, AB	13.3	*P. cruciferae*	99.0
Mohall, ND	13.1	*P. cruciferae*	96.8
LethbridgeTP2, AB	11.2	*P. cruciferae*	99.1
Morinville, AB	11.1	*P. striolata*	93.1
Wetaskiwin, AB	11.0	*P. striolata*	96.3
Max, ND	10.8	*P. cruciferae*	96.7
Carman, MB	10.6	*P. striolata*	71.5

Table 4. Number of locations where maximum flea beetle numbers correspond to particular species at the time of population peak near canola fields across the prairies, by region 2007-2011.

		2007			2008			2009		
Area	**Region**	***P.cruc***	***P.strio***	**Other**	***P.cruc***	***P.strio***	**Other**	***P.cruc***	***P.strio***	**Other**
AB	Peace R.	0	7	0	0	3	0	0	13	1
	Central	-	-	-	1	11	0	1	6	0
	South	-	-	-	4	0	0	1	2	0
SK	North	-	-	-	0	2	0	0	3	0
	Central	8	1	0	1	1	0	1	2	0
	South	2	0	0	4	0	0	6	0	0
MB	North	-	-	-	-	-	-	0	2	0
	Central	3	0	0	4	0	0	2	1	0
	South	4	0	0	2	1	0	2	1	0
Total		**17**	**8**	**0**	**16**	**18**	**0**	**13**	**30**	**1**

		2010			2011			All years		
Area	**Region**	***P.cruc***	***P.strio***	**Other**	***P.cruc***	***P.strio***	**Other**	***P.cruc***	***P.strio***	**Other**
AB	Peace R.	0	13	0	1	11	1	1	47	2
	Central	1	11	1	1	13	2	14	40	4
	South	6	0	0	7	2	1	8	4	1
SK	North	1	9	0	0	7	2	1	21	2
	Central	2	2	0	0	6	0	12	12	0
	South	12	0	0	11	0	0	35	0	0
MB	North	1	6	0	1	4	1	2	12	1
	Central	3	3	0	3	2	0	15	6	0
	South	4	0	0	1	1	0	13	3	0
ND	North	9	0	1	10	1	0	19	1	1
	Central	3	0	2	2	0	0	5	0	2
	South	8	0	0	6	1	1	14	1	**1**
Total		**50**	**44**	**5**	**43**	**48**	**8**	**139**	**147**	**14**

Table 5. Proportion (%) of *Phyllotreta cruciferae* (crucifer), *P. striolata* (striped), *Psylliodes punctulata* (hop) and other flea beetles collected on yellow sticky traps at the time of population peak over all locations across the prairies by a) province/state, and b) region, 2007-2011.

	2007			2008			2009				2010				2011			
a) Prov/ state	***P. cruc***	***P. striol***	***Ps. punct****	***P. cruc***	***P. striol***	***Ps. punct****	***P. cruc***	***P. striol***	***Ps. punct***	**Other**	***P. cruc***	***P. striol***	***Ps. punct***	**Other**	***P. cruc***	***P. striol***	***Ps. punct***	**Other**
Alberta!	3.5	84.8	11.7	29.3	69.0	1.7	11.8	78.2	9.4	0.6	26.9	63.6	2.4	7.0	25.6	63.4	5.0	5.9
Saskatchewan	90.2	7.8	1.9	50.6	39.3	10.0	59.4	38.8	1.7	0	52.6	39.8	5.1	2.5	37.6	49.7	3.1	9.5
Manitoba	89.8	10.0	0.2	77	21	1	49.5	48.6	1.0	0.9	45.8	49.4	2.4	2.4	32.4	58.4	8.8	0.4
N Dakota	-	-	-	-	-	-	-	-		-	83.3	02.3	0.5	13.8	80.3	11.3	1.3	7.1
b) Region																		
AB North!	3.5	84.8	11.7	15.3	79.2	5.5	2.8	81.9	14.2	1.1	8.5	81.1	3.4	7.0	12.5	75.7	1.6	10.2
Central	-	-	-	9.9	89.2	0.9	19.3	77.5	3.1	0.1	14.2	73.4	2.1	10.3	6.8	79.2	8.2	5.8
South	-	-	-	98.0	1.0	0.9	36.2	62.3	1.5	0	94.4	4.4	1.1	0	72.9	22.2	4.4	0.6
SK North	-	-	-	4.0	92.4	3.7	12.3	85.1	2.6	0	9.7	78.5	5.2	6.6	0.1	82.0	5.6	12.4
Central	88.0	9.5	2.4	34.7	39.1	26.2	43.6	55.8	0.6	0	55.3	30.8	13.9	0	11.6	75.1	2.4	11.1
South	100	0	0	82.0	12.8	5.0	91.0	7.1	1.8	0.1	87.5	10.4	2.0	0	82.5	9.5	1.5	6.5
MB North	-	-	-	-	-	-	26.2	73.1	0.6	0	22.7	65.8	5.6	5.9	17.6	69.4	13.0	0
Central	86.2	13.4	0.4	84.8	13.4	0.8	59.2	39.9	0.9	0	51.2	48.6	0.1	0.1	48.2	51.5	0	0.3
South	92.5	7.5	0	67.2	32.0	0.8	55.4	41.0	1.4	2.1	78.1	21.8	0.05	0.05	37.0	43.0	18.2	1.8
ND North	-	-	-	-	-	-	-	-	-	-	80.0	3.5	1.0	15.5	82.8	14.8	0.7	1.9
Central	-	-	-	-	-	-	-	-	-	-	67.8	2.7	0	29.5	95.7	4.2	0	0.1
South	-	-	-	-	-	-	-	-	-	-	97.2	0.7	0.2	1.9	73.2	8.2	2.6	16.0

* In 2007 and 2008 the *Ps. punct* category included a small number of flea beetles other than *Psylliodes punctulata* (hop flea beetle).
! Including two sites from British Columbia in 2007

Table 6. Proportion (%) of *P. striolata* striped flea beetles collected on yellow sticky traps in or near canola fields that were located within 2 km of previous year`s sites, by location 2007-2011.

Province	Region	Location	2007	2008	2009	2010	2011
Alberta	Peace River	BeaverlodgeRF	96.6	100	94.0	90.7	97.7
	Central	Barrhead		100	94.2	90.9	98.9
		Westlock		100	98.8	96.0	98.9
		Morinville		98.2	91.4	93.7	94.8
		Cardiff		87.0	74.8	50.0	40.1
		Ft. Saskatchewan		93.3	88.7	94.2	95.2
	South	Brooks		0.4	8.3	20.0	70.6
Saskatchewan	North	Smeaton		94.0	93.0	92.9	88.2
		Melfort		90.7	100	100	98.4
	Central	Saskatoon1	65.8	71.0	61.4	51.9	92.0
		Saskatoon2	1.4	7.2	6.0	47.2	85.4
	South	Avonlea 1		40.0	0.4	0.8	1.5
		Avonlea2		11.3	1.1	0.5	3.4
		Richardson		0	1.9	0.5	1.9
		Rowatt		0	0	5.4	1.2
Manitoba	Central	Portage la Prairie	26.6	21.7	-	29.9	6.5
		Oakville	9.4	5.7	21.3	7.3	42.8
	South	Carman		5.3	76.2	5.7	71.5
		Lowe Farm		22.0	4.1	24.2	14.5

Table 7. Locations of the 650 yellow sticky cards used to trap crucifer-feeding flea beetles, dates of occurrence and values for maximum numbers of flea beetles, and species proportion of the maximum number caught at 25 sites across the Prairies in 2007.

				Maximum numbers		Proportion (%)		
Province	**Region**	**Nearest town**	**Sampling period**	**Dates for max. spring nos.**	**Flea beetles/ trap/day**	***P.cruciferae***	***P.striolata***	**Other FB**
BC/AB	Peace R.	Sweetwater, BC	Jun 4-Jul 5	Jun 12-18	15.67	1.7	98.3	0
		Dawson Creek, BC	Jun 4-Jul 5	Jun 4-12	1.56	0	100	0
		Beaverlodge AAFC	May 30-Sep 4	Jun 12-19	5.90	3.4	96.6	0
		Beaverlodge1	May 11-Sep 4	May 11-16	2.84	0	52.1	47.9
		Beaverlodge7	May 11-Sep 4	Jun 12-18	7.10	1.4	98.6	0
		Valhalla	May 30-Sep 4	Jun 27-Jul 4	4.40	18.2	79.5	2.3
		LaGlace	May 11-Sep 4	May 30-Jun 4	2.30	0	68.2	31.8
SK	Central	Unity	Jun 1-18	Jun 1-18	0.01	100	0	0
		Asquith	Jun 1-13	Jun 1-13	0.11	87.5	12.6	0
		Saskatoon1	Apr 19-Jun 7	May 17-24	0.54	13.2	65.8	21.1
		Saskatoon 2	May 18-Aug 30	Jun 28-Jul 5	30.13	97.6	1.4	0
		Saskatoon CDC	May 16-Jun14	May 31-Jun 7	1.88	94.1	5.9	0
		Pike Lake	May 14-Jun 18	Jun 10-18	0.22	100	0	0
		Muenster	Jun 4-19	Jun 4-19	0.03	100	0	0
		Davidson	May 31-Jun 11	May 31-Jun 11	0.03	100	0	0
		Simpson	May 21-Jun 18	Jun 5-11	1.20	100	0	0
	South	Rockhaven	Jun 1-13	Jun 1-13	0.01	100	0	0
		Leader	May 18-Jun 5	May 18-Jun 5	0.27	100	0	0
MB	Central	Bradwardine	May 21-Jul 2	Jun 21-Jul 2	4.16	94.5	4.3	1.2
		Portage la Prairie	Jun 8-14	Jun 8-14	0.64	73.4	26.6	0
		Oakville	Jun 5-14	Jun 5-14	5.93	90.6	9.4	0
	South	Roseisle	May 30-Jun 21	May 30-Jun 8	1.57	77.7	22.3	0
		Morris	Jun 6-12	Jun 6-12	3.93	100	0	0
		Rosenfeld	Jun 6-19	Jun 6-12	27.17	99.7	0.4	0
		Manitou	May 31-Jun 21	Jun 15-21	2.73	92.7	7.4	0

Table 8. Locations of the 560 yellow sticky cards used to trap crucifer-feeding flea beetles, dates of occurrence and values for maximum numbers of flea beetles, and species proportion of the maximum number caught at 19 sites in Alberta in 2008.

			Maximum numbers		Proportion (%)		
Region	**Nearest town**	**Sampling period**	**Dates for max. spring nos.**	**Flea beetles/ trap/day**	***P.cruciferae***	***P.striolata***	**Other FB**
Peace R.	Beaverlodge1	Apr 29-Aug 25	Jun 9-16	1.23	0	100	0
	Beaverlodge2	Apr 29-Aug 25	May 26-Jun2	2.54	6.7	87.6	5.6
	Sexsmith	May 14-Jul 7	May 22-30	2.00	39.1	50.0	10.9
Central	Barrhead1	May 15-Jun 16	Jun 69-16	2.91	0	100	0
	Barrhead2	Jun 2-16	Jun 9-16	2.96	0	100	0
	Westlock	Jun 2-16	Jun 2-9	3.26	0	100	0
	Morinville	Jun 2-16	Jun 2-9	6.54	1.7	98.2	0
	Cardiff	Jun 2-16	Jun 9-16	1.31	13.0	87.0	0
	Ft. Saskatchewan	Jun 2-16	Jun 2-9	0.86	6.7	93.3	0
	Ellerslie	May 23-Jun 20	Jun 13-20	0.97	76.5	23.5	0
	St. Albert	May 23-Jun 20	Jun 6-13	1.14	0	100	0
	Lacombe1	May 16-Jun 25	Jun 19-25	5.67	2.4	94.7	3.0
	Lacombe2	May 16-Jul 2	Jun 19-25	3.70	14.3	81.0	4.8
	Crestomere	May 27-Jun 24	Jun 17-24	2.43	2.3	95.3	2.4
	Lochinvar	May 29-Jun 26	Jun 19-26	1.86	1.5	96.9	1.5
South	Brooks	May 5-Jun 18	Jun 13-18	5.54	98.2	0.4	1.4
	Bow Island	May 5-Jun 23	Jun 16-23	3.97	97.1	0.7	2.2
	Lethbridge1	May 16-Aug 1	Jun 13-20	16.1	98.1	1.9	0
	Lethbridge2	May 16-Aug 1	Jun 13-20	18.4	98.8	1.2	0

Table 9. Locations of the 655 yellow sticky cards used to trap crucifer-feeding flea beetles, dates of occurrence and values for maximum numbers of flea beetles, and species proportion of the maximum number caught at 15 sites across Saskatchewan and Manitoba in 2008.

				Maximum numbers		Proportion (%)		
Province	**Region**	**Nearest town**	**Sampling period**	**Dates for max. spring nos.**	**Flea beetles/ trap/day**	***P.cruciferae***	***P.striolata***	**Other FB**
Saskatchewan	North	Smeaton	May 14-Sep 25	May 21-27	2.23	6.0	94.0	0
		Melfort	May 27-Sep 25	May 27-Jun 3	0.77	1.9	90.7	7.4
	Central	Saskatoon1	Apr 17-Aug 14	May 2-8	0.52	1.6	71.0	27.4
		Saskatoon2	May 21-Oct 10	May 28-Jun 4	0.20	67.8	7.2	25.0
	South	Avonlea1	May 5-Jun 1	May 25-Jun 1	0.14	60.0	40.0	0
		Avonlea2	May 5-Jun 2	May 19-Jun 2	0.38	88.7	11.3	0
		Rowatt	May 26-Jun 24	Jun 3-10	6.40	99.1	0	0.1
		Richardson	May 20-28	May 20-28	0.12	80.0	0	20.0
Manitoba	Central	Griswald	May 14-Jul 2	Jun 16-23	48.1	96.3	3.2	0.5
		Rignold	May 15-Jun 26	Jun 19-26	12.3	70.9	23.0	6.0
		Portage la Prairie	May 25-Jun 26	Jun 12-19	25.4	77.8	21.7	0.6
		Oakville	May 14-Jun 26	Jun 12-19	28.1	94.2	5.7	0.1
	South	Carman	May 14-Jun 25	Jun 18-25	13.9	93.6	5.3	1.0
		St. Elizabeth	May 14-Jun 25	Jun 3-11	4.57	30.0	68.7	1.3
		Lowe Farm	May 21-Jun 25	Jun 18-25	3.11	78.0	22.0	0

Table 10. Locations of the 489 yellow sticky cards used to trap crucifer-feeding flea beetles, dates of occurrence and values for maximum numbers of flea beetles caught at 24 sites in Alberta in 2009.

			Maximum numbers		Proportion (%)			
Region	**Nearest town**	**Sampling period**	**Dates**	**Flea beetles /trap/day**	***P. cruciferae***	***P. striolata***	***P. punctulata***	**Other flea beetles**
Peace R.	Hotchkiss	June 15 - June 22	Jun 15-22	1.91	1.5	82.0	14.9	1.6
	North Star	June 15 - June 22	Jun 15-22	1.51	0	81.2	18.9	0
	Deadwood1	June 15 - June 22	Jun 16-23	1.83	3.1	92.2	3.1	1.6
	Deadwood2	June 15 - June 22	Jun 15-22	2.19	2.2	87.0	10.9	0
	Worsley	June 3 - June 22	Jun 3-10	9.00	0.3	23.2	76.4	0
	Peoria	May 30 - June 12	May 30-Jun 5	2.37	0	98.6	1.4	0
	Spirit River	June 1 - June 22	Jun 1-9	4.20	0	95.2	1.2	3.6
	Rycroft	May 22 - June 12	May 29-Jun 5	3.18	5.6	91.0	3.4	0
	Eaglesham	May 25 - June 15	Jun 1-8	3.63	1.6	98.4	0	0
	Beaverlodge1	May 22 - Aug 14	May 29-Jun 5	2.86	5.0	94.0	1.0	0
	Beaverlodge2	May 22 - Aug 14	May 29-Jun 5	5.97	3.8	79.0	17.2	0
	Beaverlodge3	May 26 - Aug 14	Jun 19-26	2.31	8.6	91.4	0	0
	Sexsmith1	June 18 - July 14	Jun 8-18	2.48	8.1	51.6	32.3	8.1
	Sexsmith2	June 18 - July 14	Jun 8-18	2.92	0	82.0	18.0	0
Central	Barrhead	May 22 - June 19	May 29-Jun 2	8.60	1.2	94.2	4.1	0.6
	Westlock	May 22 - June 19	Jun 5-12	4.88	0.6	98.8	0.6	0
	Morinville	May 22 - June 19	Jun 12-19	7.00	7.8	91.4	0.8	0
	Cardiff	May 22 - June 19	Jun 12-19	6.80	16.0	74.8	9.2	0
	Fort Sask.	May 22 - June 19	May 22-29	7.57	6.8	88.7	4.5	0
	St. Albert	June 3- July 3	Jun 3-11	1.38	10.9	87.3	1.8	0
	Ellerslie	June 3 - July 3	Jun 11-24	3.88	92.1	7.5	0.4	0
South	Lochinvar	June 3- July 3	Jun 8-16	1.10	11.4	88.6	0	0
	Crestomere	June 3 – July 8	Jun 30-Jul 8	1.50	6.7	90.0	3.3	0
	Brooks	May 21- July 8	Jun 30-Jul 8	1.87	90.5	8.3	1.2	0

Table 11. Locations of the 1293 yellow sticky cards used to trap crucifer-feeding flea beetles, dates of occurrence and values for maximum numbers of flea beetles caught at 12 sites in Saskatchewan in 2009.

			Maximum numbers		Proportion (%)			
Region	**Nearest town**	**Sampling period**	**Dates**	**Flea beetles /trap/day**	***P. cruciferae***	***P. striolata***	***P. punctulata***	**Other flea beetles**
North	Smeaton	May 22-Jul 2	May 29-Jun 4	2.4	6.2	93.8	0	0
	Scott	May 19-Jun 9	May 26-Jun 2	0.38	30.6	61.6	7.8	0
	Melfort	May 22-Jul 2	May 22-29	0.44	0	100	0	0
Central	St. Benedict	Jun 23-Jul 4	Jun 23-Jul 4	0.82	0	100	0	0
	Saskatoon1	Jun 3-10	May 1-6	0.57	36.8	61.4	1.8	0
	Saskatoon 2	Apr 33-Jul 1	May 26-Jun 3	0.71	94.0	6.0	0	0
South	Swift Current1	May 20-27	May 20-27	2.57	87.3	3.3	8.9	0
	Swift Current2	May 27-Jun 27	Jun 11-17	5.93	63.5	36.0	0.6	0
	Avonlea1	May 10-Jul 5	Jun 28-Jul 5	28.0	99.6	0.4	0	0
	Avonlea2	May 17-Jul 5	Jun 21-28	28.6	98.6	1.1	0	0.2
	Rowatt	Jun 12-Jul 2	Jun 24-Jul 2	5.38	96.7	1.9	1.4	0
	Richardson	Jun 17-Jul 2	Jun 17-24	5.00	100	0	0	0

Table 12. Locations of 209 yellow sticky cards used to trap crucifer-feeding flea beetles, dates of occurrence and values for maximum numbers of flea beetles caught at 8 sites in Manitoba in 2009.

			Maximum numbers		Proportion (%)			
Region	**Nearest town**	**Sampling period**	**Dates**	**Flea beetles/ trap/day**	***P. cruciferae***	***P. striolata***	***P. punctulata***	**Other flea beetles**
North	Swan River	Jun 22-Jul 3	Jun 29-Jul 3	8.17	7.8	91.2	1.0	0
	Teulon	Jun 4-Jul 29	Jun 18-25	25.5	44.7	55.0	0.2	0
Central	Winnipeg Beach	Jun 10-Jul 29	Jun 23-25	3.50	25.7	74.3	0	0
	Oakville	May 22-Jul 3	Jun 12-19	43.5	78.5	21.3	0	0.1
	Holland	May 21-Jun 17	Jun 10-17	6.96	73.3	24.1	2.6	0
South	Carman	May 21-Jul 2	Jun 12-18	7.00	23.8	76.2	0	0
	Lowe Farm	May 22-Jul 9	Jun 25-Jul 2	12.7	95.9	4.1	0	0
	St. Elizabeth	Jun 1-Jul 2	Jun 18-25	8.43	46.4	42.7	4.1	6.8

Table 13. Locations of the 1025 yellow sticky cards used to trap crucifer-feeding flea beetles, dates of occurrence and values for maximum numbers of flea beetles caught in spring at 32 sites in Alberta in 2010.

			Maximum numbers		Proportion (%)			
Region	**Nearest town**	**Sampling period**	**Dates**	**Flea beetles/ trap/day**	***P. cruciferae***	***P. striolata***	***P. punctulata***	**Other flea beetles**
Peace R.	Marie Reine	May 17 - 31	May 24 - 31	0.57	35.0	65.0	0	0
	Worsley	May 14 - 25	May 14 - 25	3.03	4.8	93.4	1.8	0
	Homestead	May 27 - Aug 10	June 3 - 10	1.57	0	88.6	6.8	4.5
	Valhalla1	May 28 - Aug 10	May 28 - June 3	0.13	0	50	0	50
	Valhalla2	May 27 - Aug 10	June 10 - 17	0.79	0	86.4	0	13.6
	Hythe1	May 28 - Aug 10	June 10 - 17	0.23	0	100	0	0
	Hythe2	May 27 - Aug 10	June 10 - 17	0.60	0	100	0	0
	Beaverlodge1	May 27 - Aug 10	June 29 - July 7	1.62	1.9	96.2	0	1.9
	Beaverlodge2	May 27 - Aug 10	June 2 -10	1.80	0	93.7	0	6.3
	BeavrldgeRF1	May 11 - Aug 10	May 11 - 18	1.23	0	90.7	9.3	0
	BeavrldgeRF2	May 11 - Aug 10	June 2 - 10	0.69	0	79.2	20.8	0
	Sexsmith1	May 13 - June 23	June 16 - 23	2.49	2.3	82.8	0	14.9
	Sexsmith2	May 13 - June 23	June 16 - 23	2.74	66.7	28.1	5.2	0
Central	Barrhead	May 22 - June 19	June 17 - 23	7.33	0	90.9	9.1	0
	Westlock	May 22 - June 19	June 9 - 17	2.52	3.0	96.0	1.0	0
	Morinville	May 22 - June 19	June 2 - 9	5.46	5.8	93.7	0.5	0
	Cardiff	May 22 - June 19	June 9 -17	2.45	44.9	50.0	5.1	0
	Ft. Sask'n	May 22 - June 19	May 25 - June 2	4.72	5.8	94.2	0	0
	St Albert1	May 18 - July 23	May 18 - 25	3.06	18.7	44.9	0	36.4
	St. Albert2	May 25 - July 23	June 15 - 22	1.34	4.3	34.0	0	61.7
	St. Albert3	June 8 - June 7	June 22 - 29	0.76	12.5	87.5	0	0
	Vegreville1	May 12 - July 20	May 12 -19	0.71	0	88.0	0	12.0
	Vegreville2	May 12 - July 20	May 12 -19	0.63	4.5	90.9	0	4.6
	Vegreville3	May 19 - July 20	May 27 - June 9	3.30	72.7	16.2	4.5	6.6
	Lacombe Met	May 20 - June 22	May 27 - June 3	0.40	7.1	85.7	7.1	0
	Lacombe2	May 20 - June 22	May 27 - June 3	1.11	5.1	82.1	0	12.8
South	Brooks1	May 19 - June 22	June 14 - 22	0.25	80.0	20.0	0	0

Brooks2	May 26 – July 8	June 15 - 24	1.53	100	0	0	0
Taber	May 15 - June 15	May 15 - June 15	0.17	87.5	6.2	6.2	0
LethbridgeW	June 16 - July 1	June 24 - July 1	11.5	99.3	0.2	0.5	0
LethbridgeE	June 16 - July 1	June 18 - 24	20.3	99.8	0.2	0	0
Lethbridge3	May 9 - July 3	June 19 - 16	0.17	100	0	0	0

Table 14. Locations of the 1730 yellow sticky cards used to trap crucifer-feeding flea beetles, dates of occurrence and values for maximum numbers of flea beetles caught at 26 sites in Saskatchewan in 2010.

			Maximum numbers		Proportion (%)			
Region	**Nearest town**	**Sampling period**	**Dates for max. spring nos.**	**Flea beetles/ trap/day**	***P. cruciferae***	***P. striolata***	***P. punctulata***	**Other flea beetles**
North	Medstead	May 21 - Jun 11	June 4 - 11	0.11	0	100	0	0
	Scott	June 1 - 29	June 22 - 29	0.86	83.3	13.3	3.3	0
	Prince AlbertM	June 1 - 28	June 8 - 15	3.49	0.8	87.7	11.5	0
	Prince AlbertV1	May 27 - June 24	June 3 - 11	0.92	2.7	73.0	2.7	21.6
	Prince AlbertV2	May 27 - June 24	June 11 - 17	0.67	0	75.0	0	25.0
	Smeaton	May 6 - October 15	June 16 - 23	1.20	2.4	92.9	4.8	0
	Valparaiso	May 24 - June 30	June 1 - 14	0.90	7.9	63.5	9.5	19.0
	Crooked River	My 24 - June 30	June 1 - 14	0.23	0	80.0	20.0	0
	Tisdale	My 24 - June 30	June 1 - 14	0.10	0	100	0	0
	Melfort	May 22 - Oct 1	June 11 - 16	0.36	0	100	0	0
Central	SaskatoonM	June 7 - 14	June 7 - 14	5.26	82.6	9.2	8.2	0
	SaskatoonB6	March 26 - Oct 5	April 16 - 22	0.64	19.5	51.9	28.6	0
	SaskatoonB23	May 20 - October 4	May 13 - 20	0.92	41.5	47.2	11.4	0
	Hanley	May 21 - June 14	June 1 - 14	0.52	77.8	14.8	7.4	0
South	Swift Current	May 7 - June 23	June 11 - 23	2.67	96.9	3.1	0	0
	Eyebrow	May 21 - June 18	June 6 - 18	5.77	97.4	1.4	1.2	0
	Moose Jaw	May 14 - June 14	May 14 - 21	18.0	98.2	0.5	1.3	0
	Richardson	May 31 - July 16	June 28 - July 7	10.3	94.6	5.4	0	0
	Rowatt	June 2 - July 16	June 28 - July 7	6.64	96.6	3.3	0	0
	Strasbourg	May 12 - June 9	June 2 - 9	0.09	100	0	0	0
	Avonlea1	May 17 - June 25	June 12 - 19	3.74	99.2	0.8	0	0
	Avonlea2	May 17 - June 25	June 19 - 25	58.8	99.5	0.5	0	0
	Indian Head1	May 26 - July 5	June 29 - July 5	8.60	79.8	20.2	0	0
	Indian Head2	May 26 - July 5	June 29 - July 5	11.2	75.0	23.5	1.5	0
	Redvers1	May 17 - June 15	June 8 - 15	0.17	33.3	66.7	0	0
	Redvers2	May 17 - June 8	May 17 - 25	0.21	80.0	0	20.0	0

Table 15. Location and sampling period of 335 yellow sticky cards used to trap crucifer-feeding flea beetles, dates of occurrence and values for maximum numbers of flea beetles and species proportions of flea beetles caught at 17 sites in Manitoba in 2010.

			Maximum numbers		Proportion (%)			
Region	**Nearest town**	**Sampling period**	**Dates for max. spring nos.**	**Flea beetles/ trap/day**	***P. cruciferae***	***P. striolata***	***P. punctulata***	**Other flea beetles**
North	Swan RiverP	May 21 - June 1	May 21 - June 1	0.42	5.9	58.9	35.3	0
	Swan RiverA	May 21 - June 21	June 1 - 21	2.79	30.9	68.6	0.4	0
	Swan RiverB	May 21 - June 21	June 1 - 21	0.48	10.5	89.5	0	0
	Ethelbert	May 26 - June 23	June 16 - 23	23.7	87.6	11.7	0.7	0
	Sifton	May 26 - June 23	June 2 - 9	5.00	4.6	91.4	2.9	1.1
	TeulonM	May 14 - June 30	June 14 - 18	7.85	10.2	87.9	0	1.9
	TeulonP	May 14 - June 30	May 14 - 21	4.20	9.5	52.4	0	38.1
Central	Forrest Station	May 21 - June 23	June 16 - 23	2.68	85.3	14.7	0	0
	Brandon	June 1 - 23	June 9 - 23	3.90	10.6	88.6	0.4	0.4
	Oakville	May 14 - June 18	June 4 - 11	41.3	92.7	7.3	0	0
	Portage la Prairie	May 24 – June 18	June 4 - 11	4.26	71.5	27.9	0.7	0
	Beausejour1	May 12 - June 21	June 14 - 21	9.18	32.7	67.3	0	0
	Beausejour2	May 21 - June 18	June 11 - 18	7.36	14.1	85.9	0	0
South	Carman	May 13 - June 23	June 10 - 17	4.03	94.3	5.7	0	0
	Lowe Farm	May 27 - June 17	June 10 - 17	1.89	75.8	24.2	0	0
	St. Pierre	May 13 - June 4	May 30 - June 4	37.2	84.1	15.7	0.1	0.1
	Dufrost	May 14 - June 5	May 30 - June 5	7.77	58.4	41.6	0	0

Table 16. Locations of 435 yellow sticky cards used to trap crucifer-feeding flea beetles, dates of occurrence and values for maximum numbers of flea beetles caught at 23 sites in N. Dakota in 2010.

			Maximum numbers		Proportion (%)			
Region	**Nearest town**	**Sampling period**	**Dates for max. spring nos.**	**Flea beetles/ trap/day**	***P. cruciferae***	***P. striolata***	***P. punctulata***	**Other flea beetles**
North	Antler	May 17 – June 15	June 8-15	2.52	80.6	5.6	0	13.6
	Lansford	May 17 – June 15	June 8-15	1.14	95.0	0	0	5.0
	Bottineau PG	May 25 – June 22	June 9-15	44.8	98.7	0.4	0	0.8
	Bisbee	May 21 – June 25	June 18-25	6.46	96.5	0.9	2.7	0
	Norwich	May 20 – June 15	May 26-June 1	10.6	96.2	2.8	0.6	0.3
	Keene	May 5 – June 7	May 31-June 7	0.46	75.0	6.2	6.2	12.5
	Minot SC	May 10 – June 2	May 26-June 2	3.76	93.2	0.8	0	6.1
	Minot WC	Apr 30 – June 22	June 9-16	5.06	52.5	17.5	0	29.9
	Minot PG	May 26 – June 21	June 15-21	5.75	95.7	0.7	0	3.6
	Charlson	May 14 – June 6	June 1-6	1.00	16.7	0	0	83.3
Central	Max	May 26 – June 24	June 17-24	0.57	43.7	0	0	56.3
	Harvey	May 26 – June 21	May 26-June 1	2.77	91.6	0	0	8.4
	Milton	May 25 - June 22	June 2-8	0.43	86.7	13.3	0	0
	Langdon	May 27- July 12	June 14-23	11.6	99.6	0.4	0	0
	Regan	May 17 – June 15	May 25-June 1	0.83	17.2	0	0	82.8
South	Regent	May 10 – June 7	June 2-7	0.40	100	0	0	0
	Mott1	May 3 – June 7	June 1-7	0.33	100	0	0	0
	Mott2	May 3 – June 7	June 1-7	0.60	88.8	0	0	11.1
	Mott3	May 3 – June 7	June 1-7	12.5	96.8	1.1	1.6	0.5
	Mott4	May 10 – June 7	June 2-7	0.32	100	0	0	0
	Mott5	May 10 – June 7	June 1-7	0.33	100	0	0	0
	Mott6	May 10 – June 7	June 7	2.91	94.1	2.0	0	3.9
	Prosper	June 4 – July 12	June 15-29	4.14	97.8	2.2	0	0

Table 17. Locations of the 1188 yellow sticky cards used to trap crucifer-feeding flea beetles, dates of occurrence and values for maximum numbers of flea beetles caught at 39 sites in Alberta in 2011.

			Maximum numbers		Proportion (%)			
Region	**Nearest town**	**Sampling period**	**Dates for max. spring nos.**	**Flea beetles/ trap/day**	***P. cruciferae***	***P. striolata***	***P. punctulata***	**Other flea beetles**
Peace R.	Marie Reine	Jun 17-Jul 7	Jun 17-Jul 7	4.91	97.8	2.2	0	0
	Eaglesham	Jun 17-Jul 6	Jun 17-27	0.10	40.0	60.0	0	0
	Valhalla1	Jun 9-Aug 17	Jun 9-22	1.69	6.4	89.1	0.9	3.6
	Valhalla2	Jun 9-Aug 24	Jun 9-22	2.42	0	97.5	0.6	1.9
	Woking	Jun 2-Jul 7	Jun 10-16	4.73	2.1	95.8	2.1	0
	Hythe1	May 31-Aug 24	Jun 9-16	0.57	0	95.0	5.0	0
	Hythe2	Apr 29-Aug 24	May 12-19	1.51	1.9	92.4	5.7	0
	Hythe3	Jun 9-Aug 24	Jun 9-22	0.35	4.3	69.6	0	26.1
	Beaverlodge1	Apr 29-Aug 24	May 5-12	4.91	0.6	97.7	1.7	0
	Beaverlodge2	Jun 9-Aug 24	Jun 9-22	1.88	3.3	85.2	0.8	10.6
	Halcourt1	May 31-Aug 24	May 31-Jun 9	1.67	0	10.7	0	89.3
	Halcourt2	Apr 29-Aug 24	May 12-19	9.71	5.9	89.1	4.1	0.9
	Sexsmith	Jun 2-22	Jun 10-16	2.50	0	100	0	0
Central	Barrhead	May 19-Jun 11	May 19-26	13.49	0	98.9	0.8	0.2
	Westlock	May 19-Jun 16	Jun 9-16	5.26	0	98.9	1.1	0
	Morinville	May 19-Jun 16	Jun 9-16	11.09	4.6	94.8	0.3	0.3
	Cardiff	May 19-Jun 16	Jun 9-16	3.49	41.0	40.1	9.0	9.9
	Ft. Saskatchewan	May 19-Jun 17	Jun 9-17	10.00	1.0	95.2	0	3.8
	St. Albert1	May 23-Jul 18	May 23-30	0.89	0	100	0	0
	St. Albert2	May 22-July 18	May 30-Jun 6	2.89	2.0	18.8	79.2	0
	Ellerslie	May 17-Jul 19	May 17-24	5.54	14.9	82.0	0	3.1
	Leduc	May 11-July 20	May 18-25	3.83	14.9	83.6	0	1.5
	Vegreville1	May 12-July 21	May 12-19	0.25	14.3	14.3	0	71.4
	Vegreville2	May 13-July 21	May 20-27	0.51	11.1	50.0	38.9	0
	Millet	May 20-Jun 20	June 6-13	6.54	0.4	96.9	0	2.6
	Wetaskiwin	May 20-Jun 20	May 20-30	11.02	1.8	97.5	0.4	0.4

	Ponoka	May 20-Jun 20	Jun 13-20	3.49	0	100	0	0
	Lacombe1	May 30-Jun 21	May 30-Jun 7	1.90	2.6	96.1	1.3	0
	Lacombe2	May 30-Jun 6	May 30-Jun 6	0.06	0	100	0	0
South	Strathmore	May 25-Jun 22	Jun 15-22	0.37	46.2	53.8	0	0
	Brooks	May 10-Jun 22	May 31-Jun 6	0.49	29.4	70.6	0	0
	Vauxhall	May 30-Jun 15	May 30-Jun 15	0.33	76.2	4.8	14.3	4.8
	Hays	May 13-30	May 13-30	0.21	14.3	57.1	28.6	0
	Lethbridge1	May 30-Jun 27	Jun 20-27	19.11	99.6	0.4	0	0
	Lethbridge2	May 30-Jun 27	Jun 20-27	7.20	94.4	5.6	0	0
	LethbridgeTP1	May 19-Jun 21	Jun 16-21	13.27	99.0	0	0	1.0
	LethbridgeTP2	Jun 7-Jul 6	Jun 30-Jul 6	11.20	99.1	0.9	0	0
	Taber	May 13-Jun 15	May 13-30	0.08	71.4	28.6	0	0
	Bow Island	May 10-Jun 27	Jun 20-27	9.03	99.7	0.3	0	0

Table 18. Locations of the 378 yellow sticky cards used to trap crucifer-feeding flea beetles, dates of occurrence and values for maximum numbers of flea beetles caught at 22 sites in Sask. in 2011.

			Maximum numbers		Proportion (%)			
Region	**Nearest town**	**Sampling period**	**Dates for max. spring nos.**	**Flea beetles/ trap/day**	***P. cruciferae***	***P. striolata***	***P. punctulata***	**Other flea beetles**
North	Medstead1	May 25-Jun 16	Jun 8-16	1.90	0	39.5	15.8	44.7
	Medstead2	May 26-Jun 15	Jun 2-8	1.17	0	100	0	0
	Medstead3	May 18-Jun 15	May 18-25	1.17	0	80.3	7.7	12.0
	Scott	May 19-Jun 17	Jun 2-9	0.46	0	100	0	0
	Prince AlbertM	May 26 -Jun 22	Jun 9-15	7.43	0	100	0	0
	Prince AlbertV	Jun 7-Jul 5	Jun 7-17	0.44	0	31.8	22.7	46.4
	Smeaton	May 5-Sep 29	May 19-25	2.83	0	88.2	3.5	8.2
	St. Benedict	May 17-Jun 28	June 4-12	0.15	0	100	0	0
	Melfort	May 5-Sep 29	May 5-12	1.23	0.8	98.4	0.8	0
Central	SaskatoonM	May 17-Jun 15	May 31-Jun 7	5.37	3.7	96.3	0	0
	Elstow	May 31-Jun 28	Jun 21-28	2.40	16.7	72.6	1.2	9.5
	SaskatoonB6	Apr 11-Oct 12	Apr 27-May 3	1.46	0.6	92.0	7.4	0
	SaskatoonB22	Apr 11-Oct 12	May 17-24	1.22	9.4	85.4	2.3	2.9
	Hanley	May 26-Jun 16	Jun 2-9	1.74	39.3	54.1	3.3	3.3
	Burr	May 26-Jun 27	Jun 3-11	0.15	0	50.0	0	50.0
South	Swift Current1	May 9-Jun 20	Jun 10-20	7.84	89.3	8.7	1.3	0.8
	Swift Current2	May 9-Jun 20	Jun 10-20	14.18	89.3	10.4	0.1	0.1
	Eyebrow	May 12-Jun 20	Jun 1-20	2.13	87.1	9.9	2.9	0
	Strasbourg	May 18-Jun 1	May 25-Jun 1	1.60	66.7	25.0	8.3	0
	Moose Jaw	May 17-Jun 20	Jun 1-20	1.63	93.6	2.6	3.9	0
	Avonlea1	May 15-Jun 25	Jun 5-10	2.60	52.3	1.5	0	46.1
	Avonlea2	May 15-Jun 25	Jun 5-10	2.32	72.4	3.4	0	24.1
	Richardson	Jun 1-July 13	Jun 23-28	6.64	98.8	1.2	0	0
	Rowatt	Jun 2-July 13	Jun 28-Jul 6	5.98	98.1	1.9	0	0
	Indian Head1	Jun 1-29	Jun 8-29	7.93	90.4	9.5	0.1	0
	Indian Head2	Jun 3-Jul 9	June 10-Jul 9	0.49	69.8	30.2	0	0

Table 19. Locations of 396 yellow sticky cards used to trap crucifer-feeding flea beetles, dates of occurrence and values for maximum numbers of flea beetles caught at 13 sites in Manitoba in 2011.

			Maximum numbers		Proportion (%)			
Region	**Nearest town**	**Sampling period**	**Dates for max. spring nos.**	**Flea beetles/ trap/day**	***P. cruciferae***	***P. striolata***	***P. punctulata***	**Other flea beetles**
North	Swan River	May 18-Jul 4	May 18-26	0.40	0	37.5	62.5	0
	Thunder Hill	May 18-Jul 7	May 26-Jun 5	2.08	3.6	95.2	1.2	0
	Minitonas	May 18-Jul 7	May 18-26	1.10	4.5	84.1	11.4	0
	Ethelbert	Jun 10-Jul 15	Jun 28-Jul 7	0.87	2.6	94.9	2.6	0
	Sifton	Jun 10-Jul 15	Jun 20-27	6.78	7.4	92.3	0.4	0
	Gilbert Plains	Jun 10-Jul 15	Jun 28-Jul 7	9.11	87.6	12.4	0	0
Central	Brandon	May 25-Jun 29	Jun 22-29	91.23	88.1	11.9	0	0
	Portage la Prairie	May 6-Jun 30	Jun 10-17	61.00	93.4	6.5	0	0
	Oakville	May 6-Jul 15	May 13-20	20.68	56.5	42.8	0	0.7
	BeausejourK	Jun 10-Jul 8	Jun 10-17	5.89	2.4	97.5	0	0
	BeausejourM	Jun 10-Jul 8	Jun 10-17	8.49	0.6	98.7	0	0.6
South	Carman	May 5-Jul 7	May 12-19	10.63	28.5	71.5	0	0
	Lowe Farm	May 5-Jul 7	Jun 9-16	1.57	45.5	14.5	36.4	3.7

Table 20. Locations of 405 yellow sticky cards used to trap crucifer-feeding flea beetles, dates of occurrence and values for maximum numbers of flea beetles caught at 21 sites in North Dakota in 2011.

			Maximum numbers		Proportion (%)			
Region	**Nearest town**	**Sampling period**	**Dates for max. spring nos.**	**Flea beetles/ trap/day**	***P. cruciferae***	***P. striolata***	***P. punctulata***	**Other flea beetles**
North	Mohall	Jun 13-Jul 13	Jun 27-Jul 5	13.1	96.8	0.4	0.2	2.7
	Antler	May 23-Jun 20	Jun 13-20	39.97	94.5	2.3	0.1	3.1
	Bottineau	Jun 11-Jul 6	Jun 11-17	37.47	98.7	0.8	0.5	0
	Keene	May 25-Jun 16	Jun 9-16	3.31	93.1	0.8	0.8	5.1
	Minot	May 9-Jun 8	May 31-Jun 8	8.45	91.1	1.5	0.3	7.1
	Rugby	Jun 11-Jul 6	Jun 30-Jul 6	29.57	99.9	0.1	0	0
	Max	May 23-Jun 20	Jun 15-20	10.80	96.7	1.5	1.9	0
	Agate	May 27-Jun 23	Jun 16-23	0.77	74.1	18.5	3.7	3.7
	Milton	Jun 11-Jul 6	Jun 11-17	1.00	16.7	86.3	0	0
	LangdonW	May 16-Jun 9	Jun 1-9	7.33	54.6	45.1	0	0.3
	Langdon (NDSU)	Jun 1-24	Jun 16-24	9.43	94.2	5.6	0.3	0
Central	Devil's Lake	Jun 11-Jul 6	Jun 11-17	2.93	92.0	8.0	0	0
	Simcoe	May 24-Jun 20	Jun 13-20	22.14	99.4	0.4	0	0.3
South	Regent1	May 17-Jun 22	May 31-Jun 9	0.36	25.0	0	0	75.0
	Regent2	May 17-Jun 22	Jun 9-16	0.63	90.9	0	4.5	4.5
	Regent3	May 17-Jun 22	Jun 9-16	1.54	94.4	0	0	5.6
	Mott1	May 25-Jun 22	Jun 9-16	2.34	87.8	1.2	3.7	7.3
	Mott2	May 25-Jun 22	Jun 1-9	0.63	64.0	0	4.0	32.0
	Mott3	May 25-Jun 22	Jun 16-22	0.93	89.3	0	7.1	3.6
	Mott4	May 25-Jun 22	Jun 9-16	4.34	97.4	1.3	1.3	0
	Prosper	May 26-Jun 16	Jun 2-9	0.52	36.4	63.6	0	0

Figure 1. Proportion of flea beetle species collected from yellow sticky traps placed near or in canola fields in the spring across the Prairies, 2007-2011.

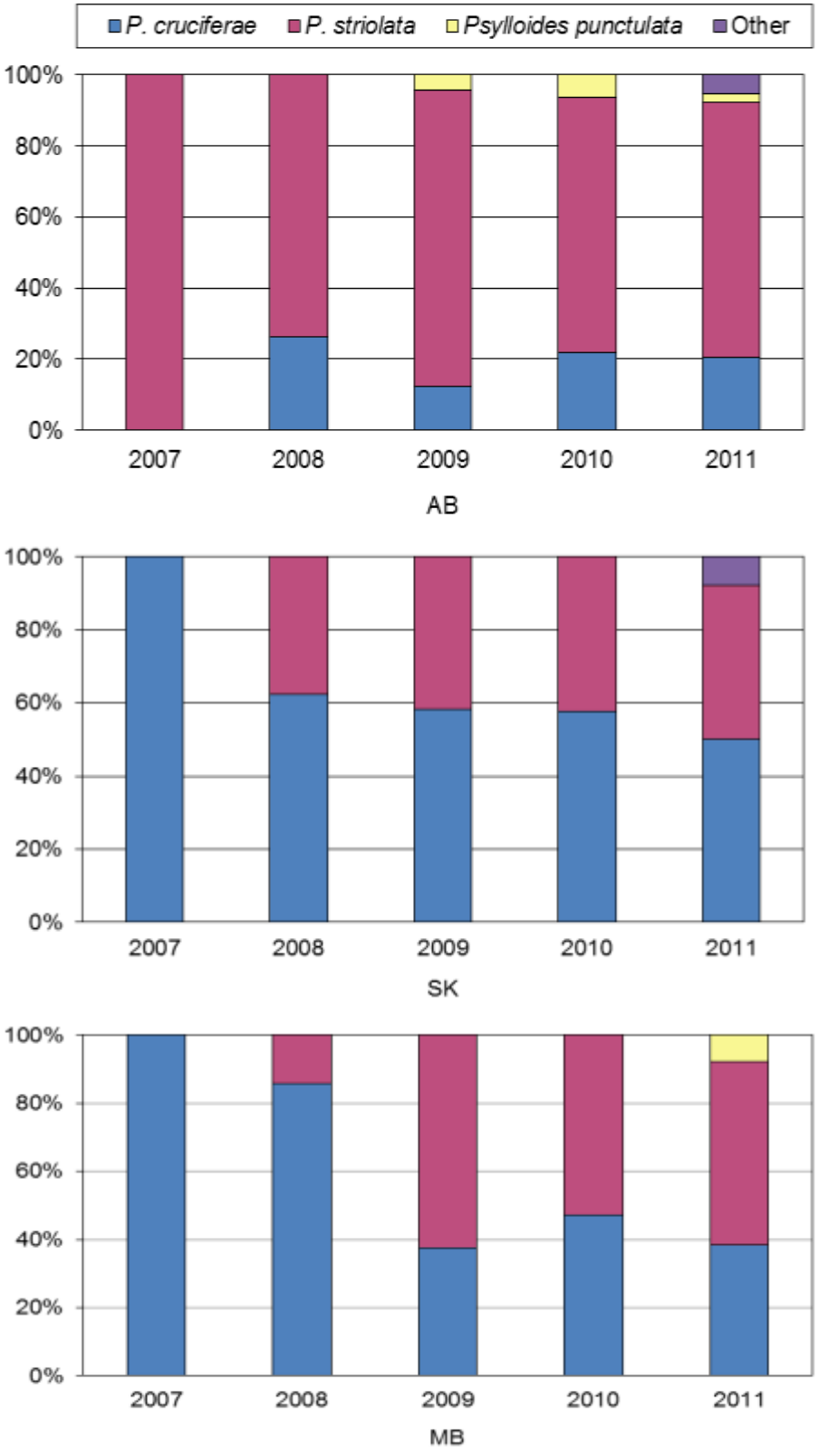


Figure 1, continued

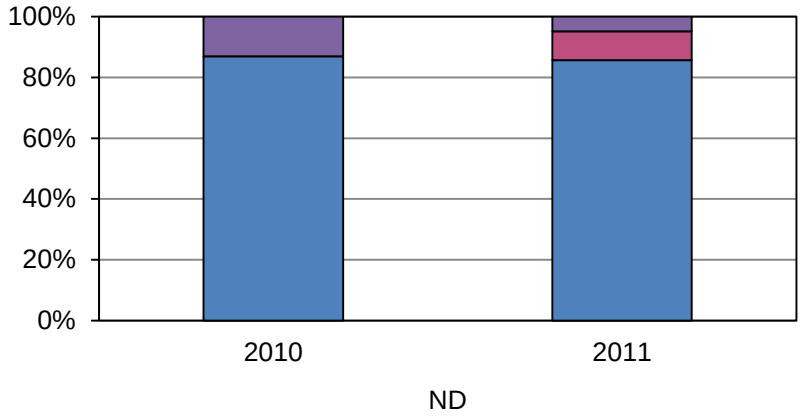
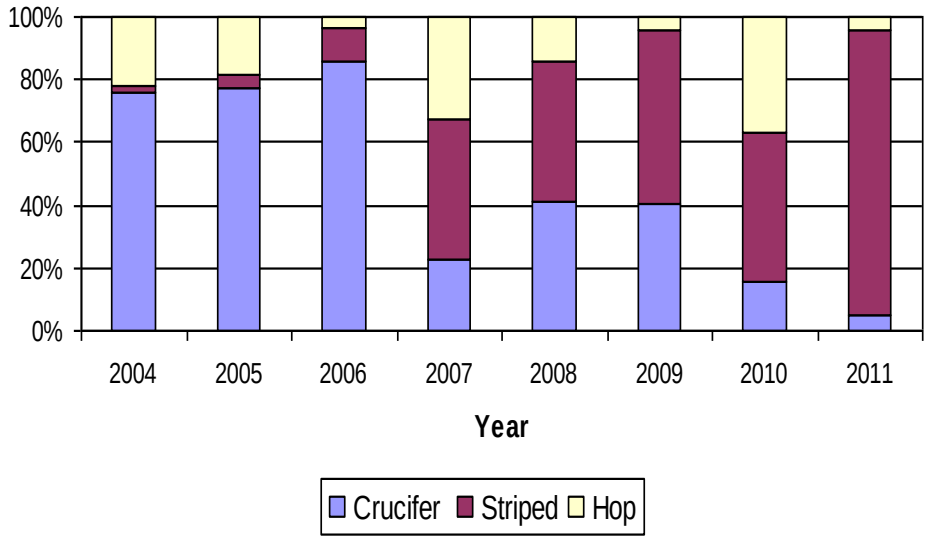


Figure 2. Proportion of flea beetle species collected on yellow sticky traps near the edge of a canola plot, Saskatoon Research Centre Farm, 2004-2011.



Appendix

Figure 1. Flea beetle numbers and species composition on yellow sticky traps placed in or near canola fields in British Columbia, 2007.

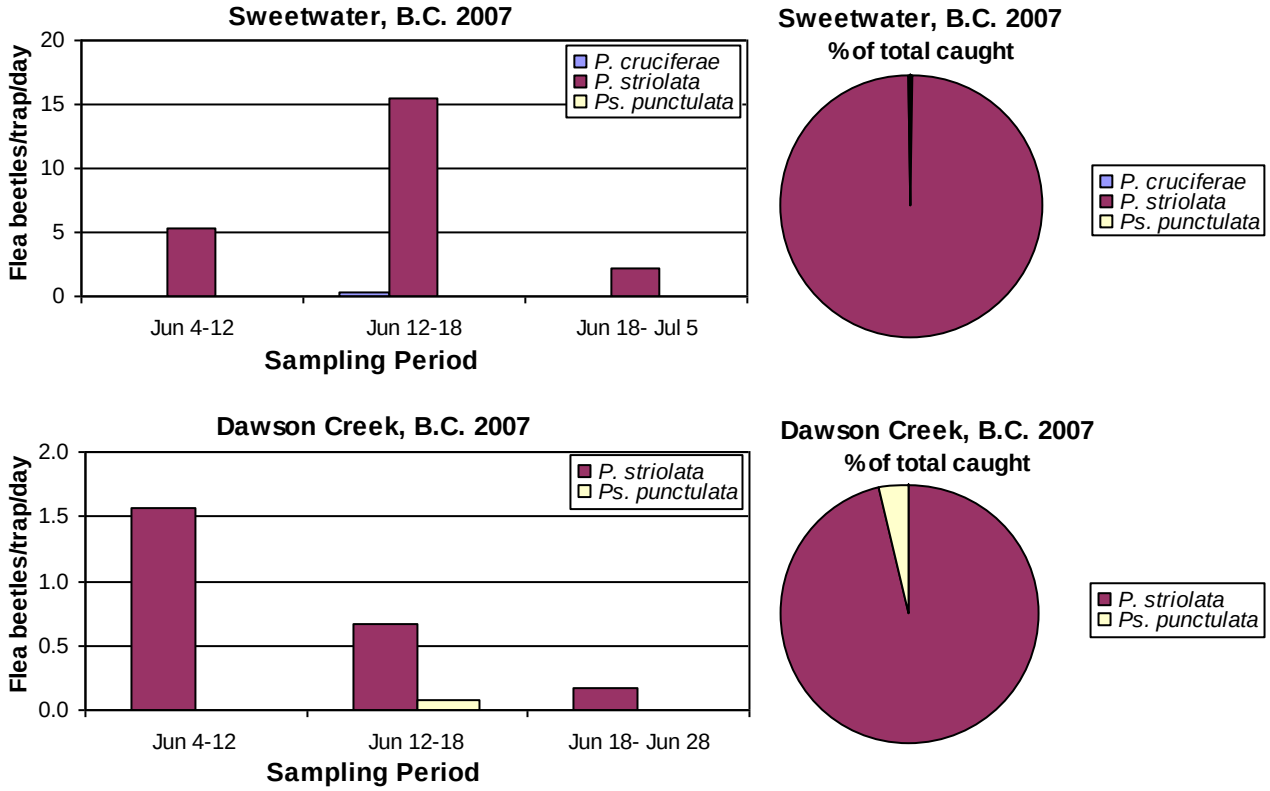


Figure 2. Flea beetle numbers and species composition on yellow sticky traps placed in or near canola fields in Alberta, 2007.

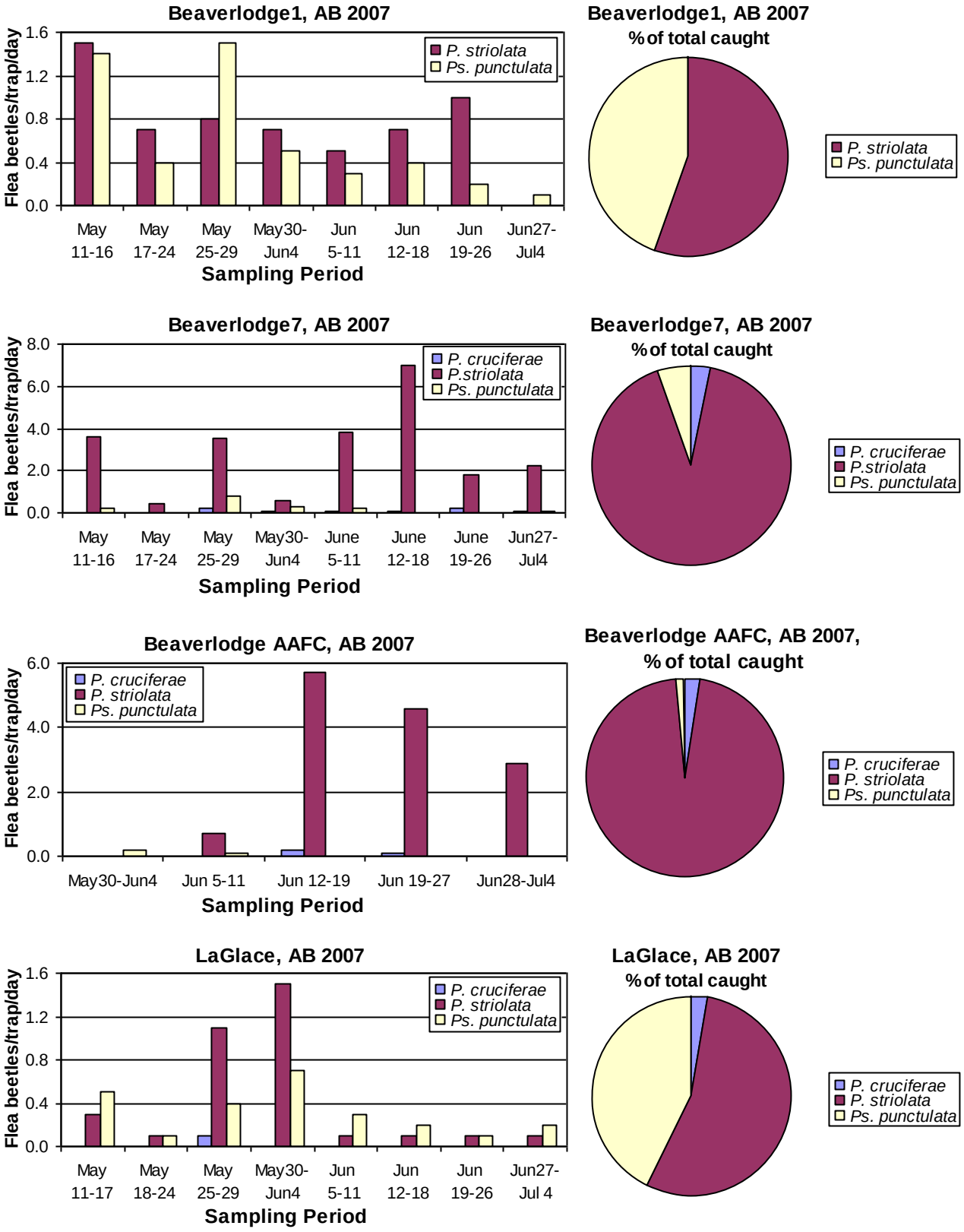


Figure 2 continued

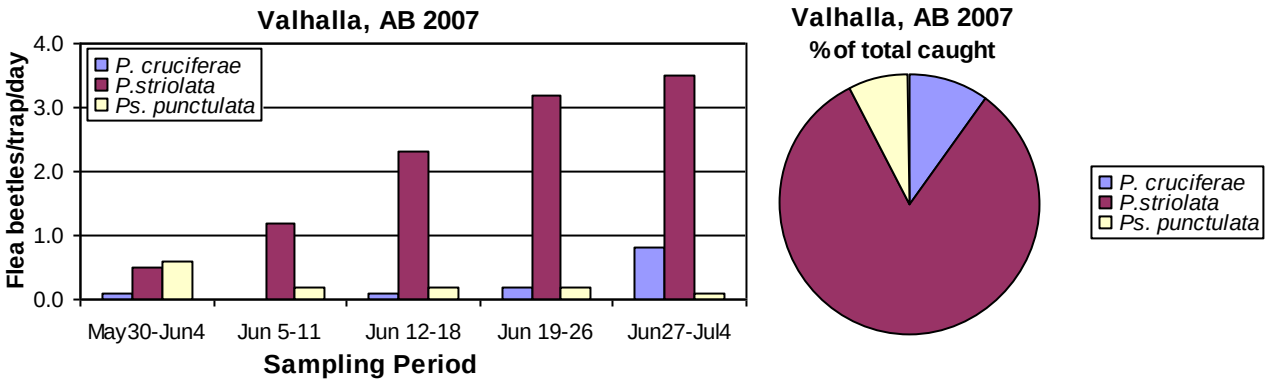


Figure 3. Flea beetle numbers and species composition on yellow sticky traps placed in or near canola fields in Saskatchewan, 2007.

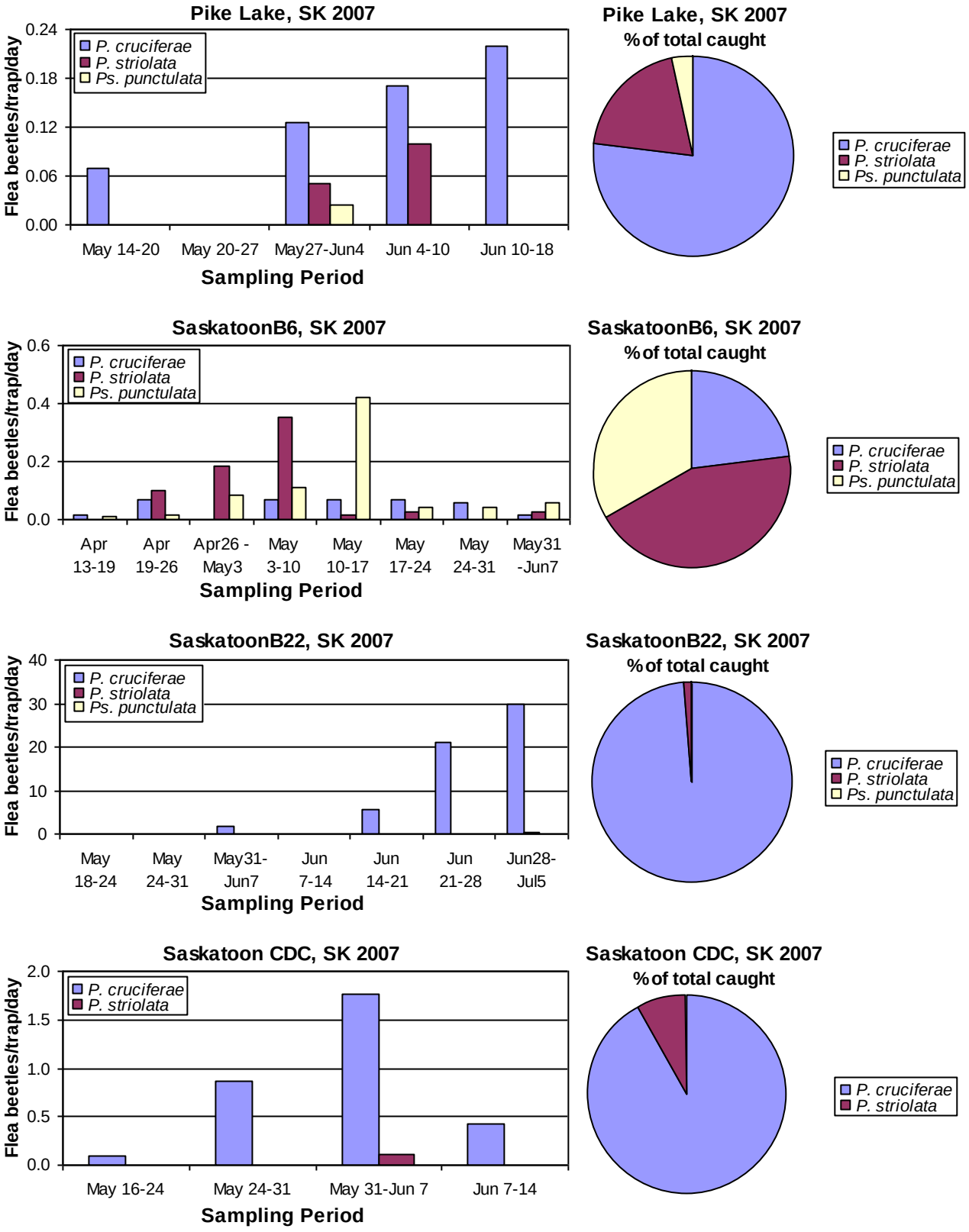


Figure 3 continued

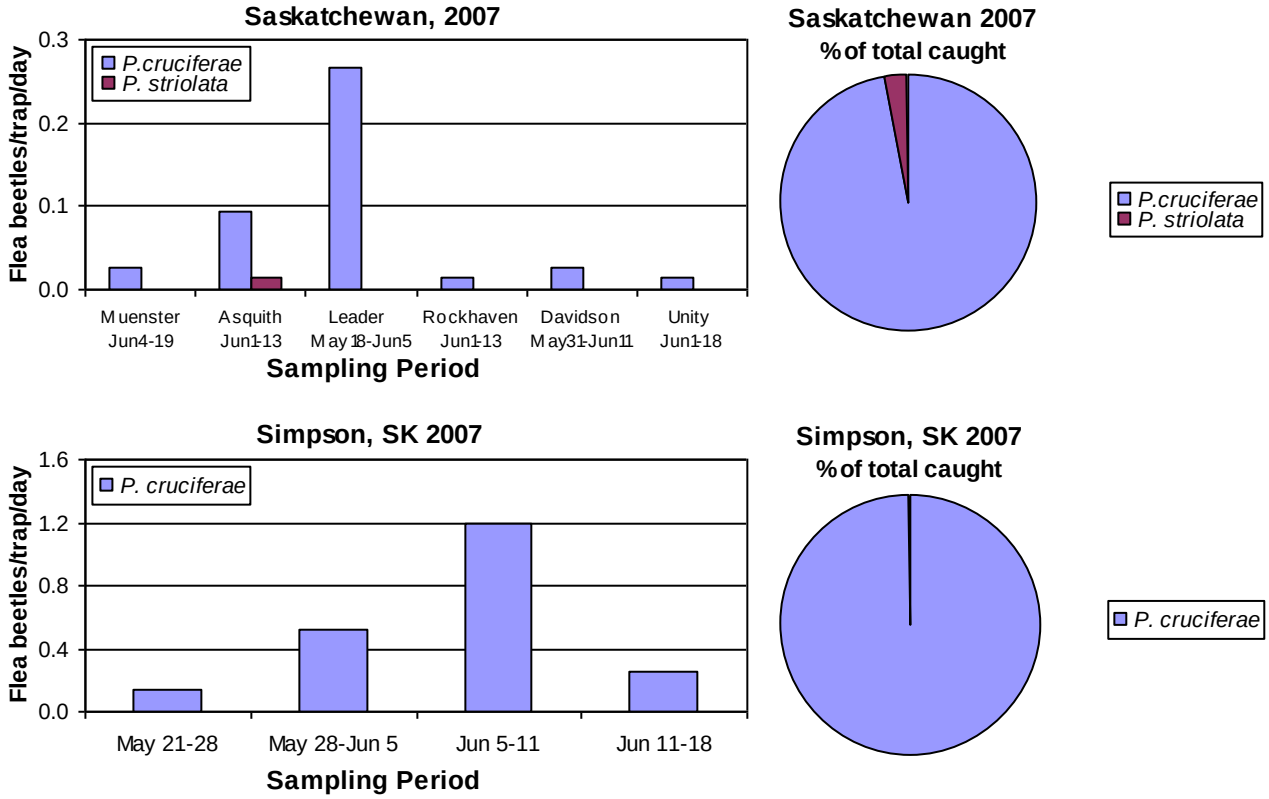
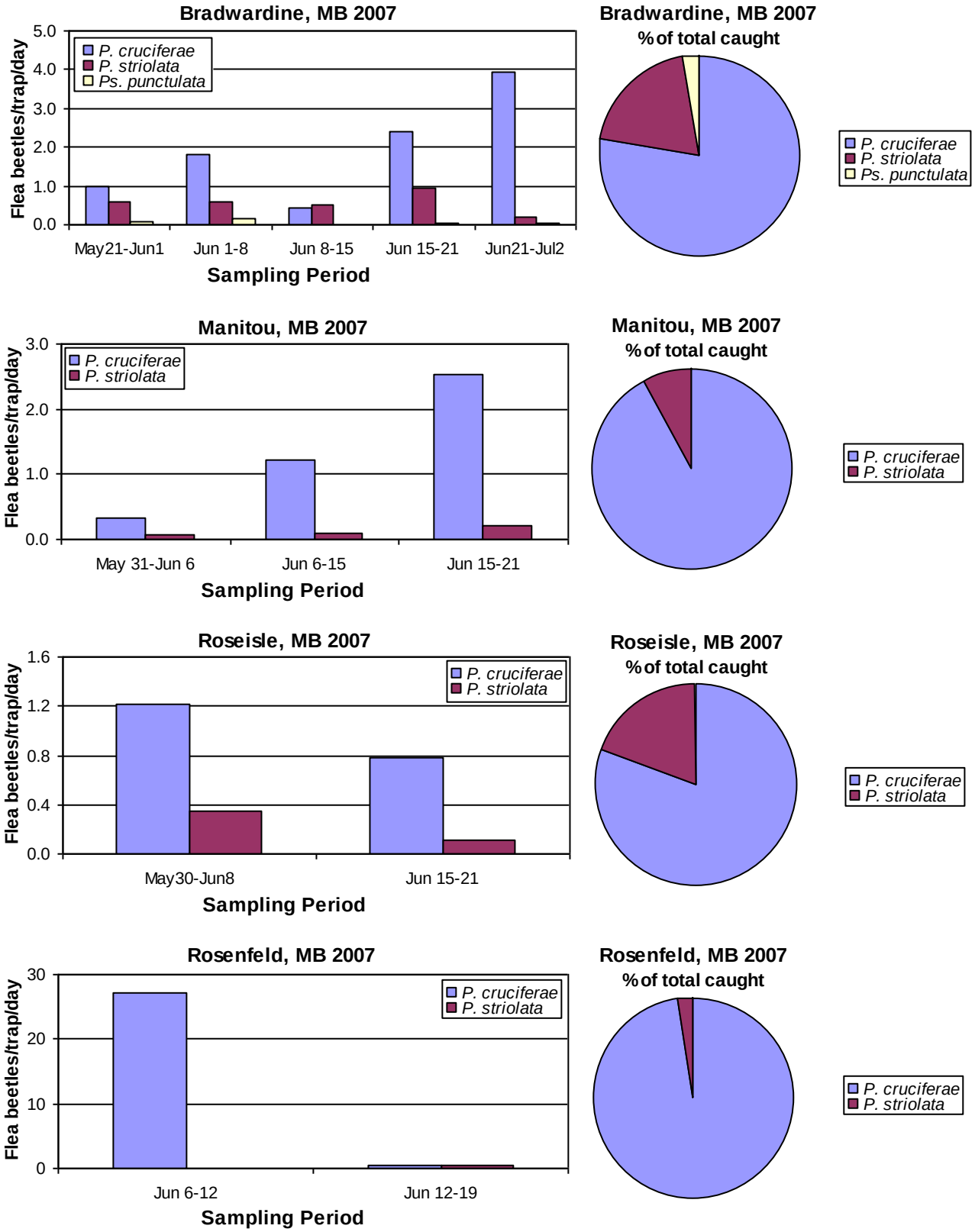


Figure 4. Flea beetle numbers and species composition on yellow sticky traps placed in or near canola fields in Manitoba, 2007.



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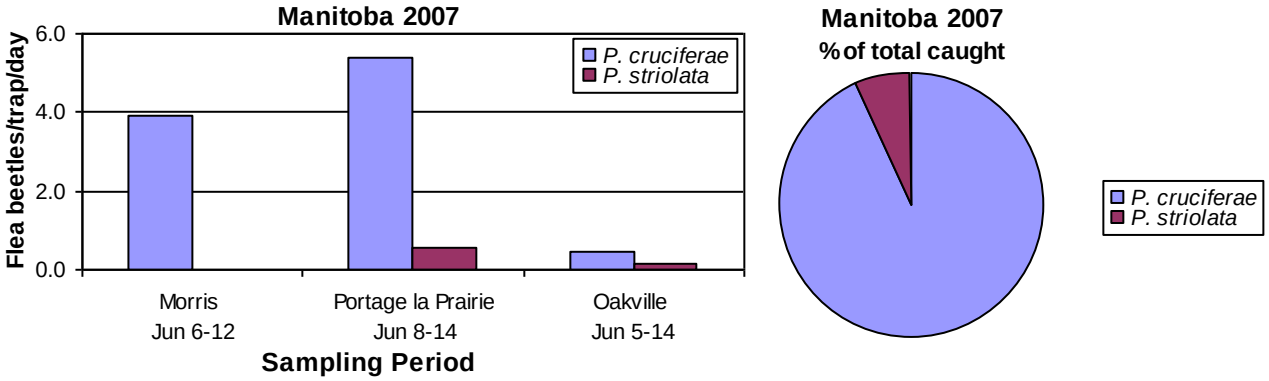
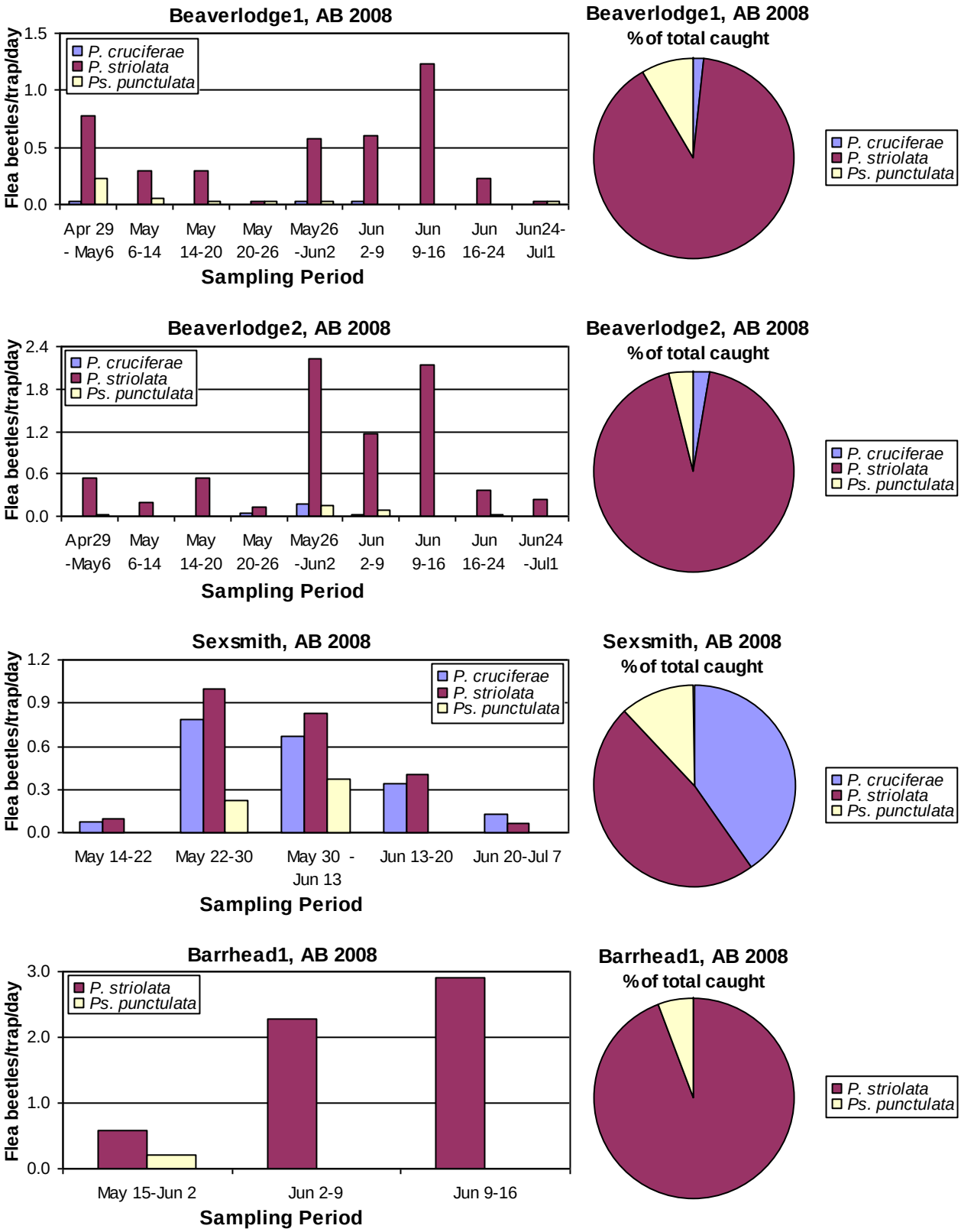


Figure 5. Flea beetle numbers and species composition on yellow sticky traps placed in or near canola fields in Alberta, 2008.



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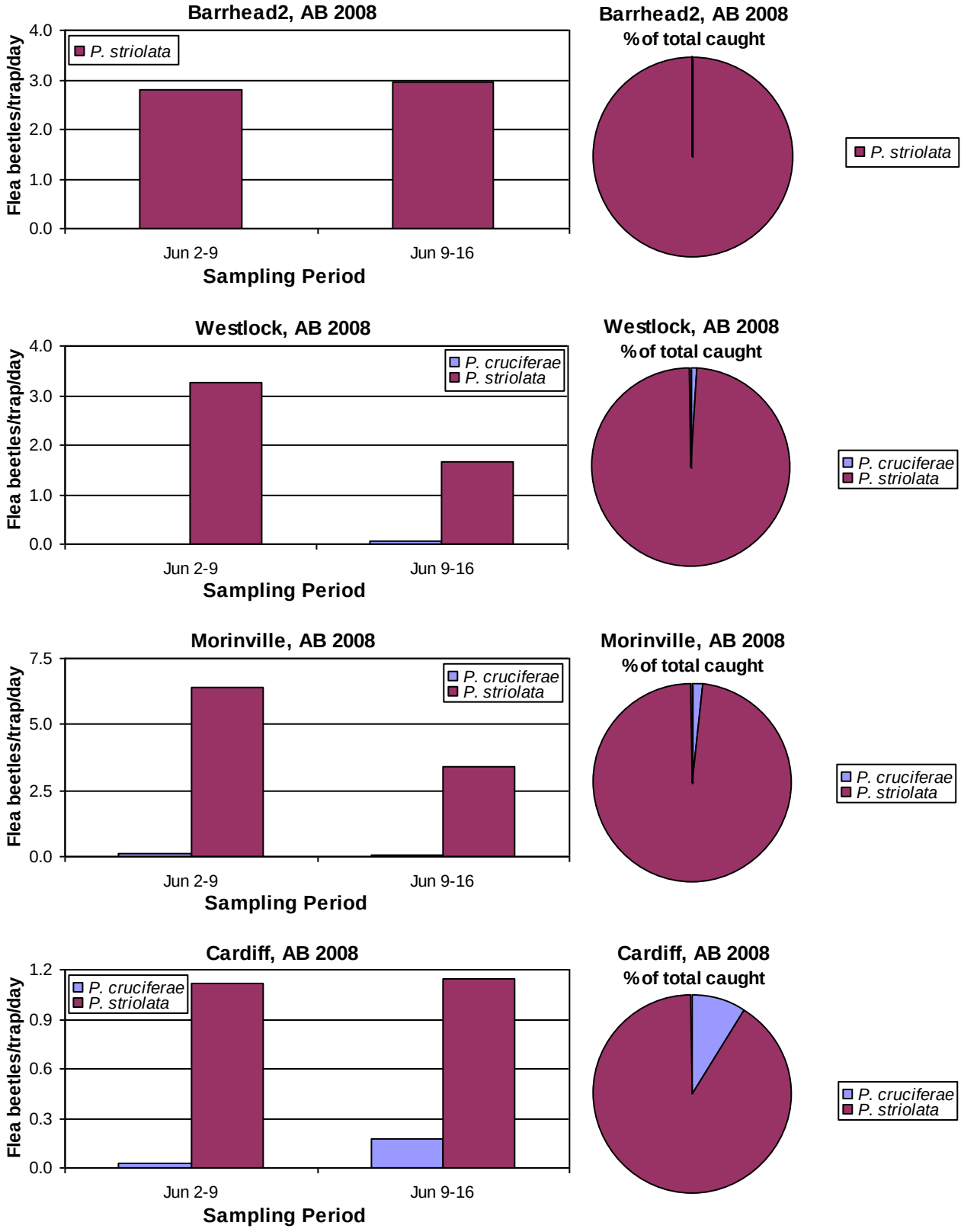

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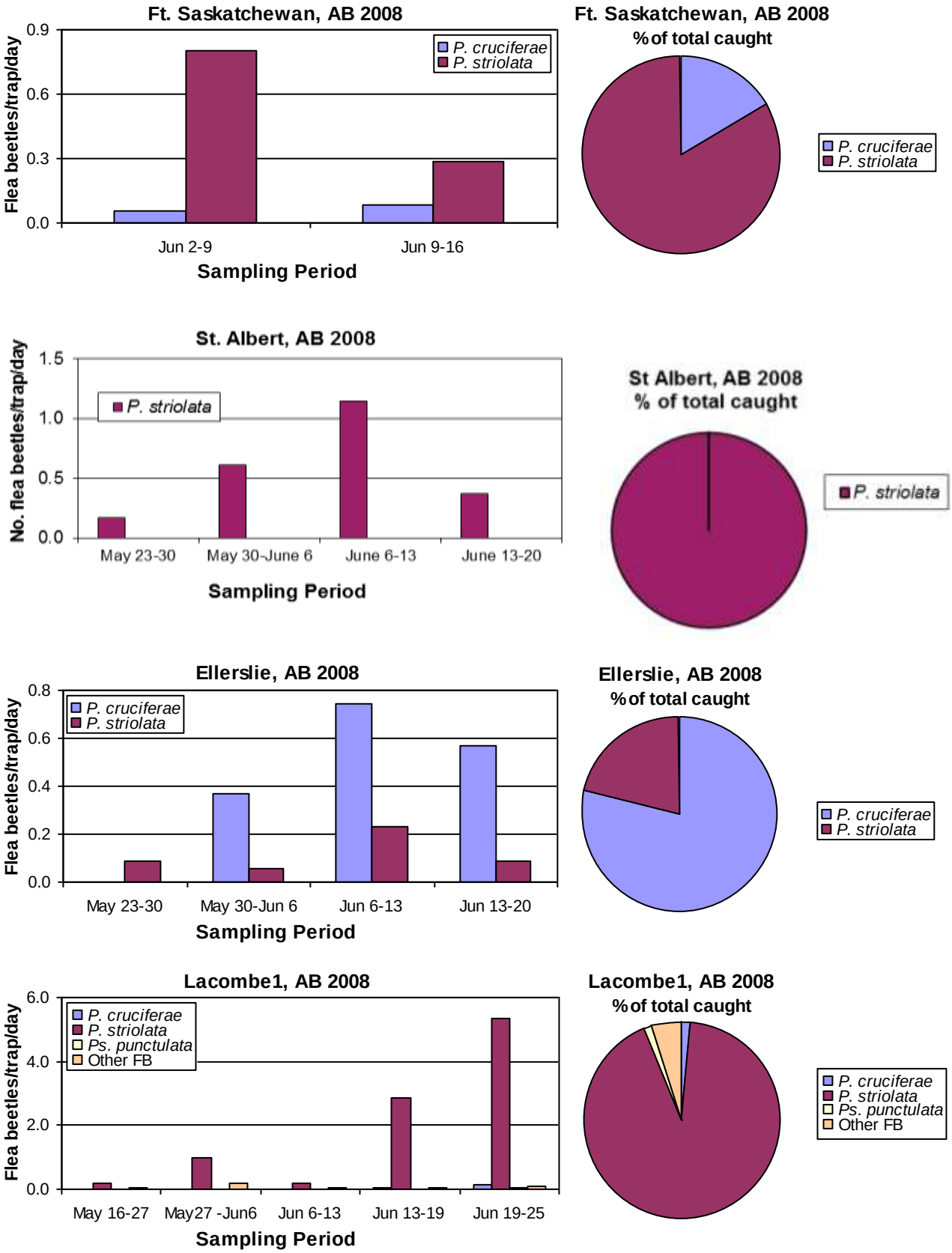

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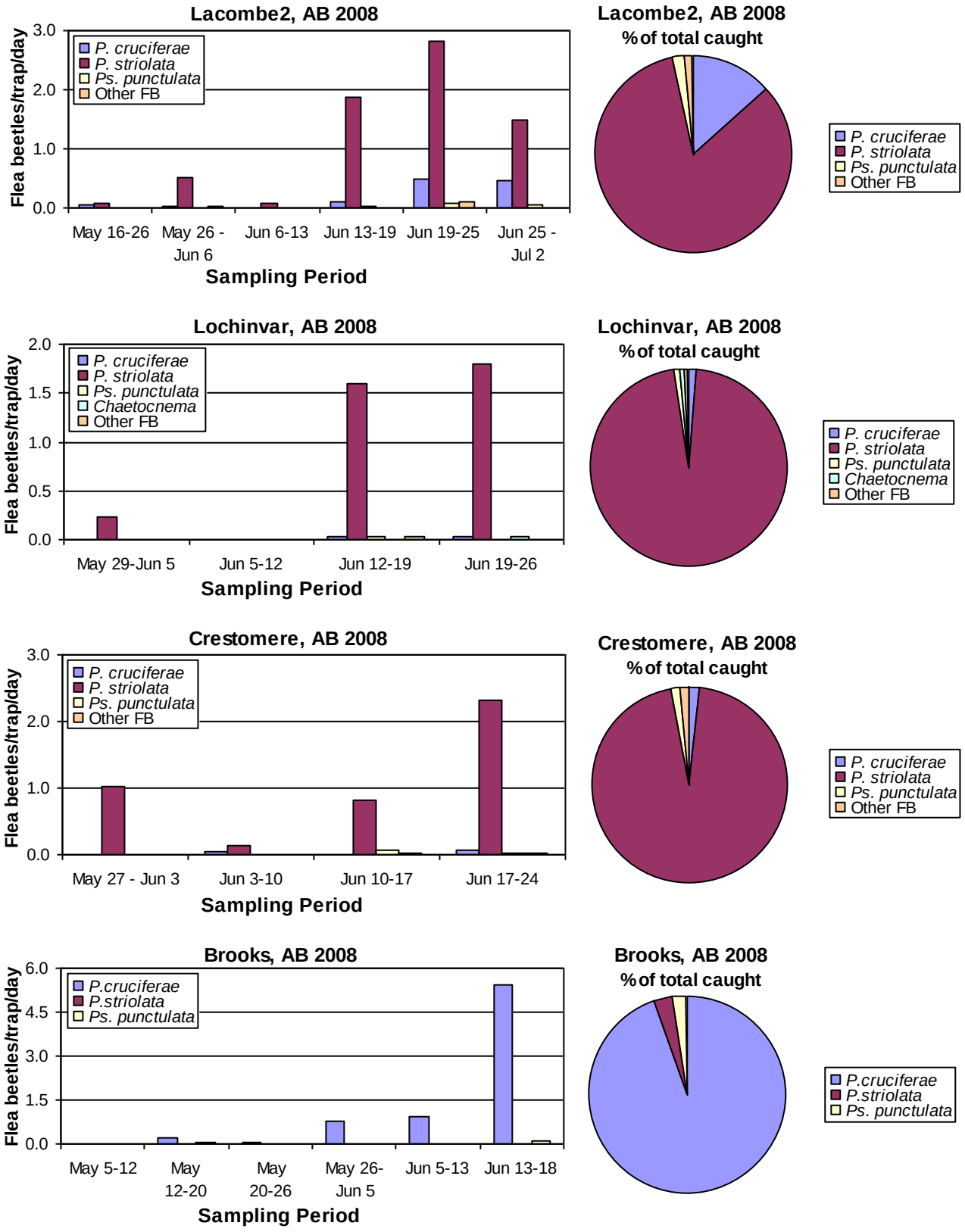

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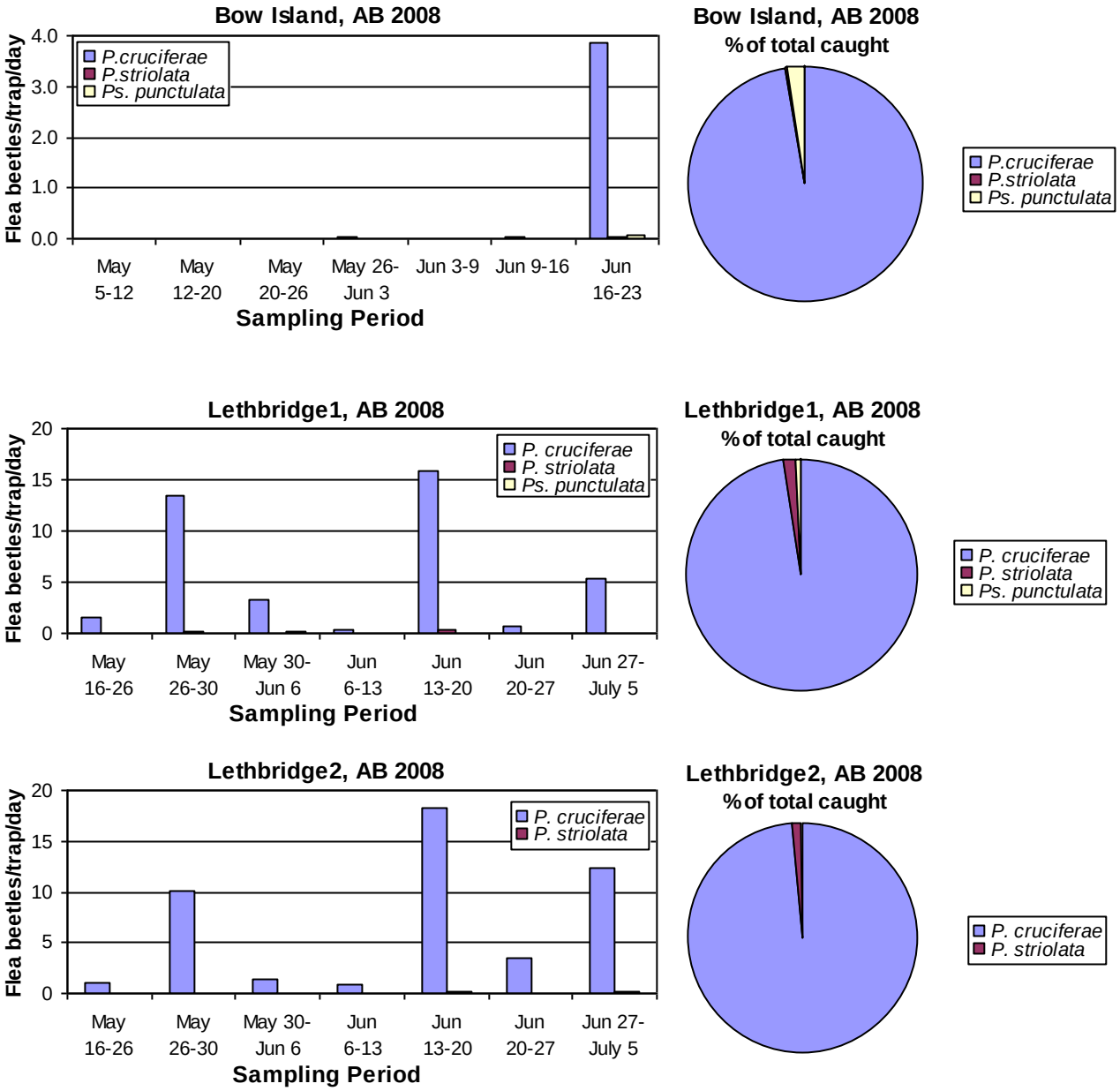
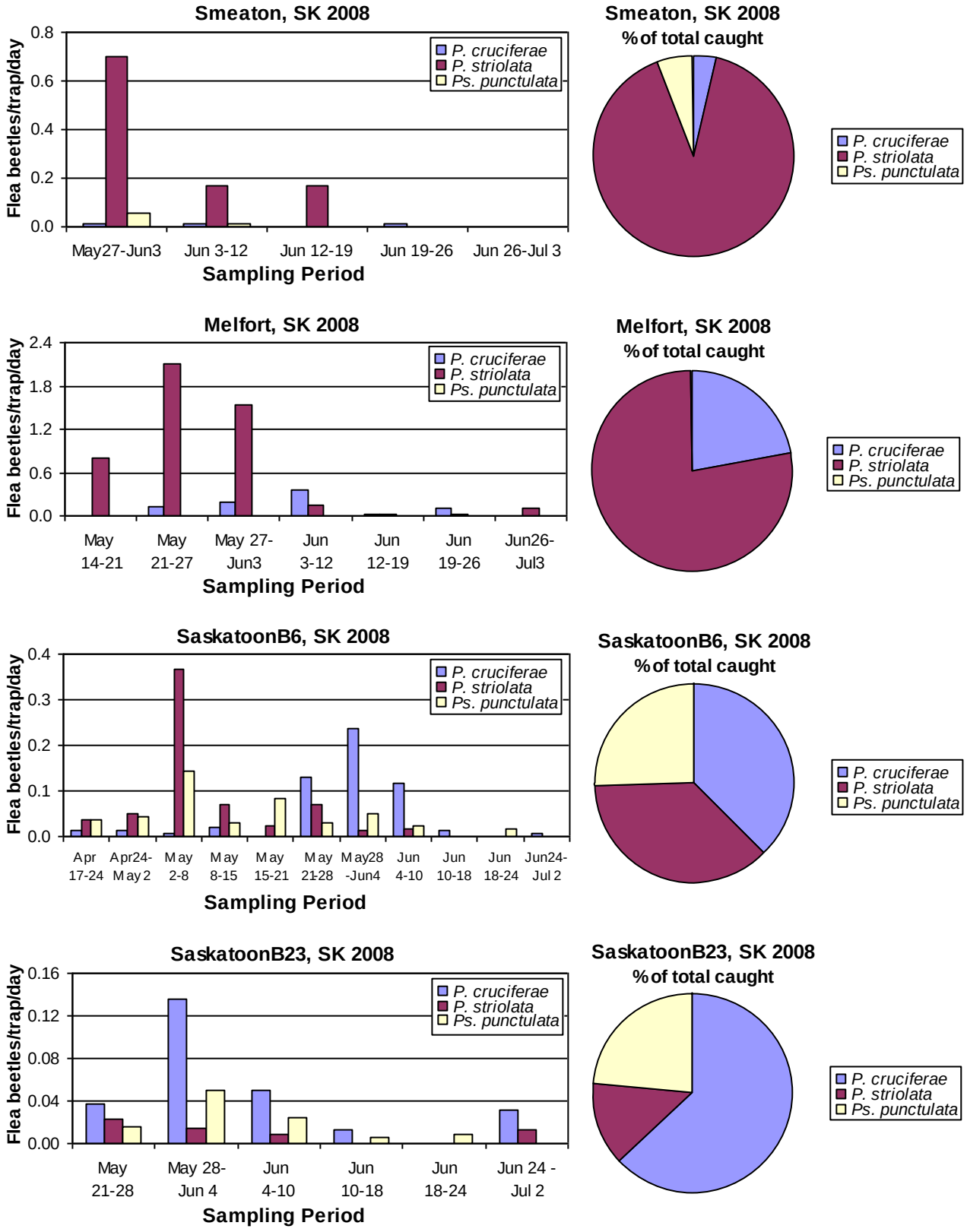


Figure 6. Flea beetle numbers and species composition on yellow sticky traps placed in or near canola fields in Saskatchewan, 2008.



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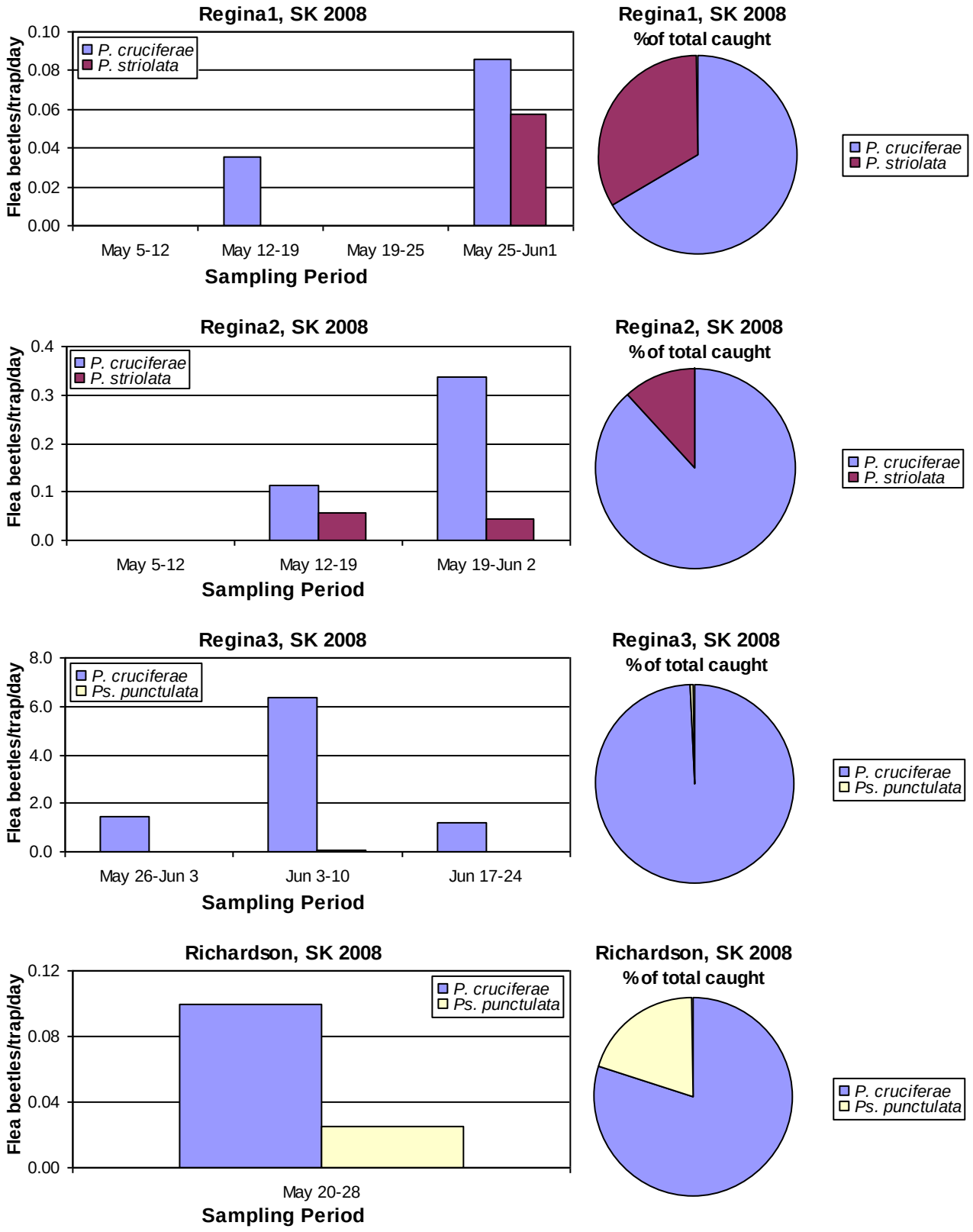
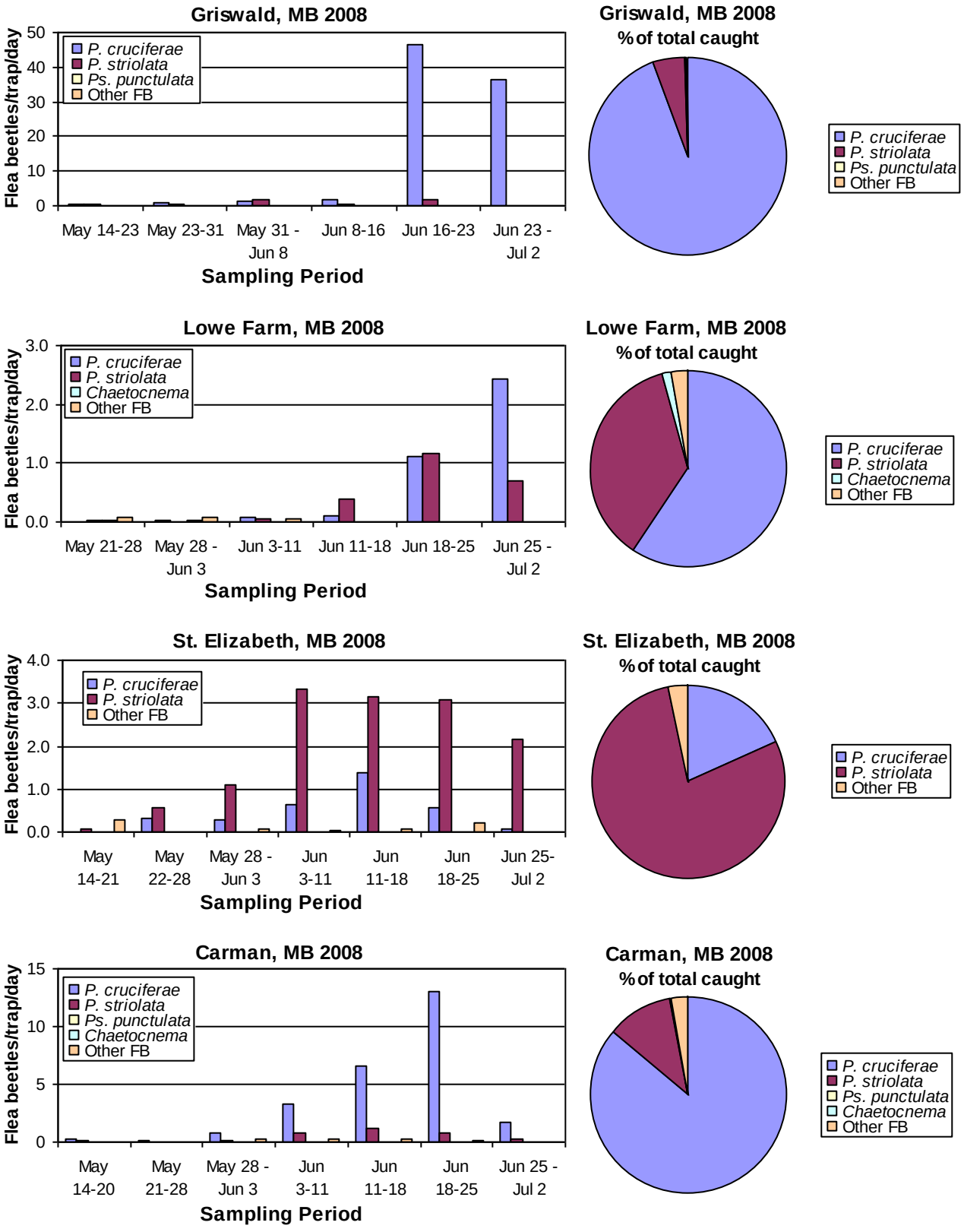


Figure 7. Flea beetle numbers and species composition on yellow sticky traps placed in or near canola fields in Manitoba, 2008.



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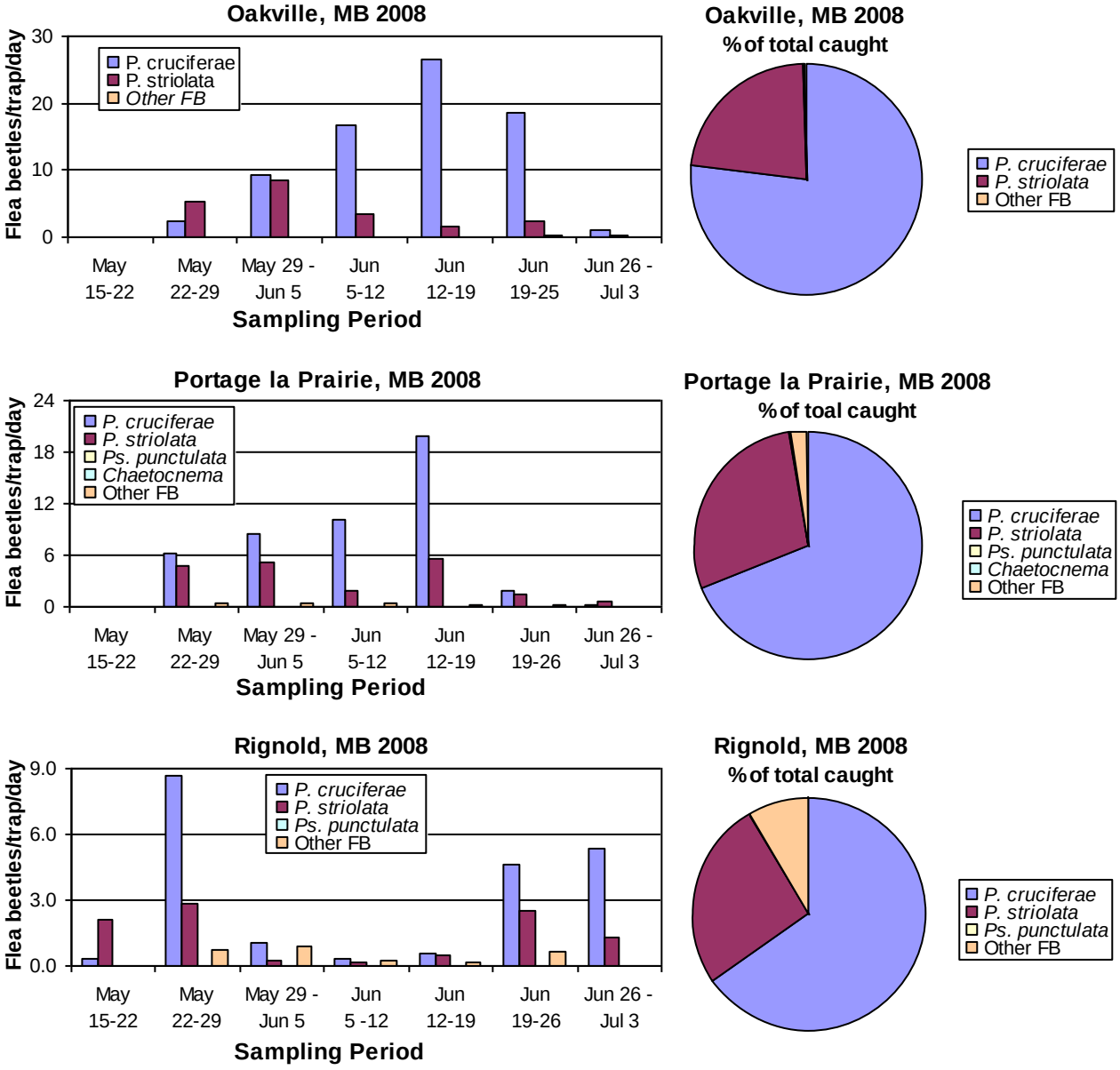
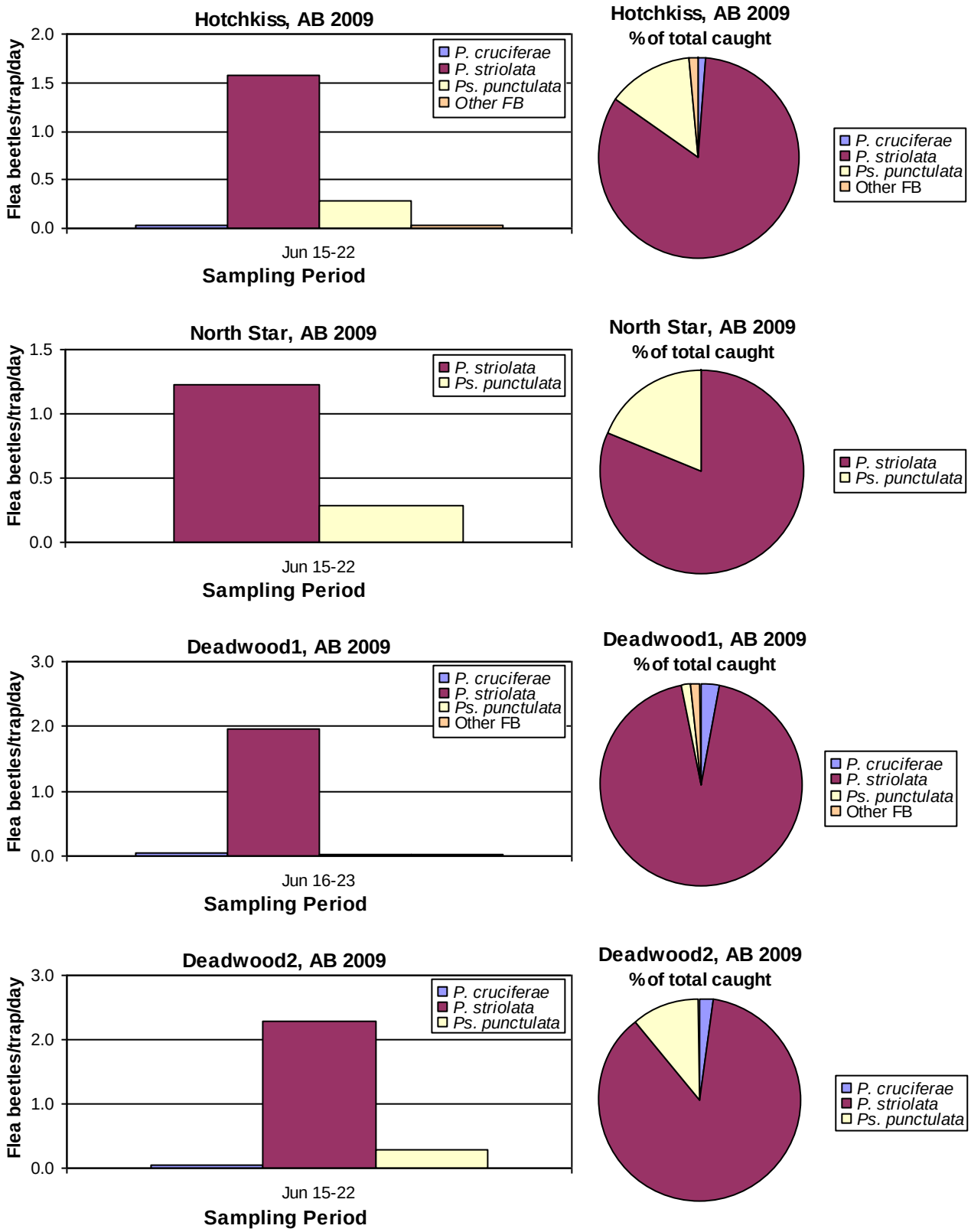


Figure 8. Flea beetle numbers and species composition on yellow sticky traps placed in or near canola fields in Alberta, 2009.



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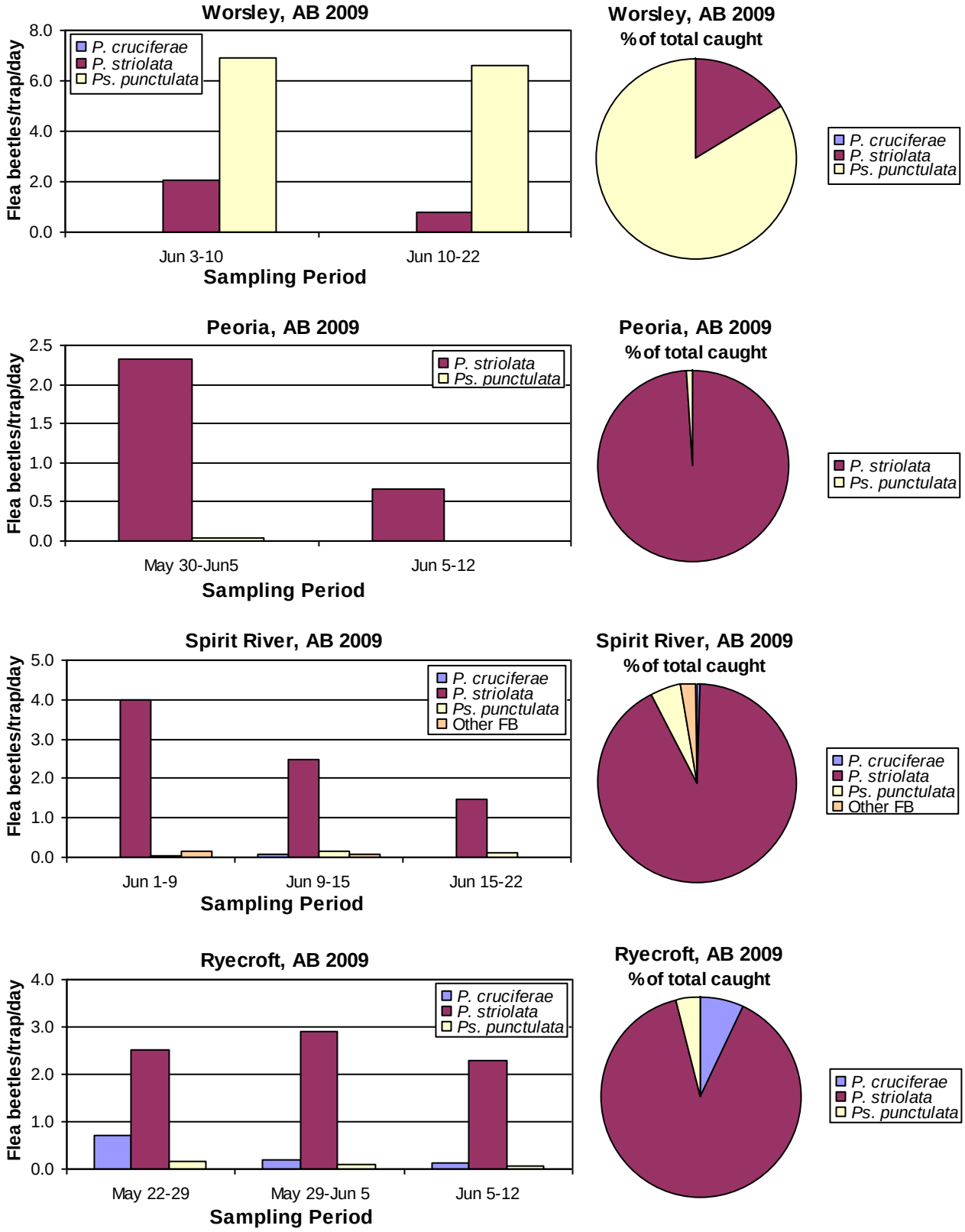

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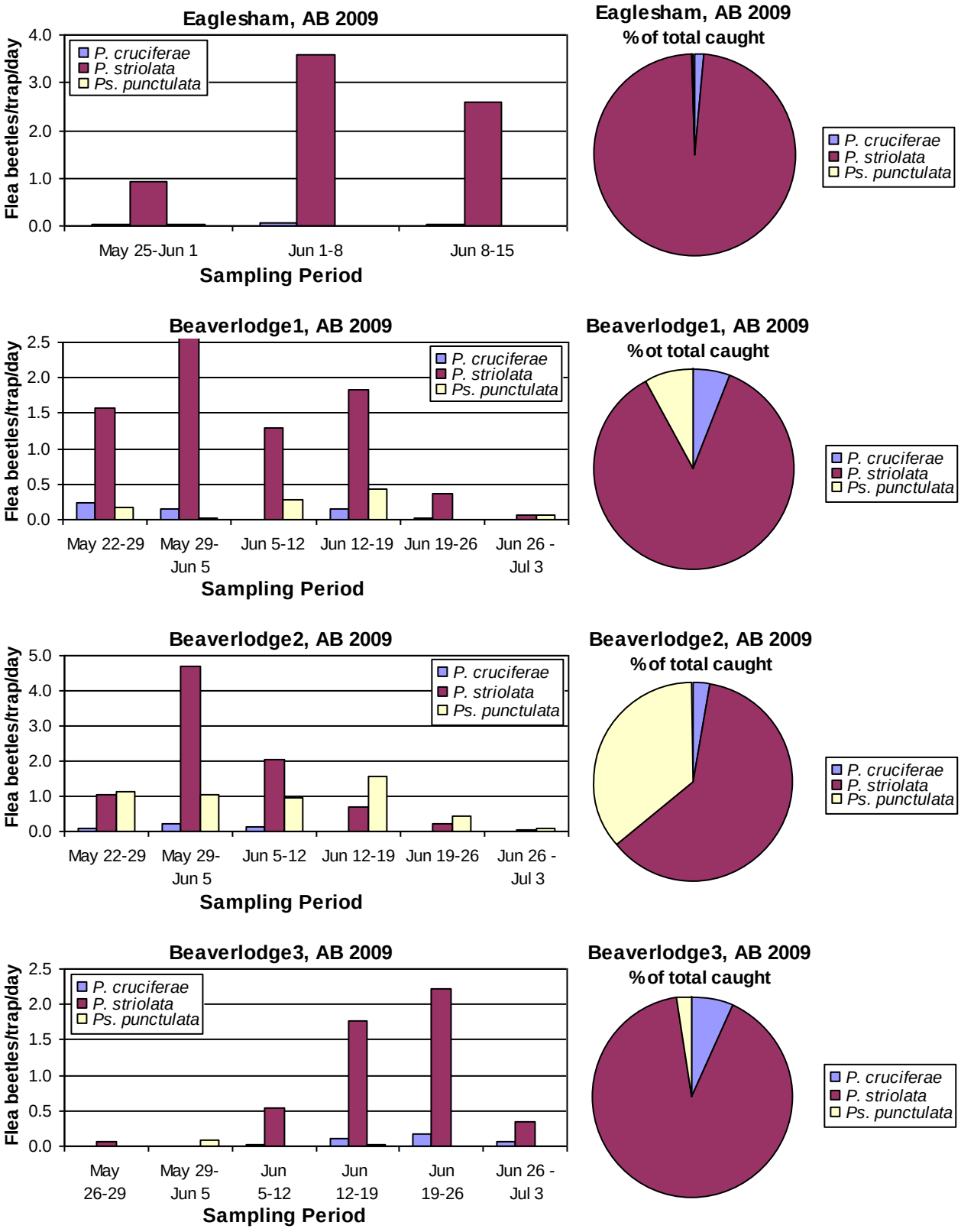

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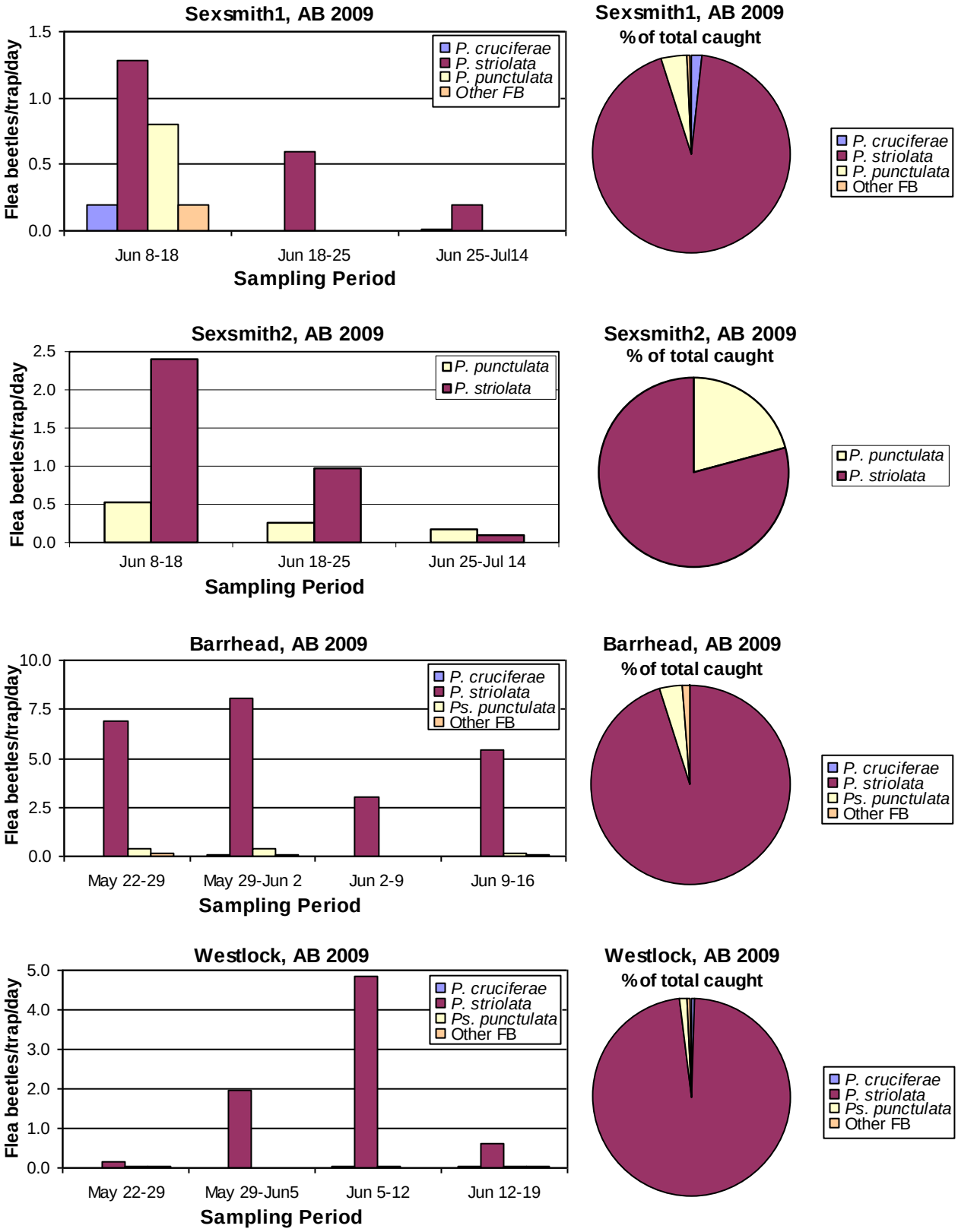

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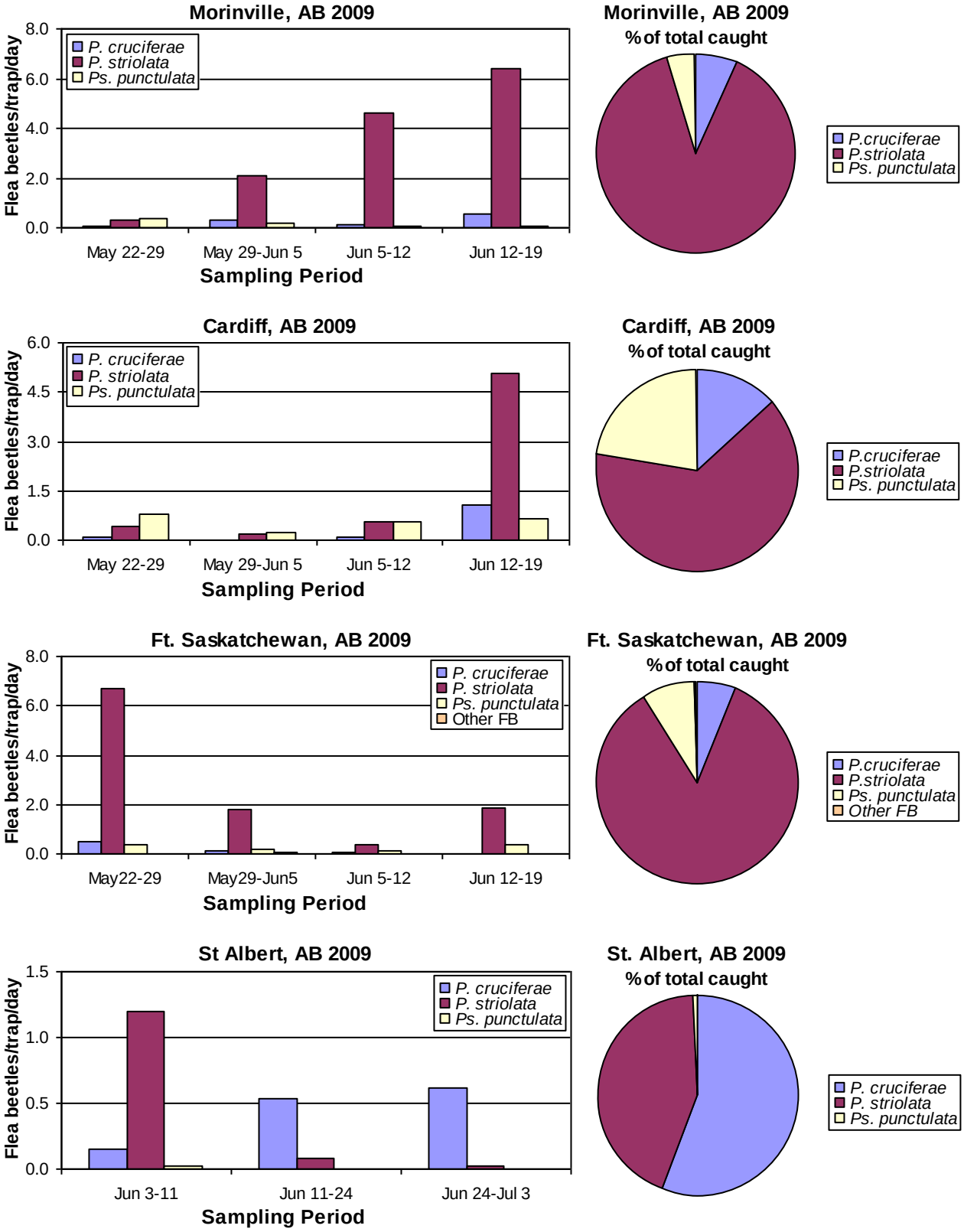

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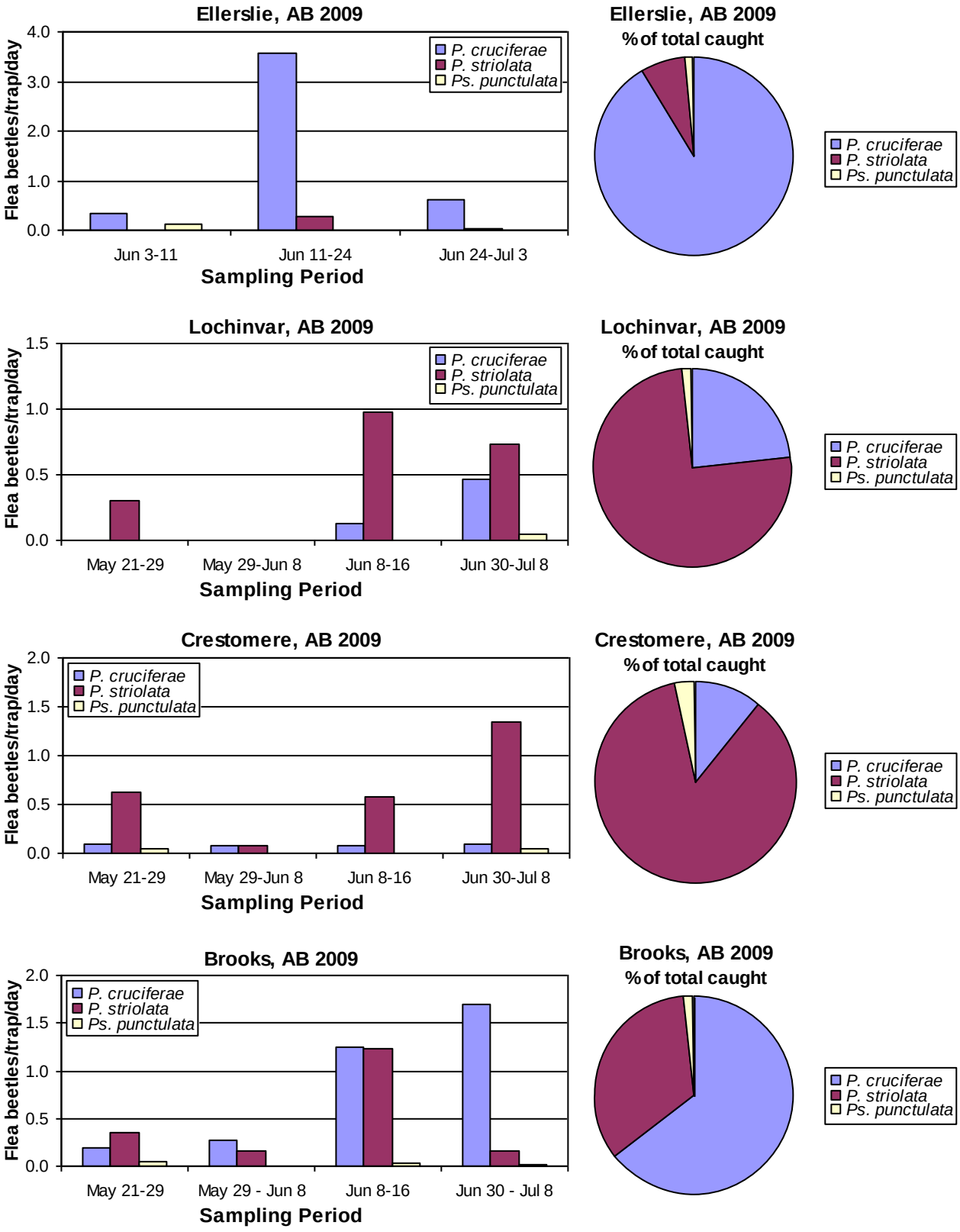
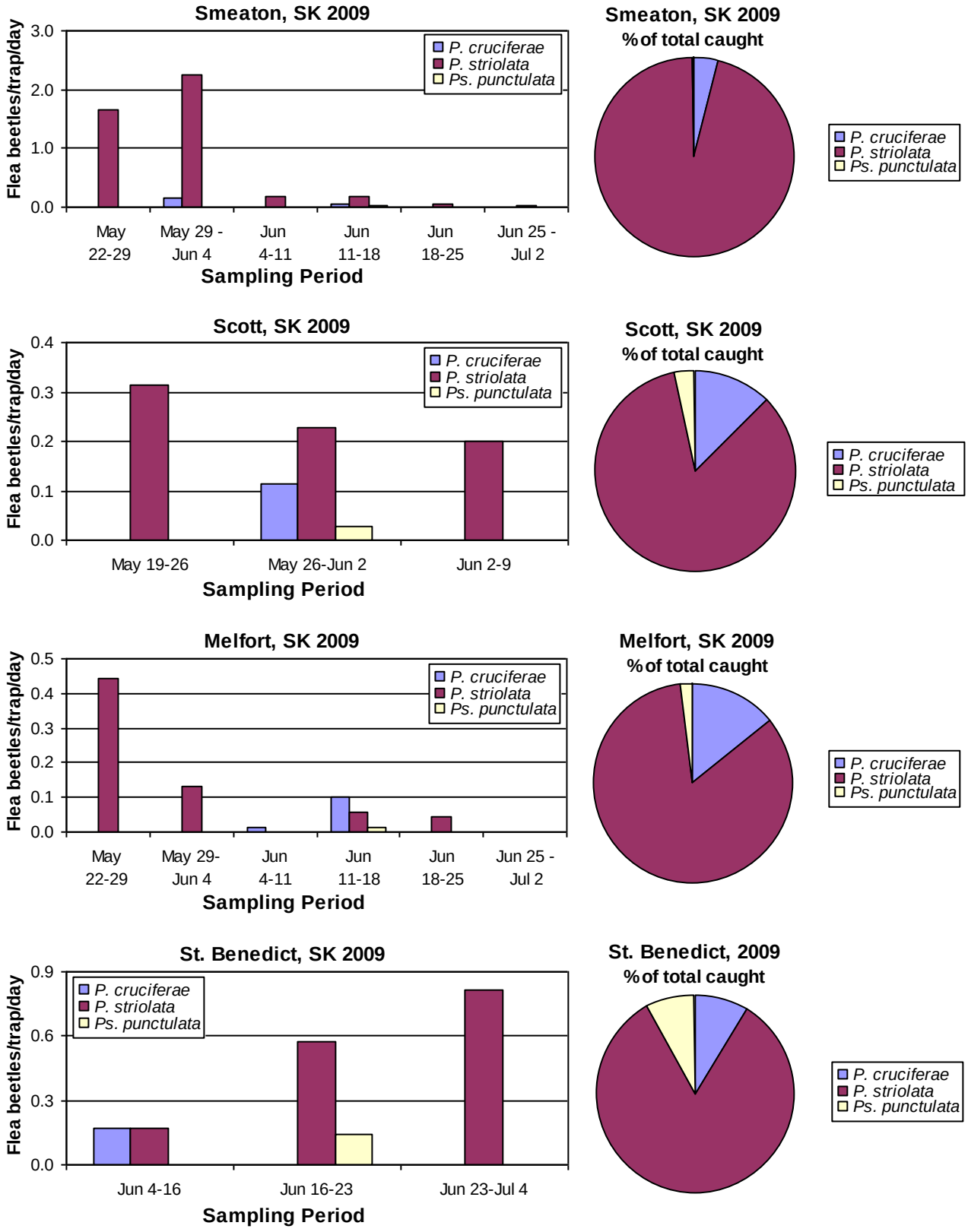


Figure 9. Flea beetle numbers and species composition on yellow sticky traps placed in or near canola fields in Saskatchewan, 2009.



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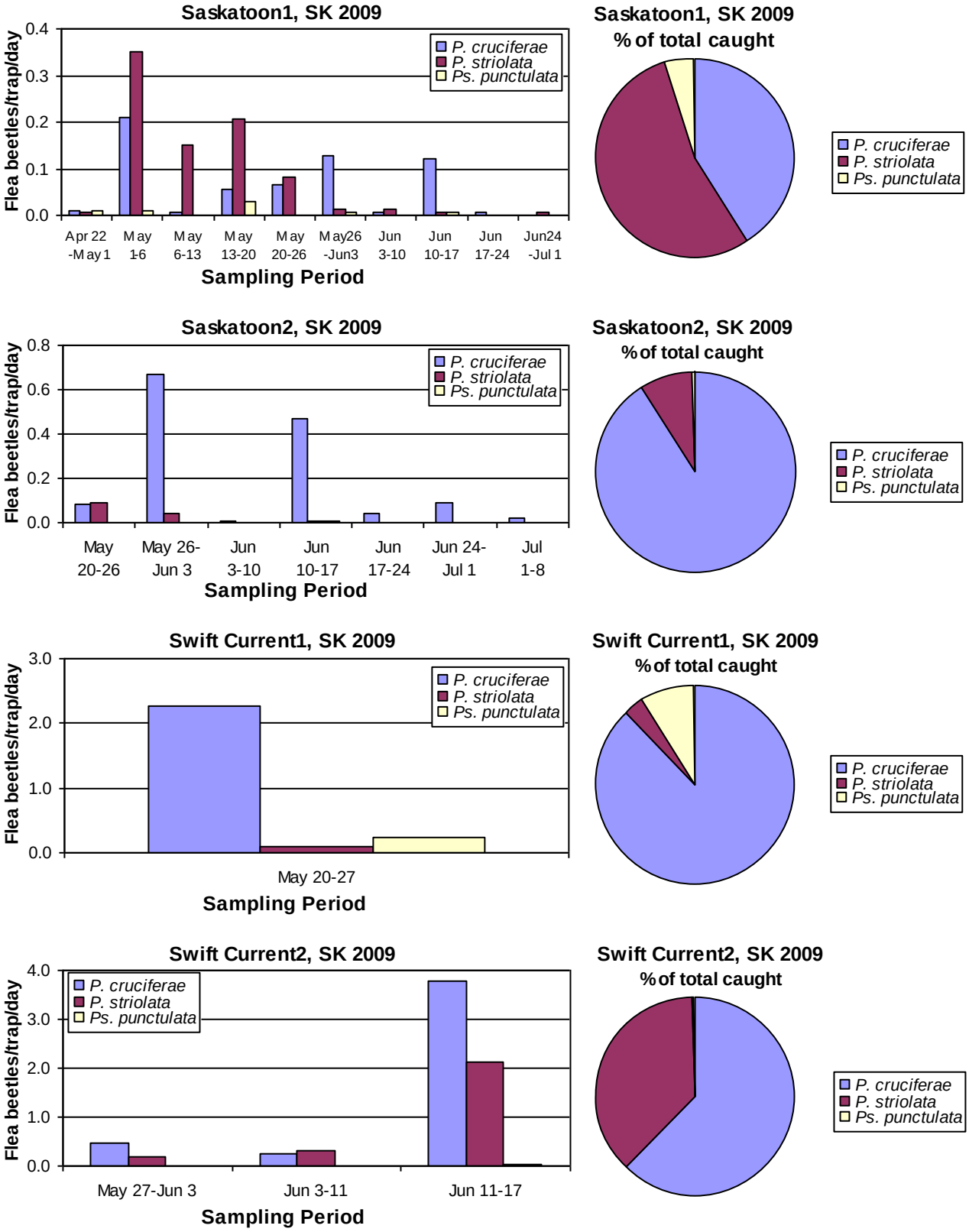

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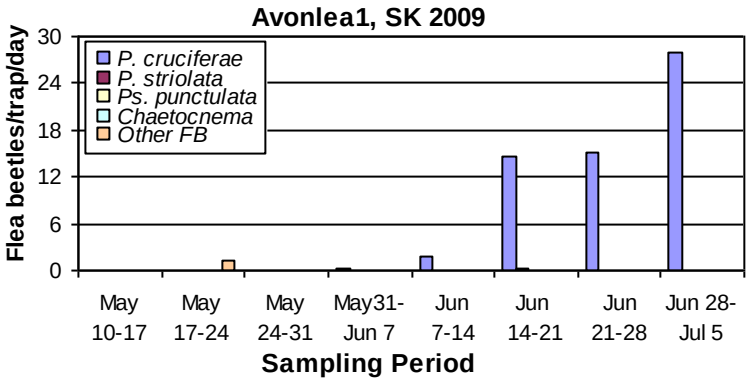
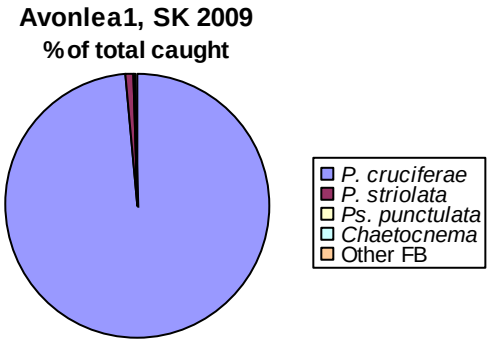
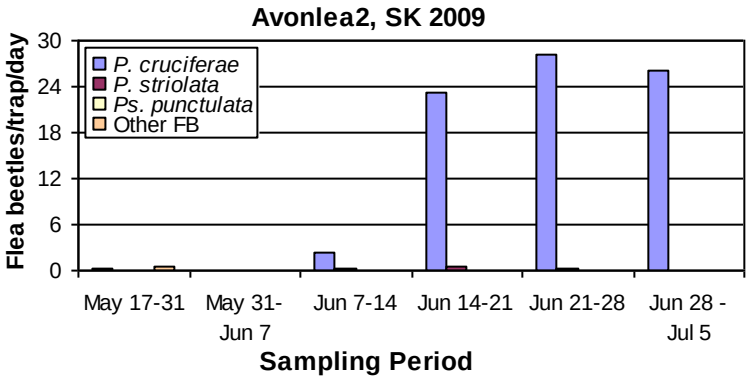
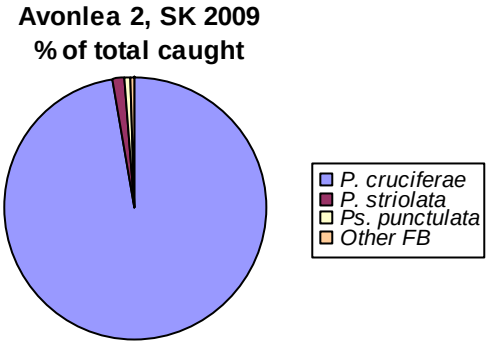
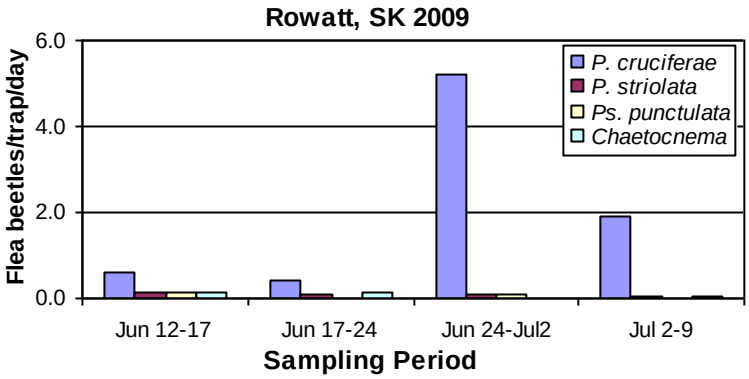
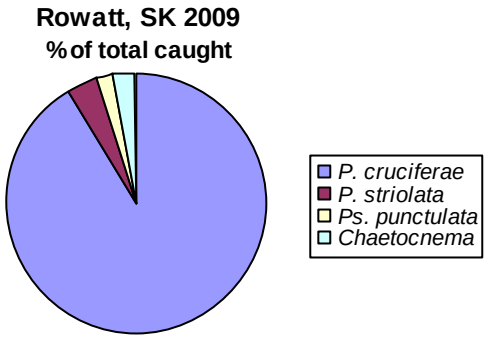


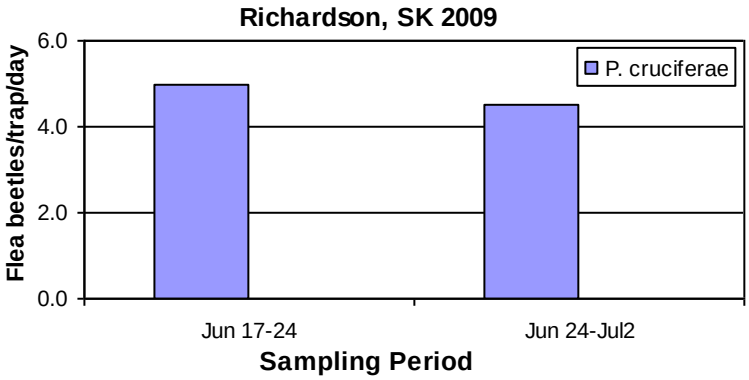












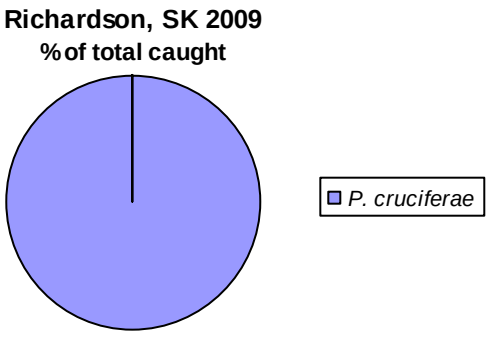
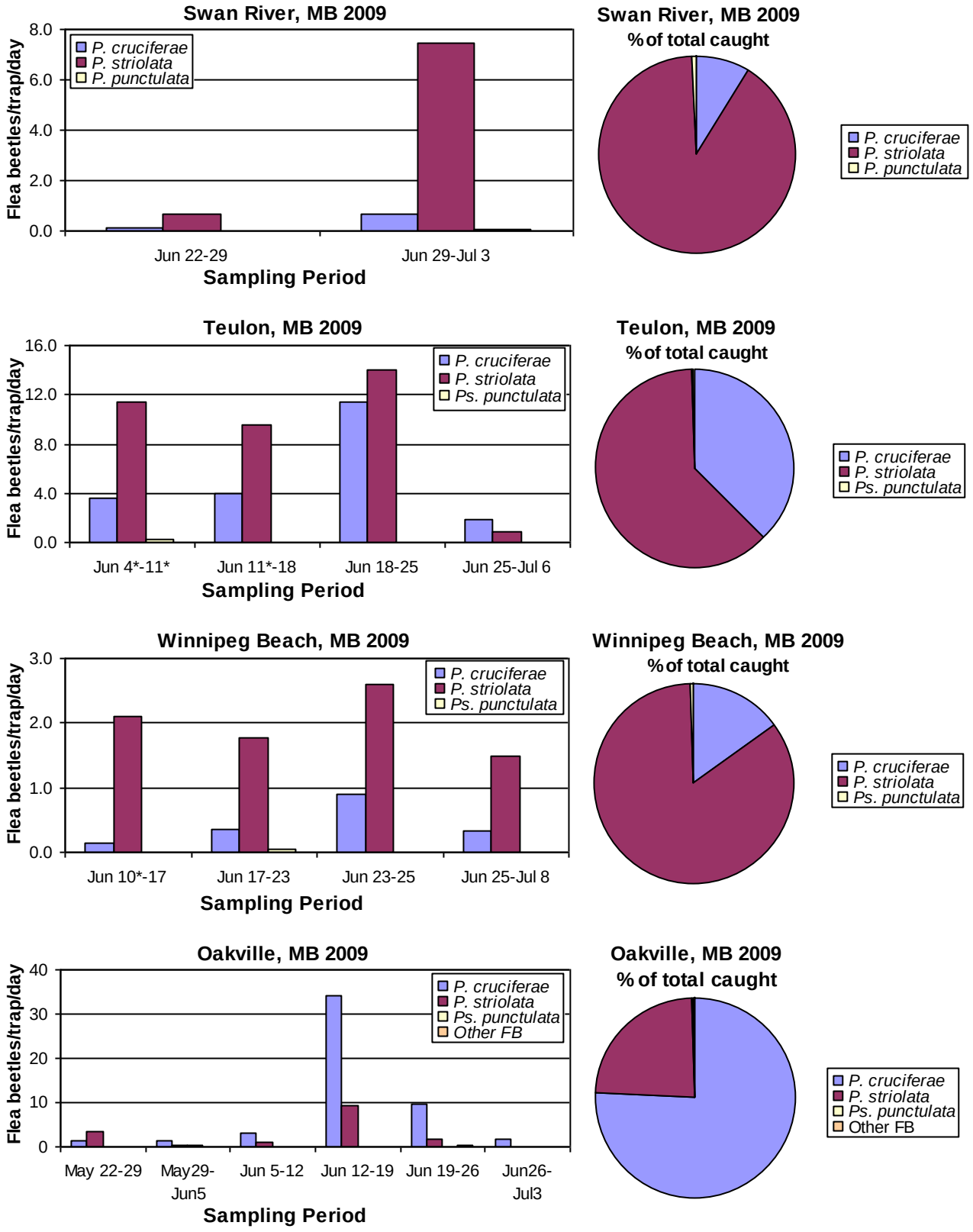


Figure 10. Flea beetle numbers and species composition on yellow sticky traps placed in or near canola fields in Manitoba, 2009.



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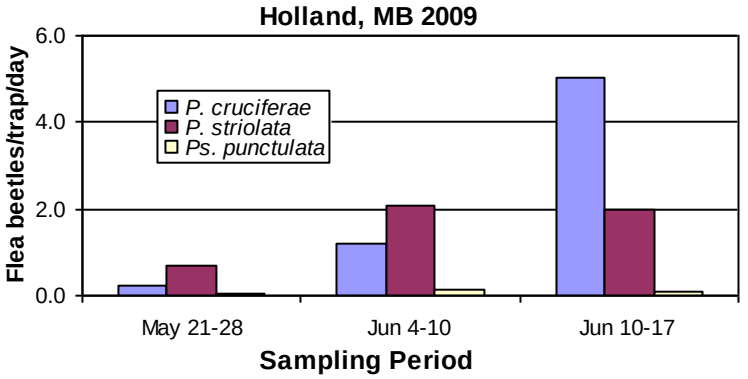
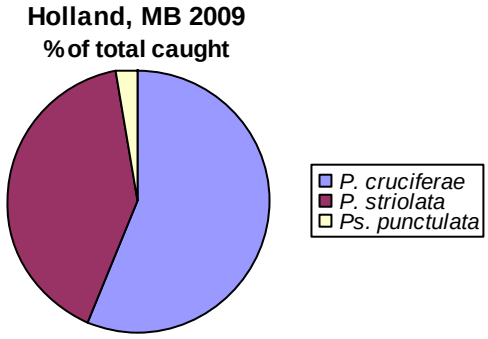
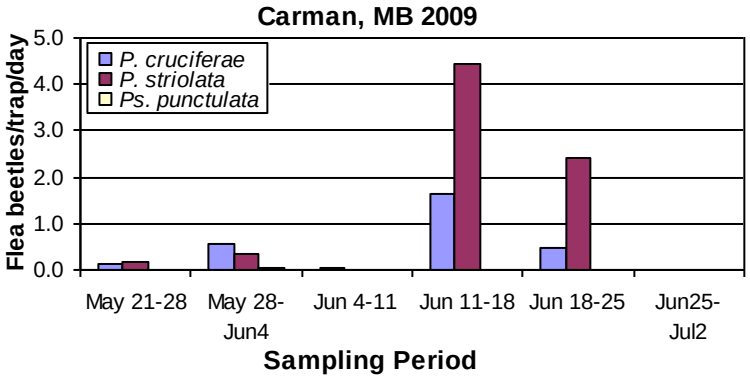
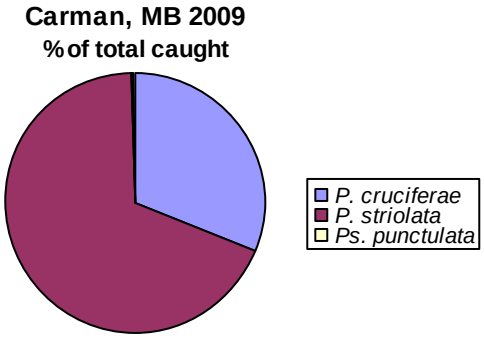
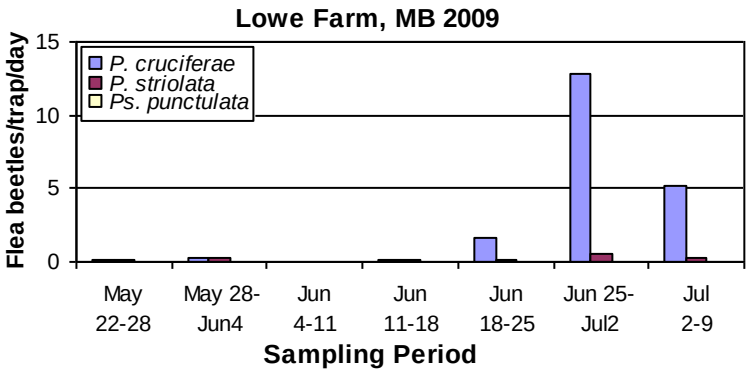
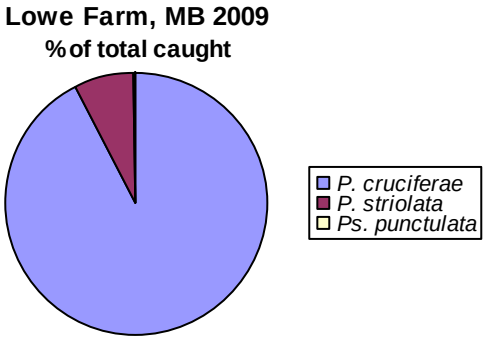


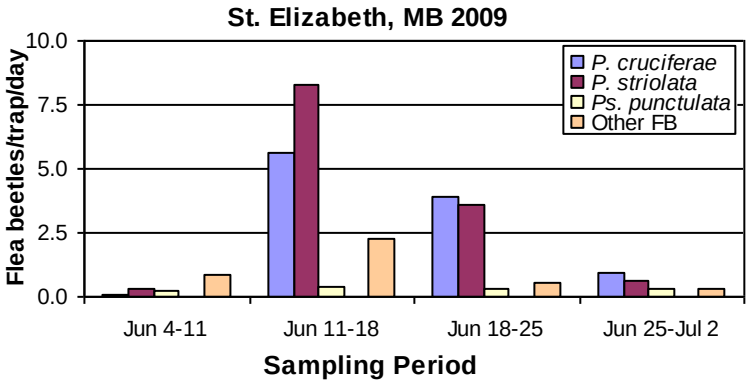












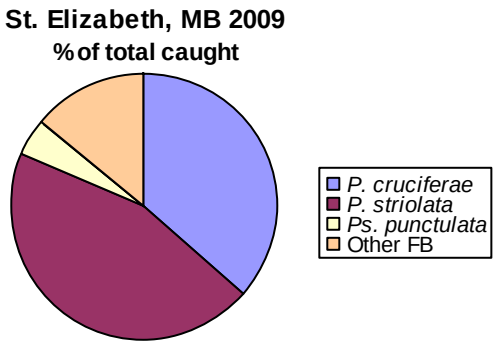


Figure 11. Flea beetle numbers and species composition on yellow sticky traps placed in or near canola fields in Alberta, 2010.

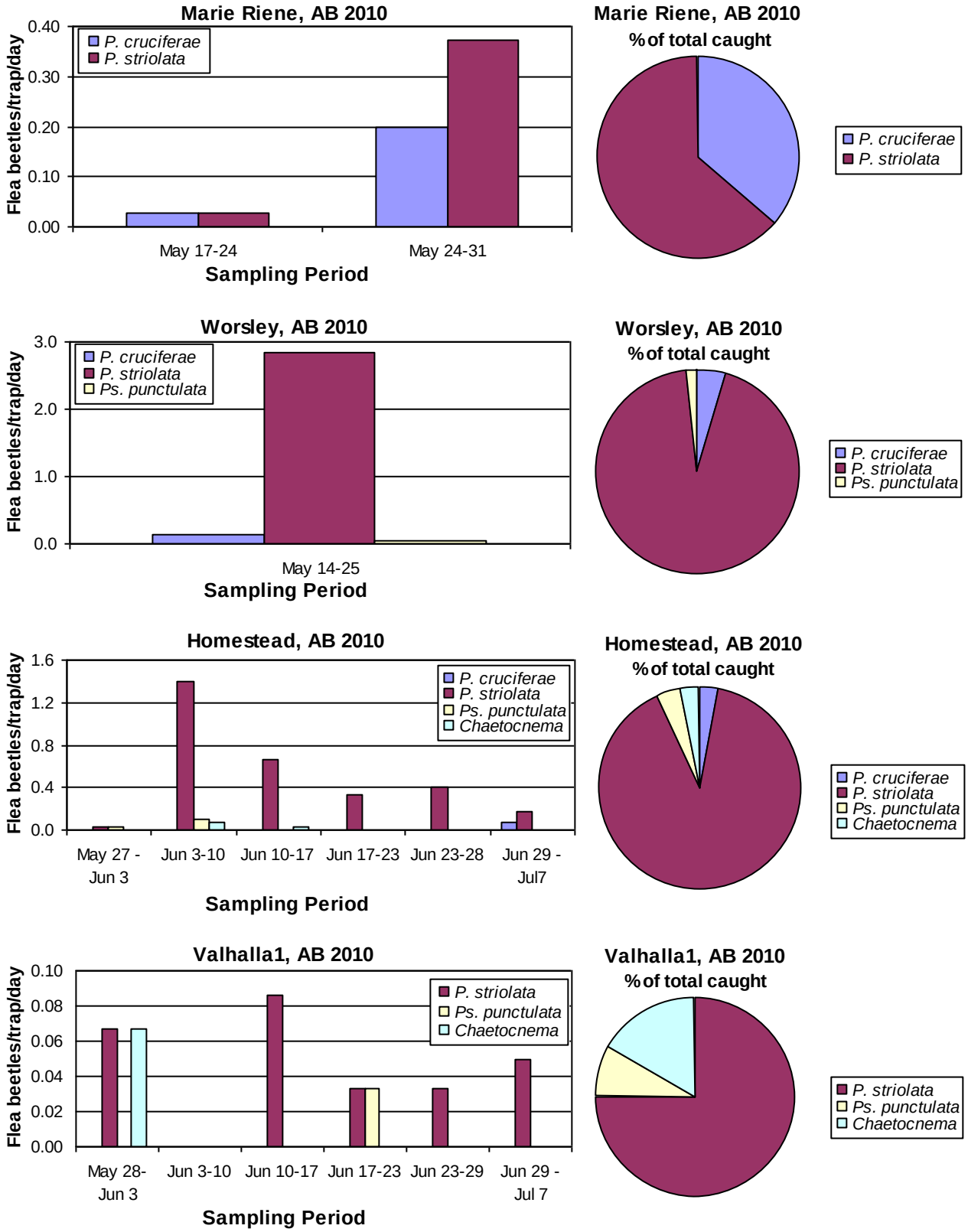
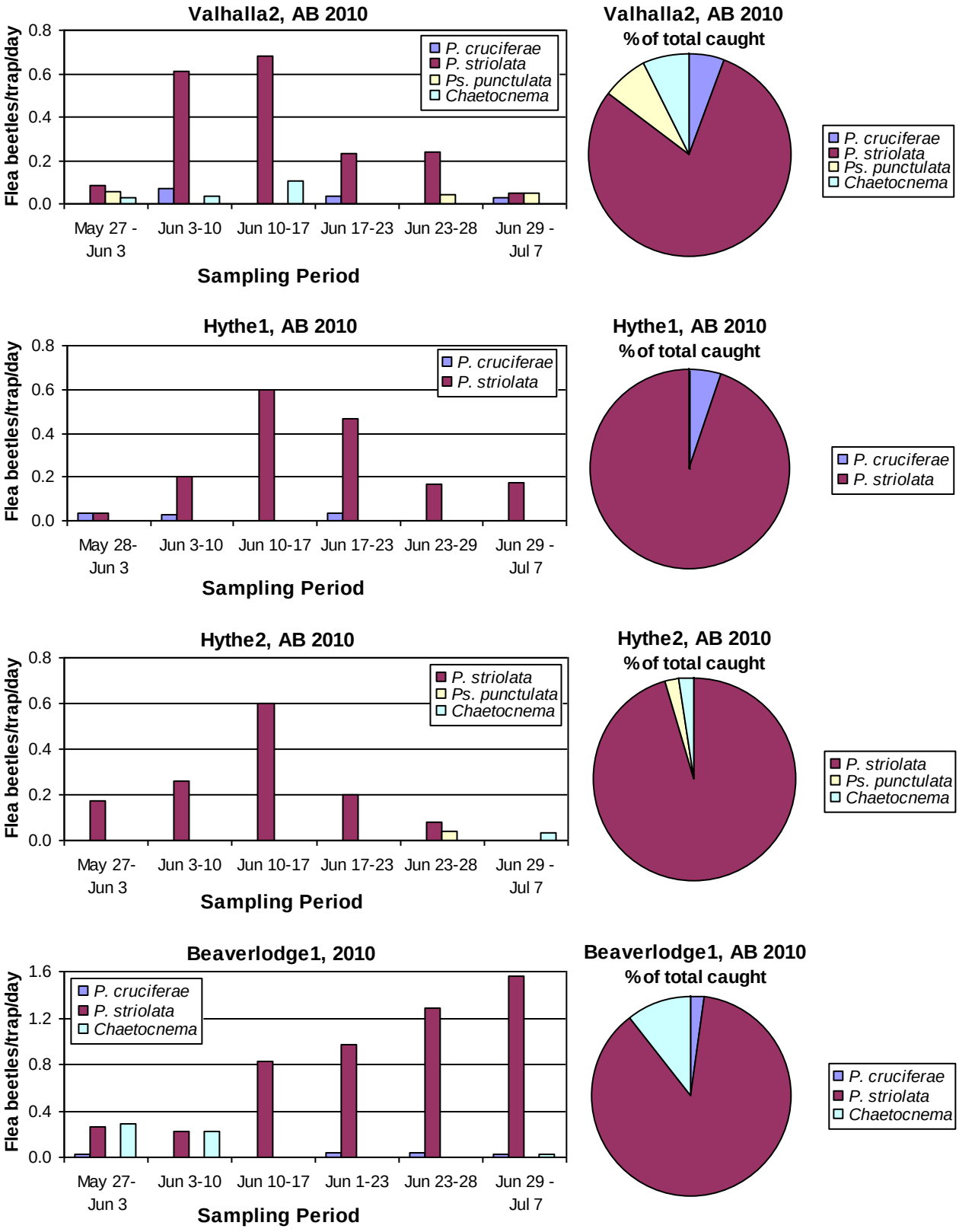


Figure 11 continued



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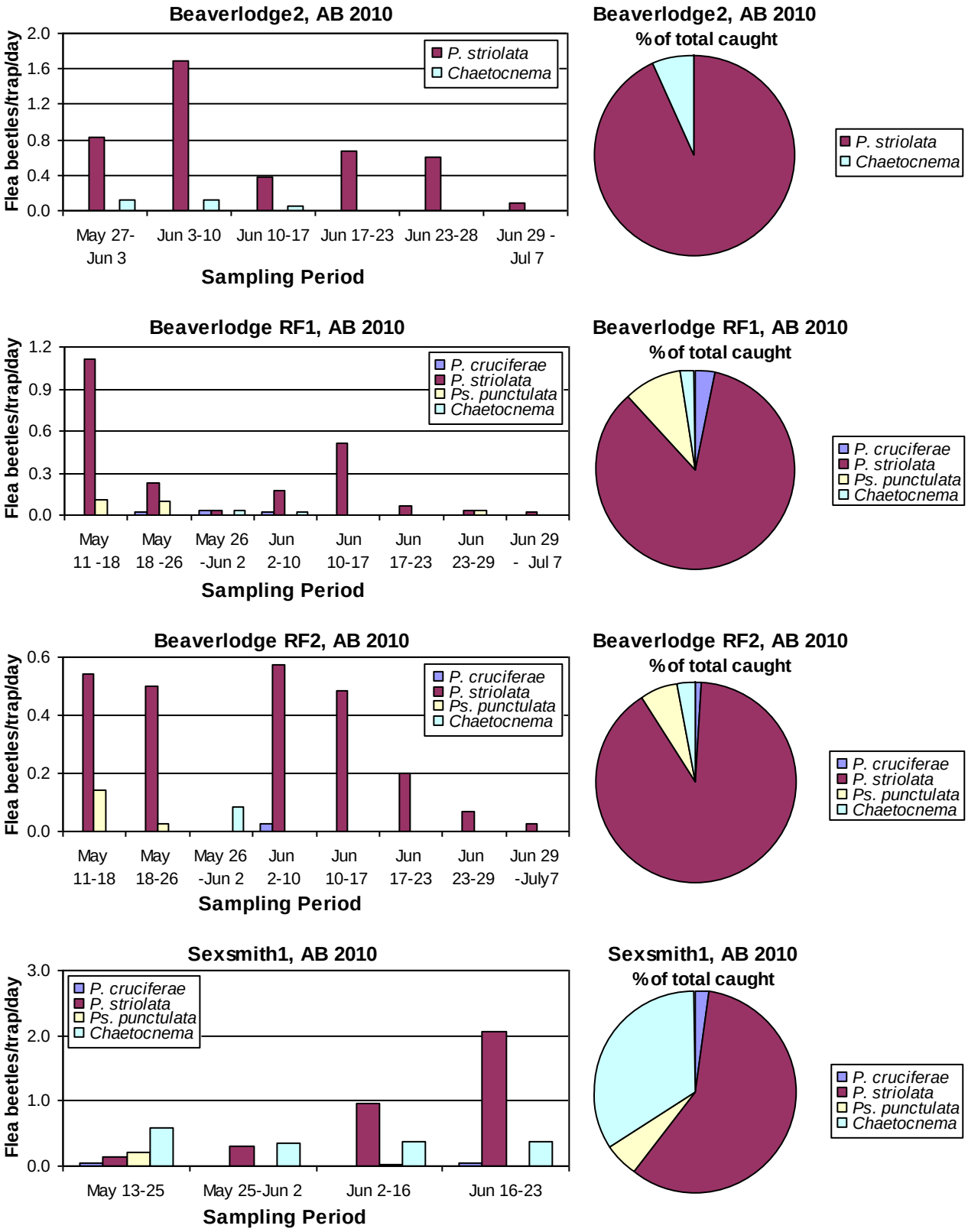

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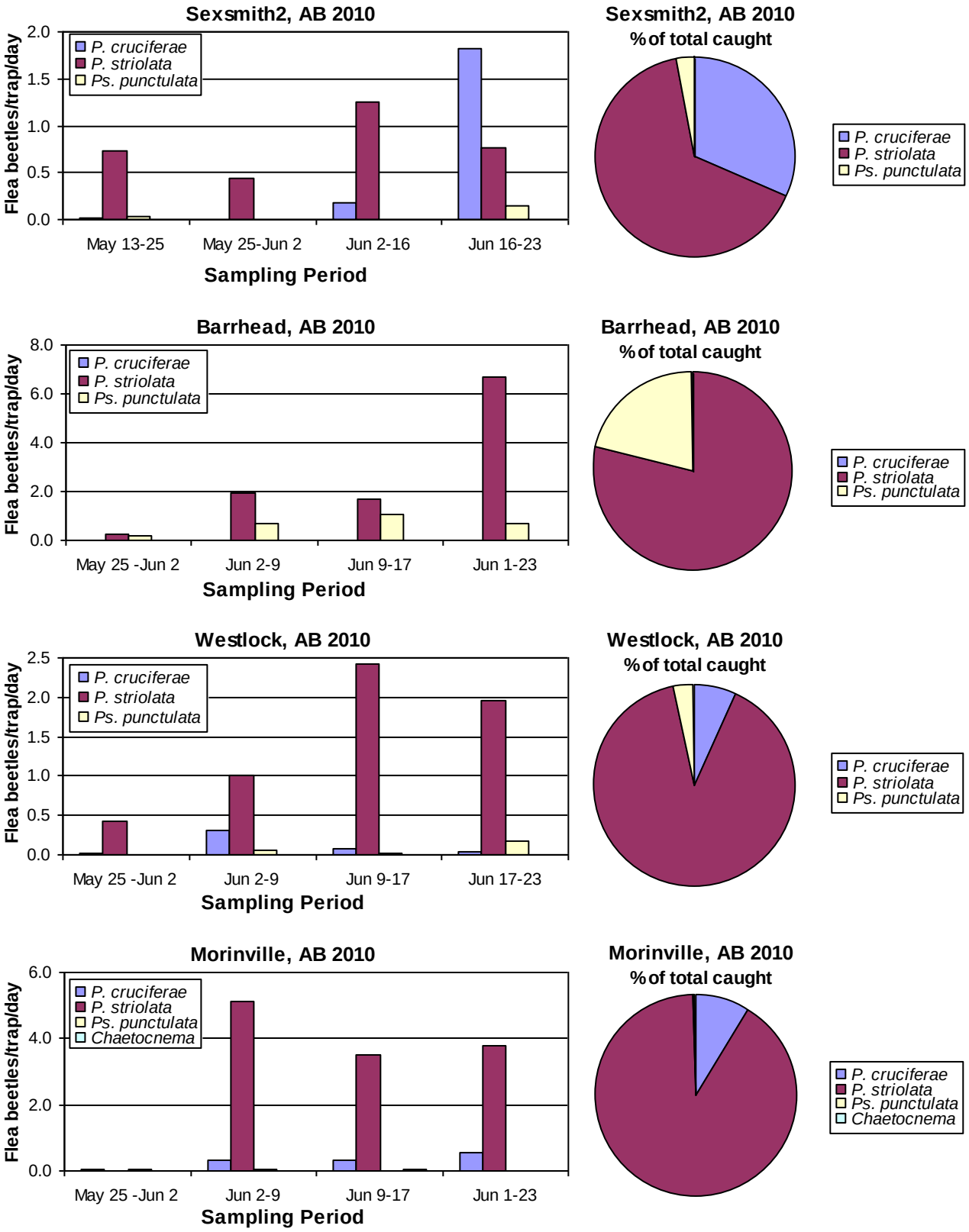

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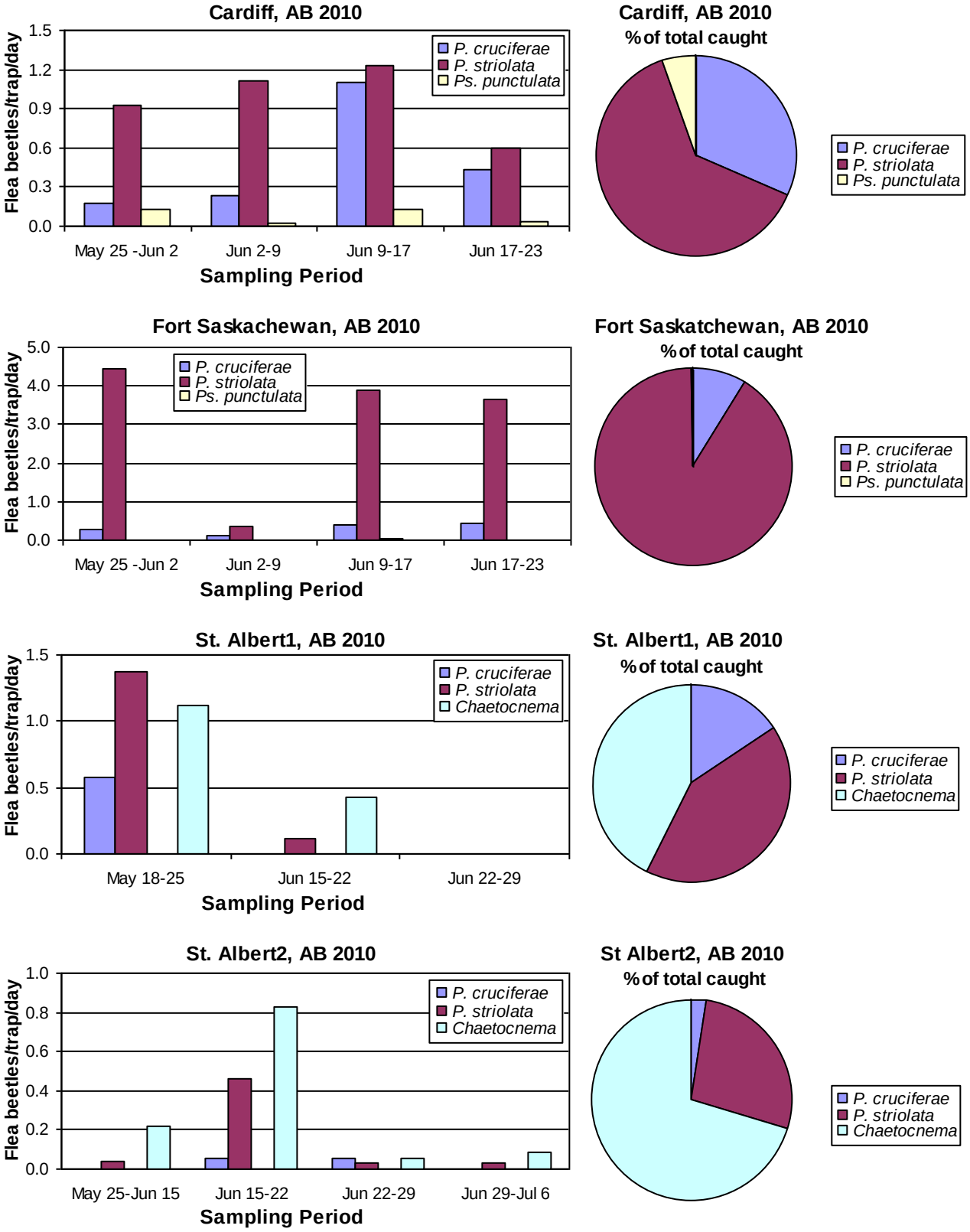

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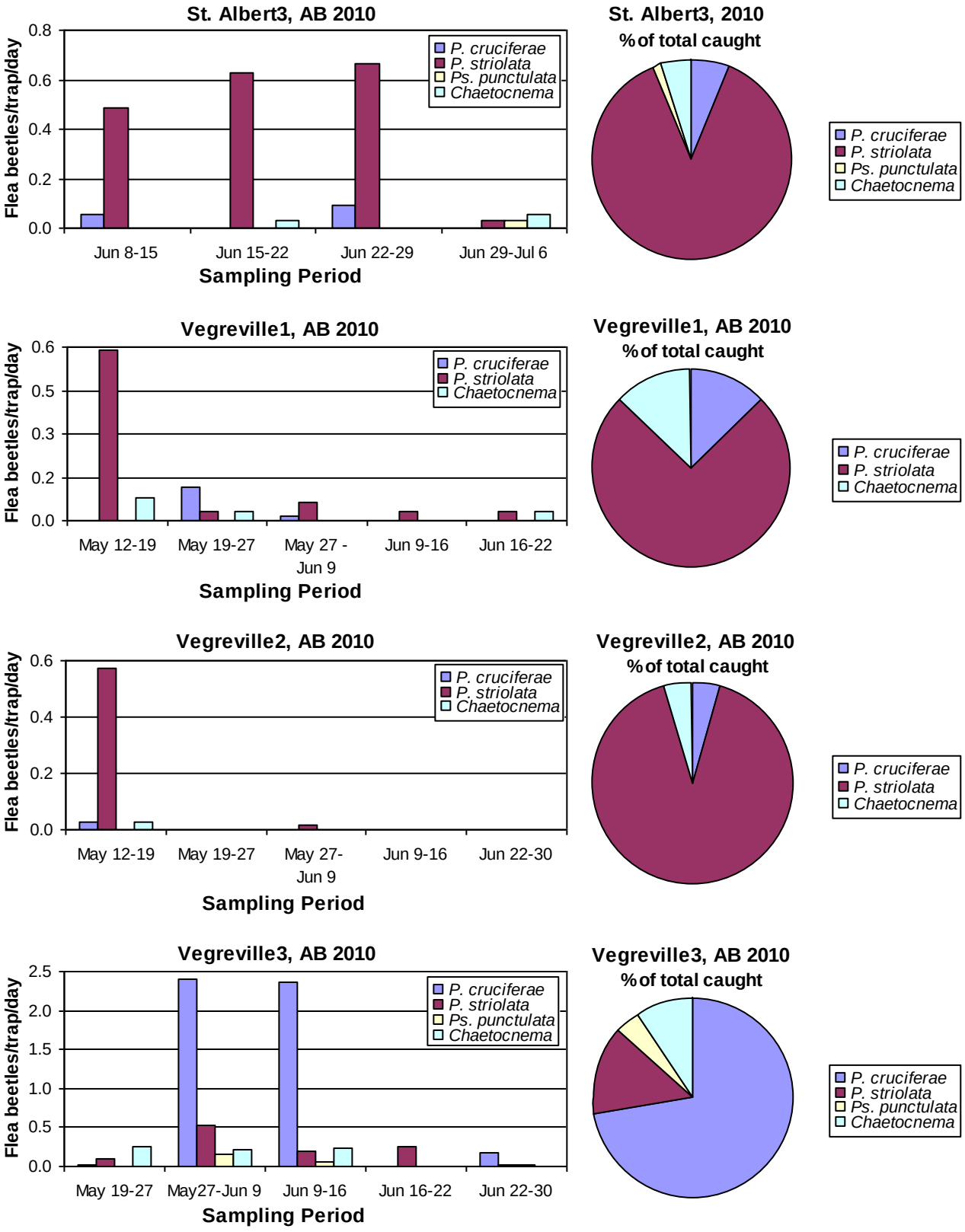

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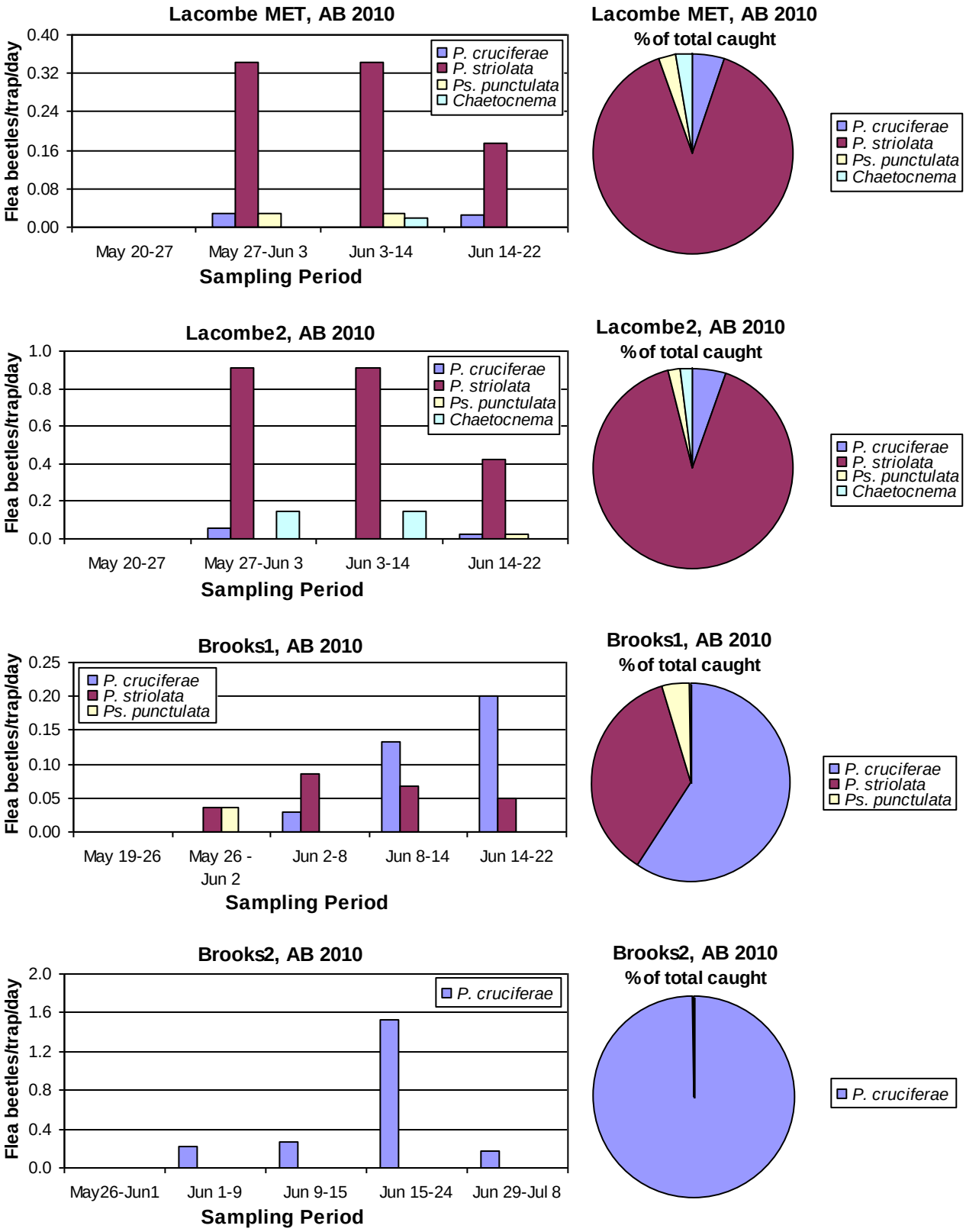

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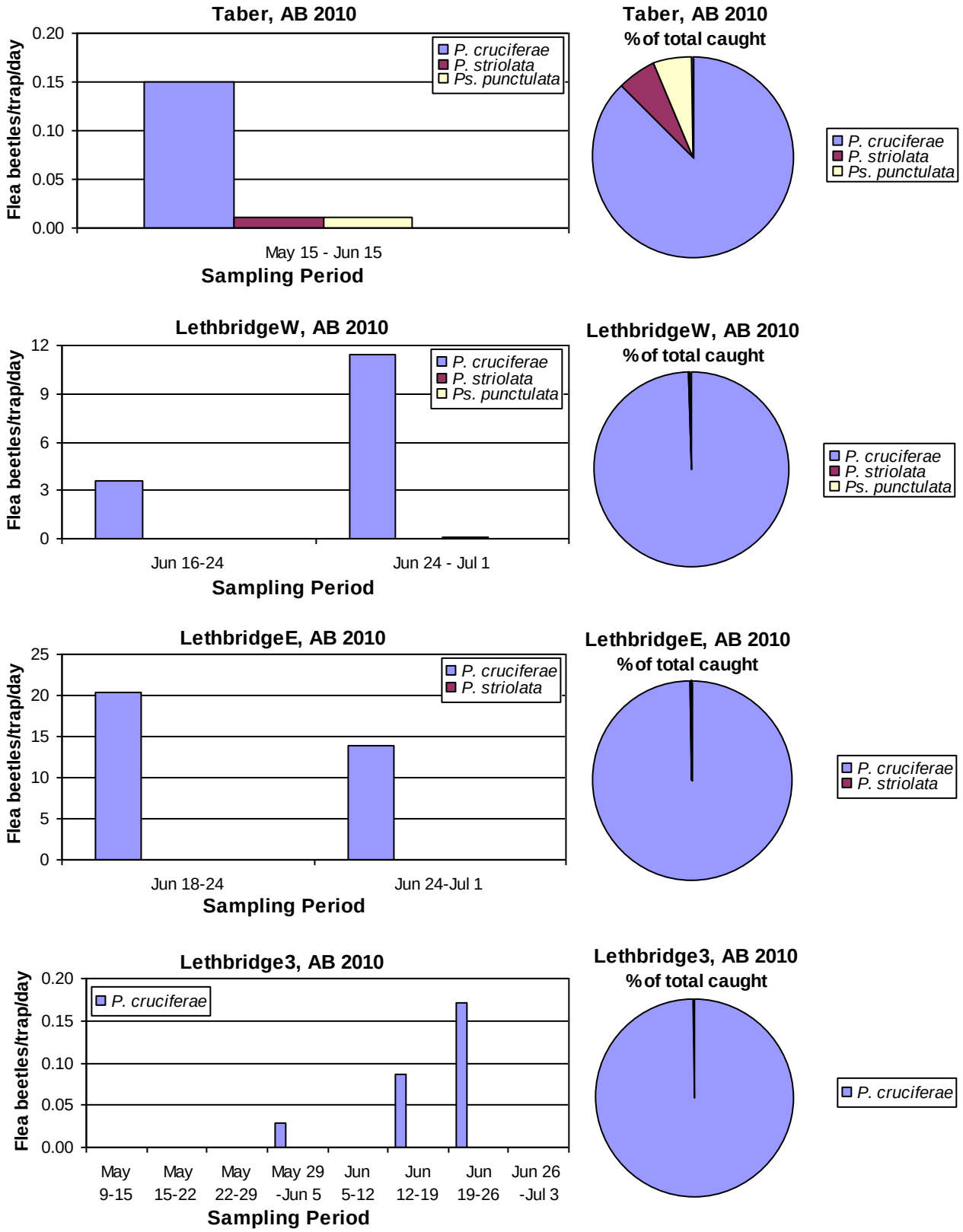
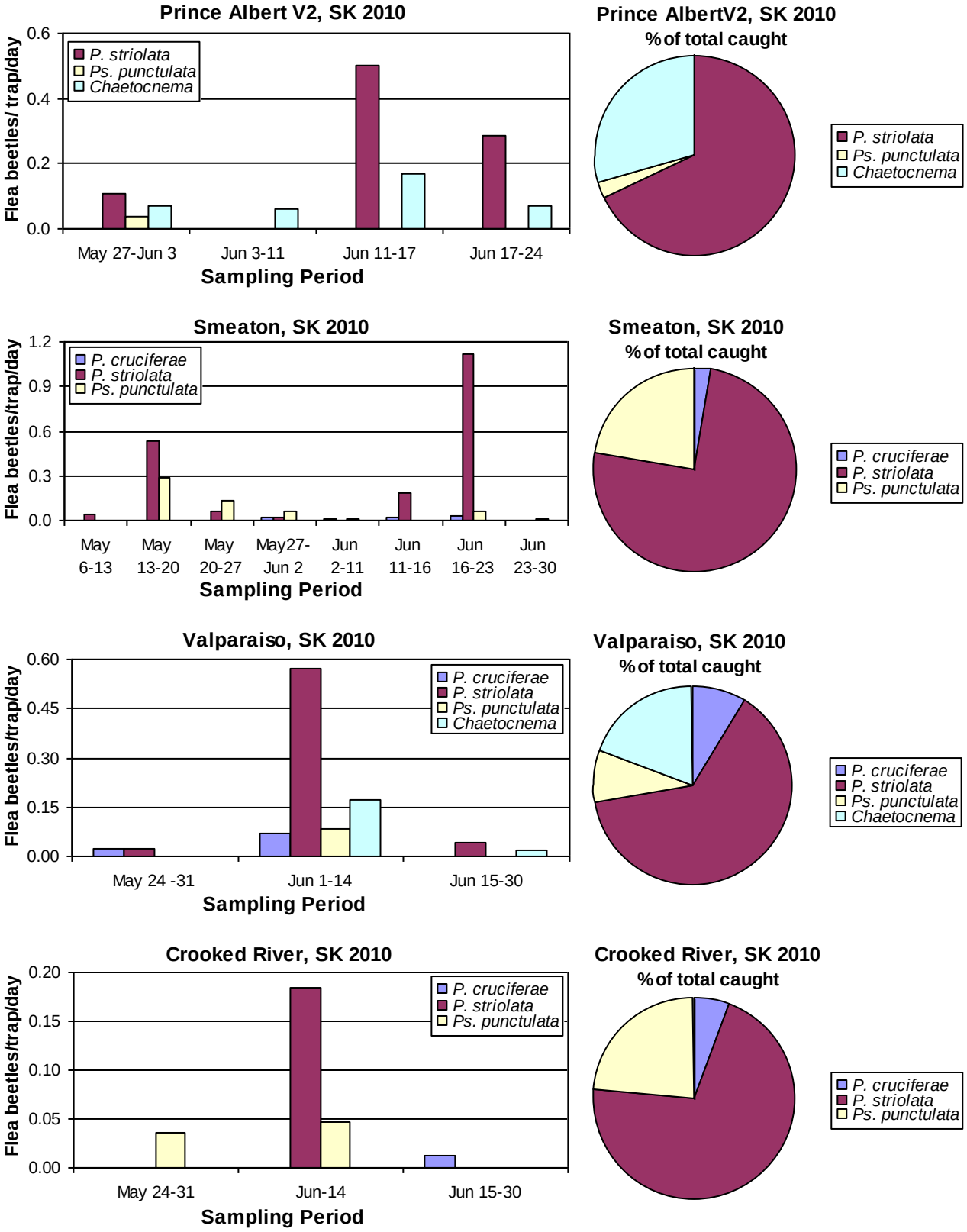


Figure 12. Flea beetle numbers and species composition on yellow sticky traps placed in or near canola fields in Saskatchewan, 2010.

Figure 12 continued



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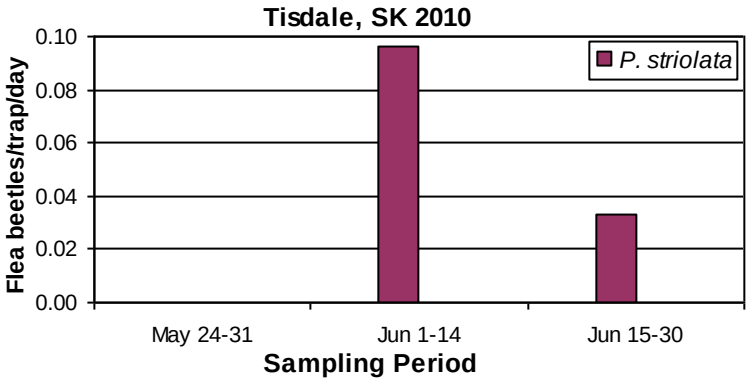

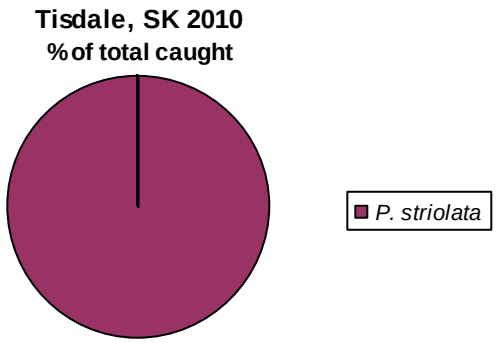

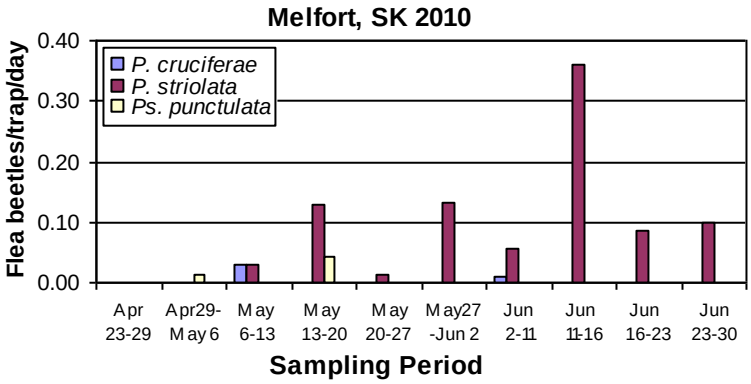

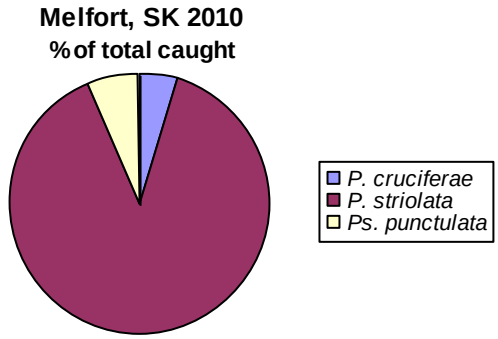

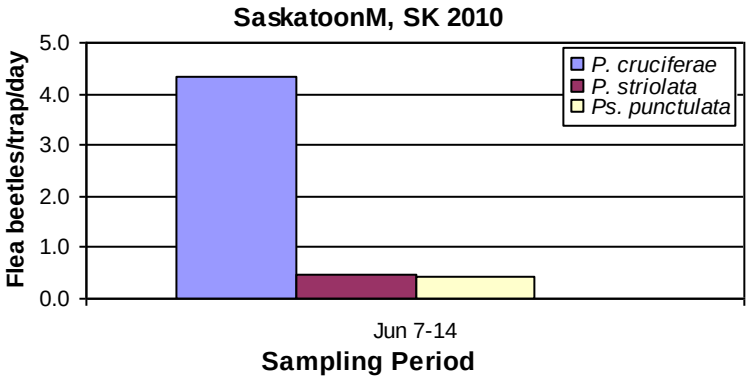

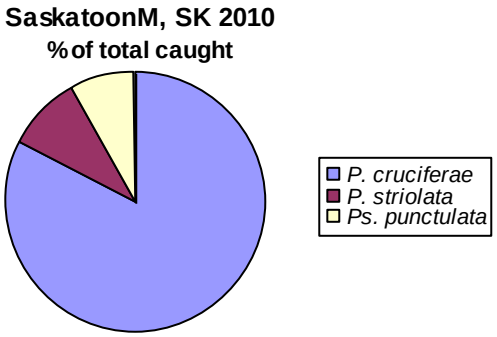

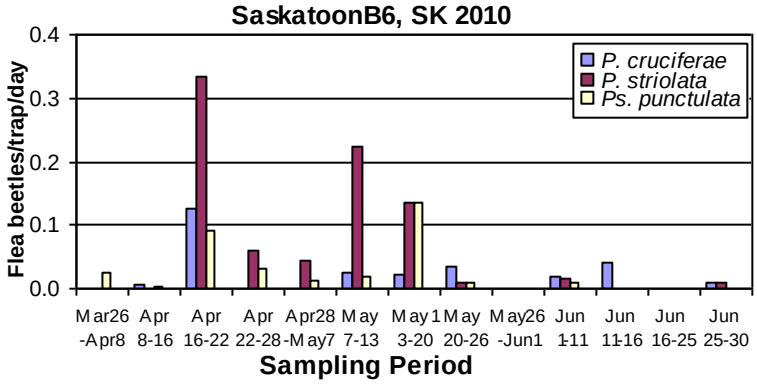

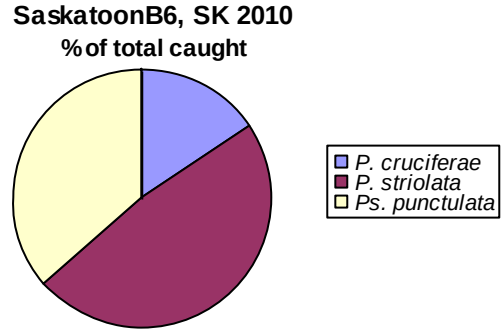

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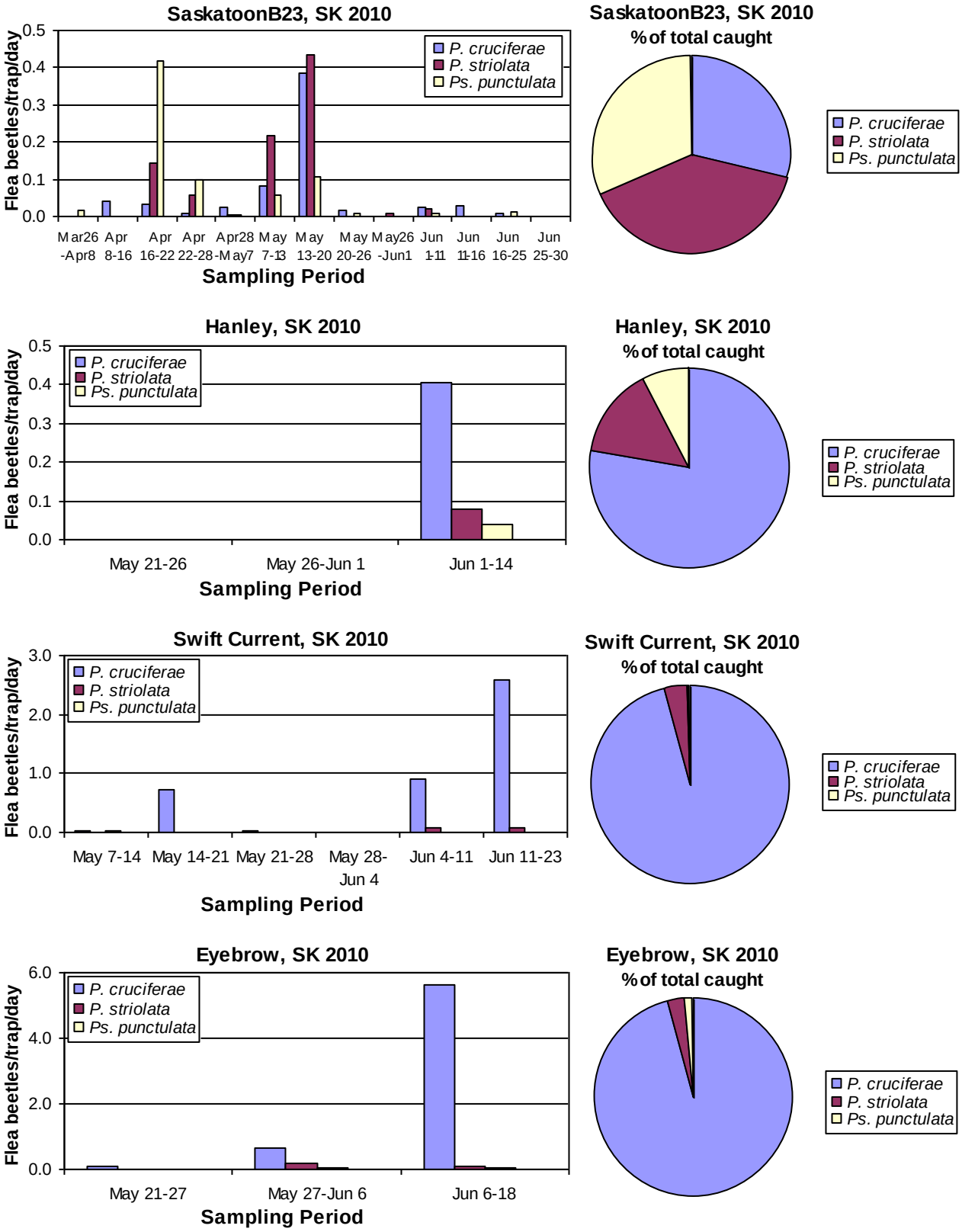

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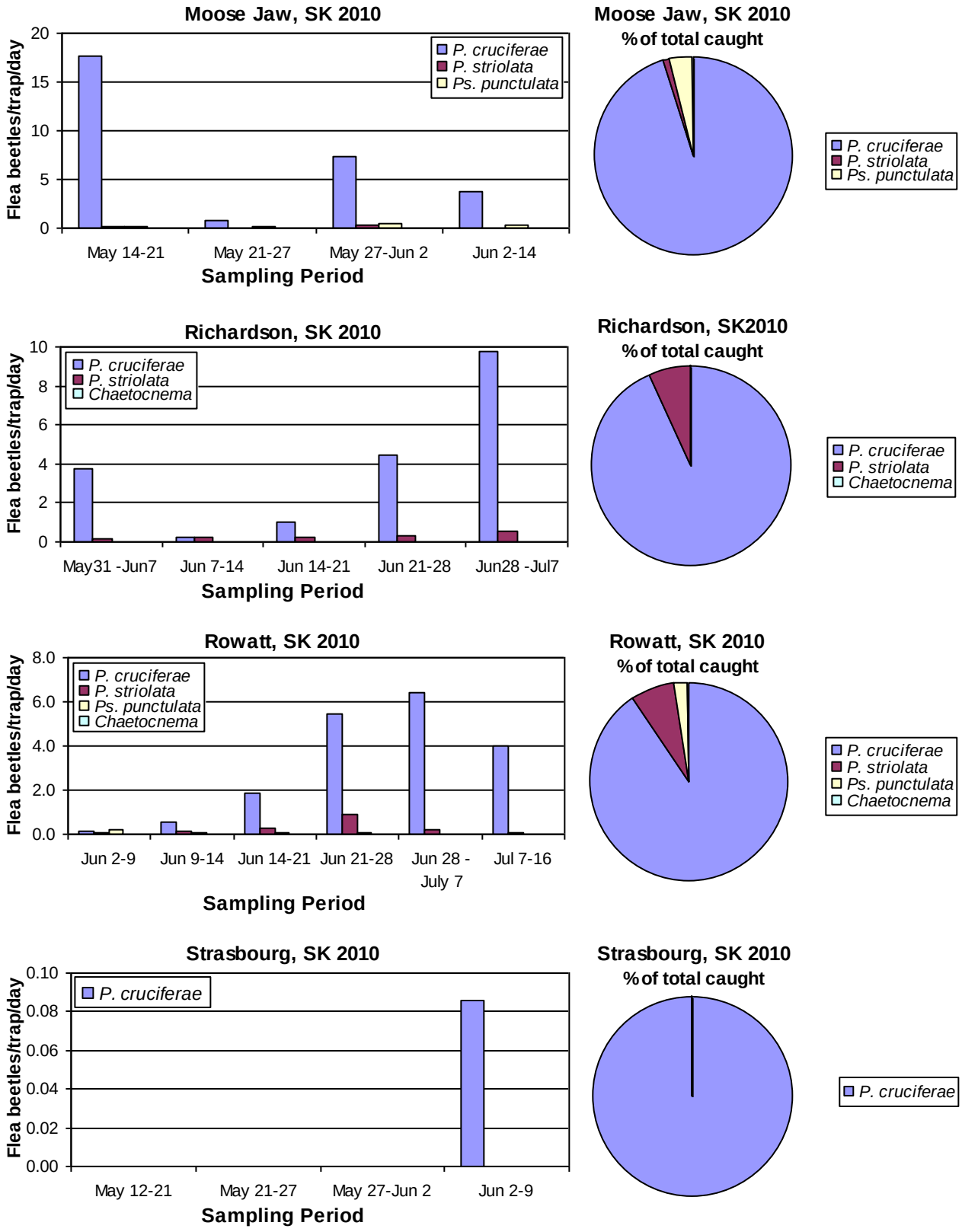

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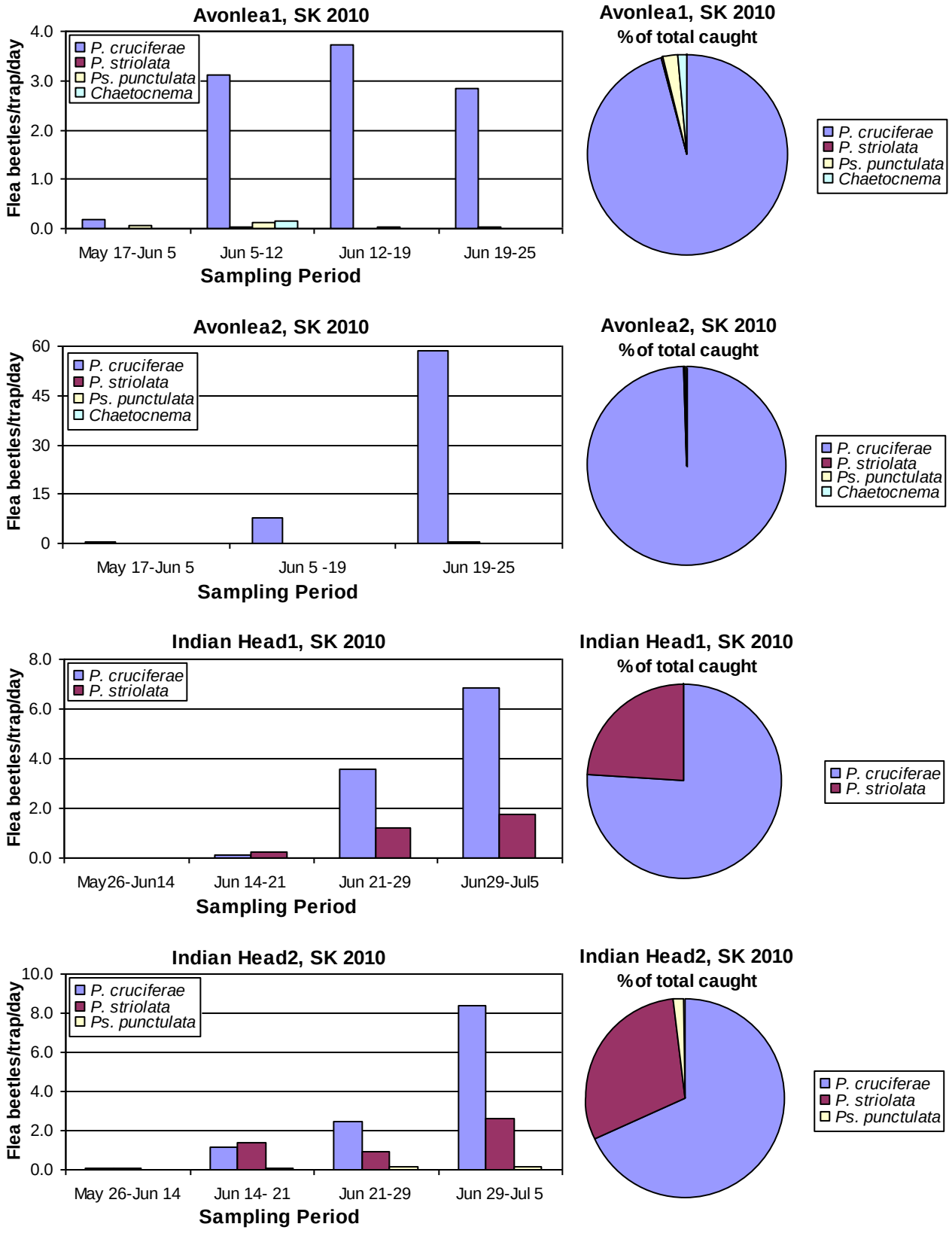

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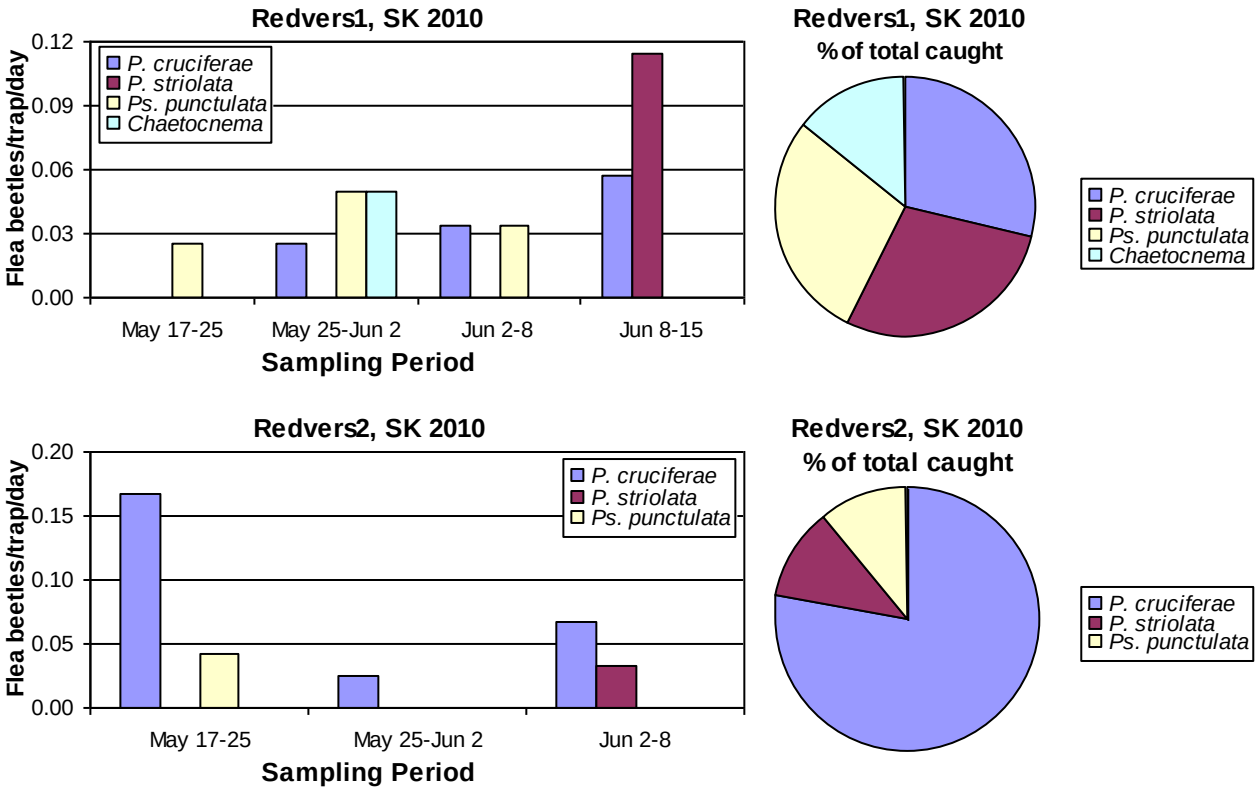
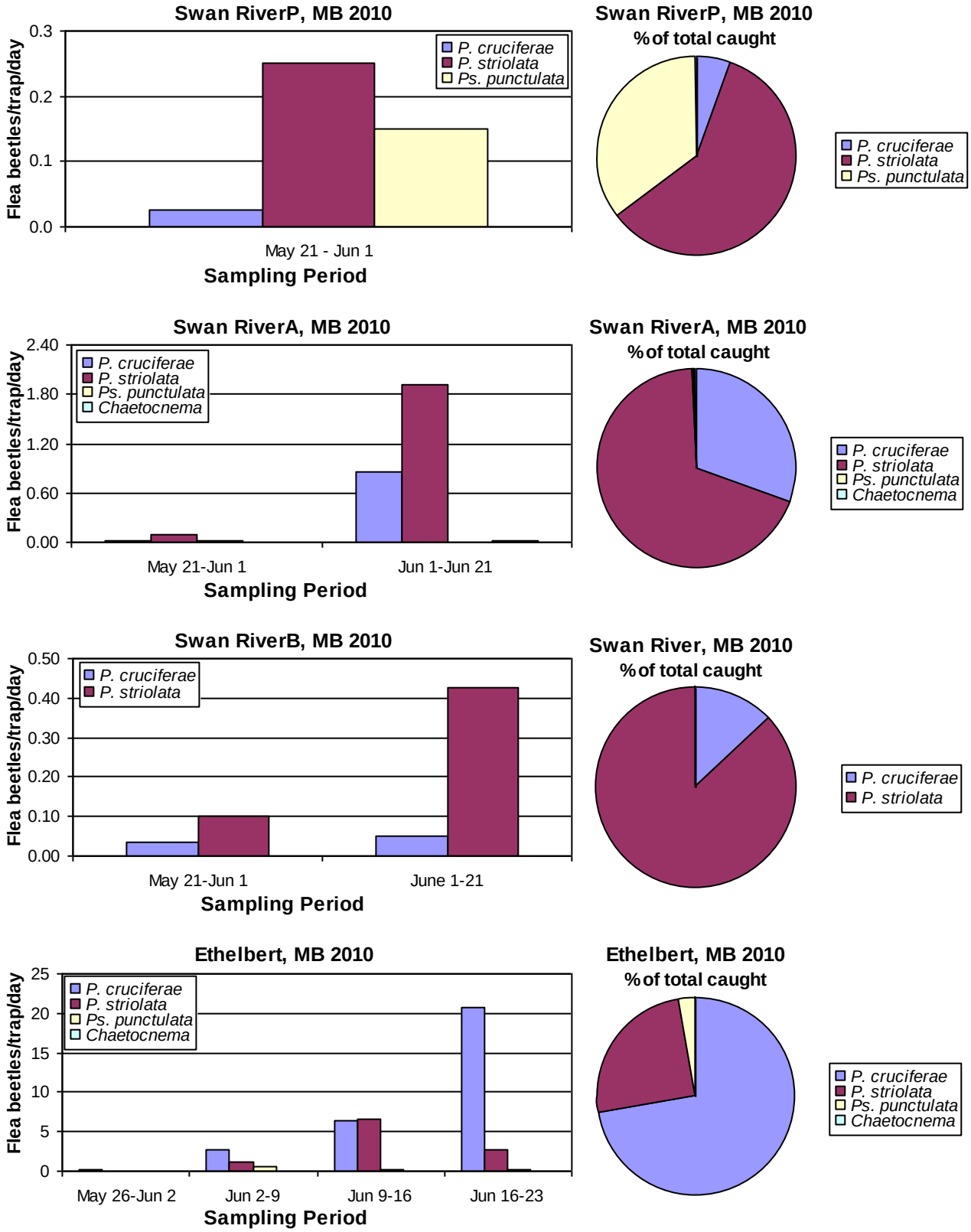


Figure 13. Flea beetle numbers and species composition on yellow sticky traps placed in or near canola fields in Manitoba, 2010.



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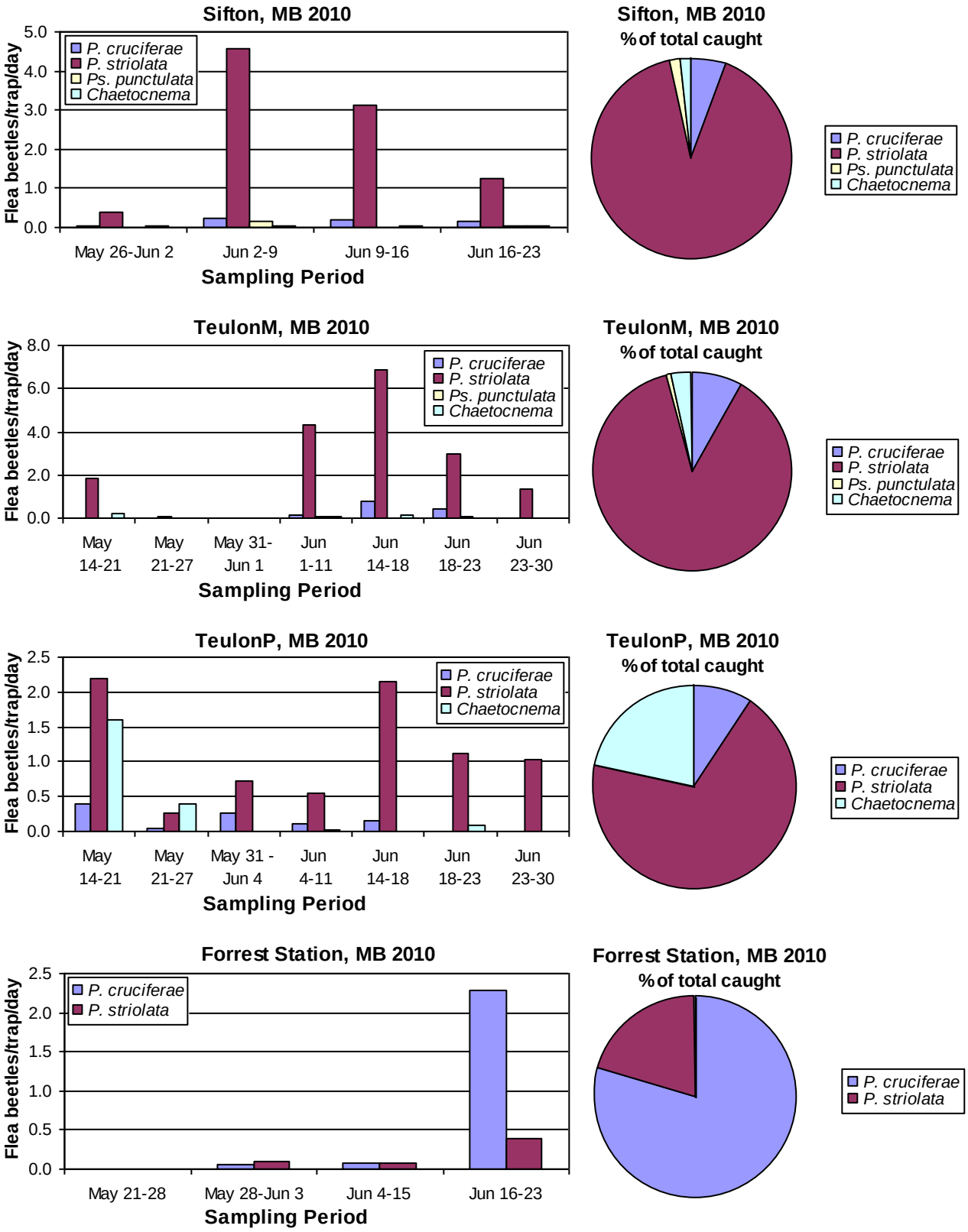
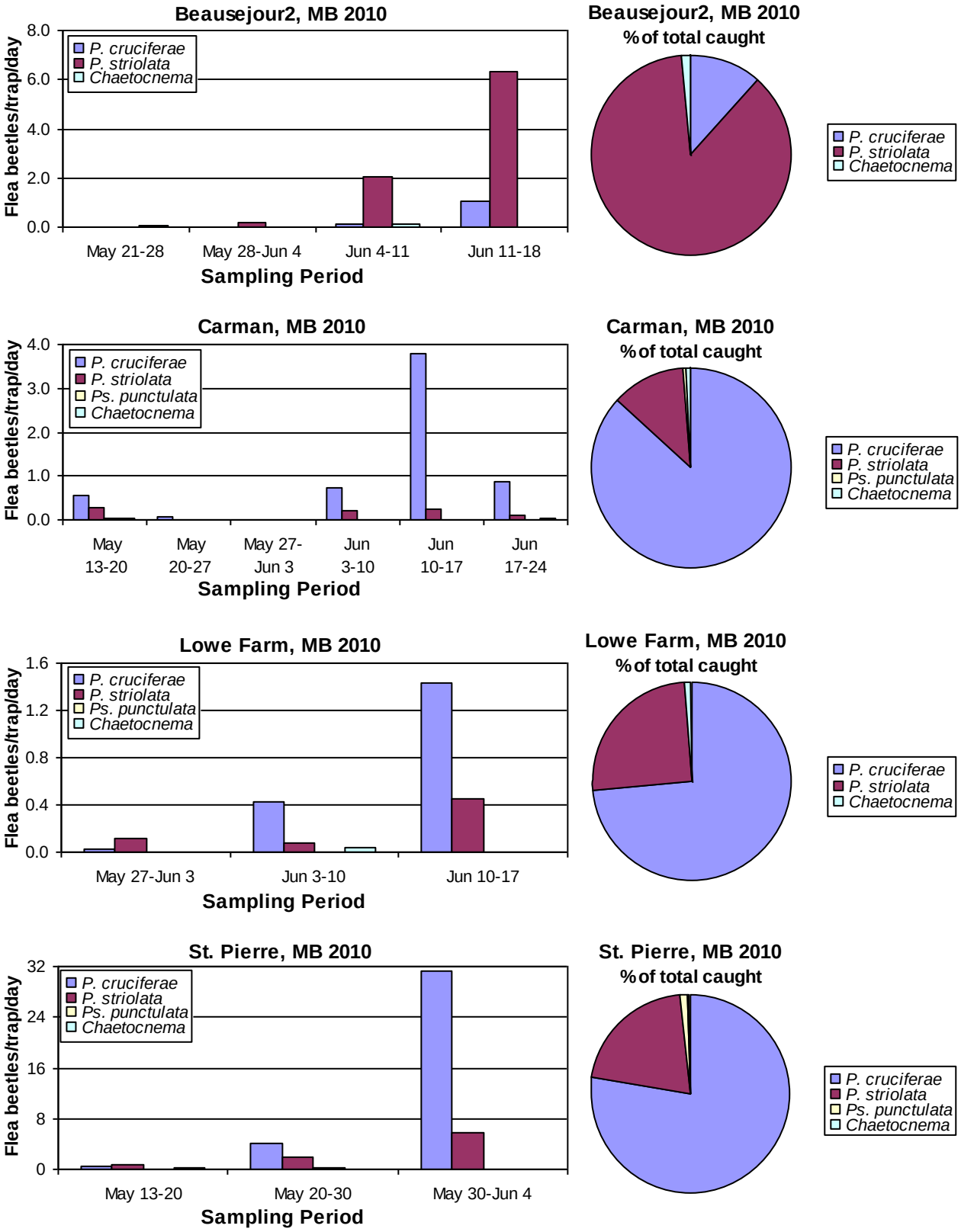


Figure 13 continued

Figure 13 continued



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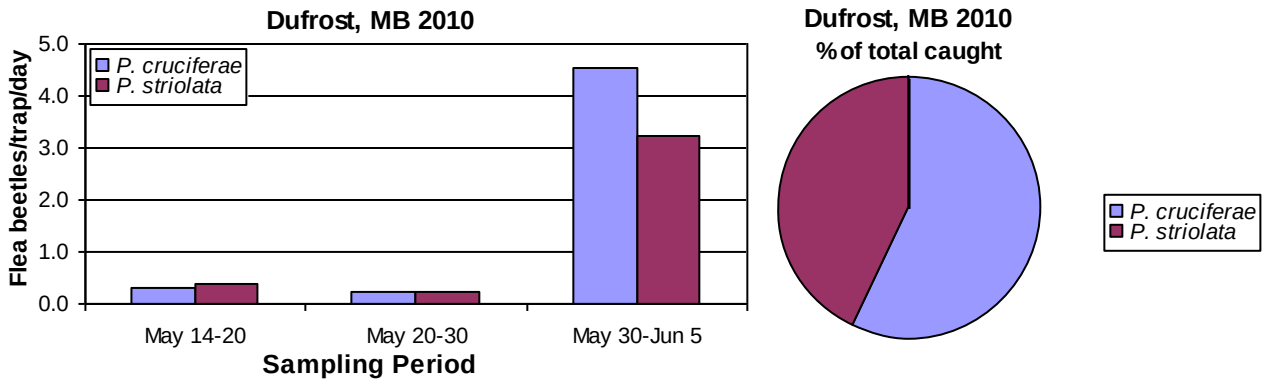
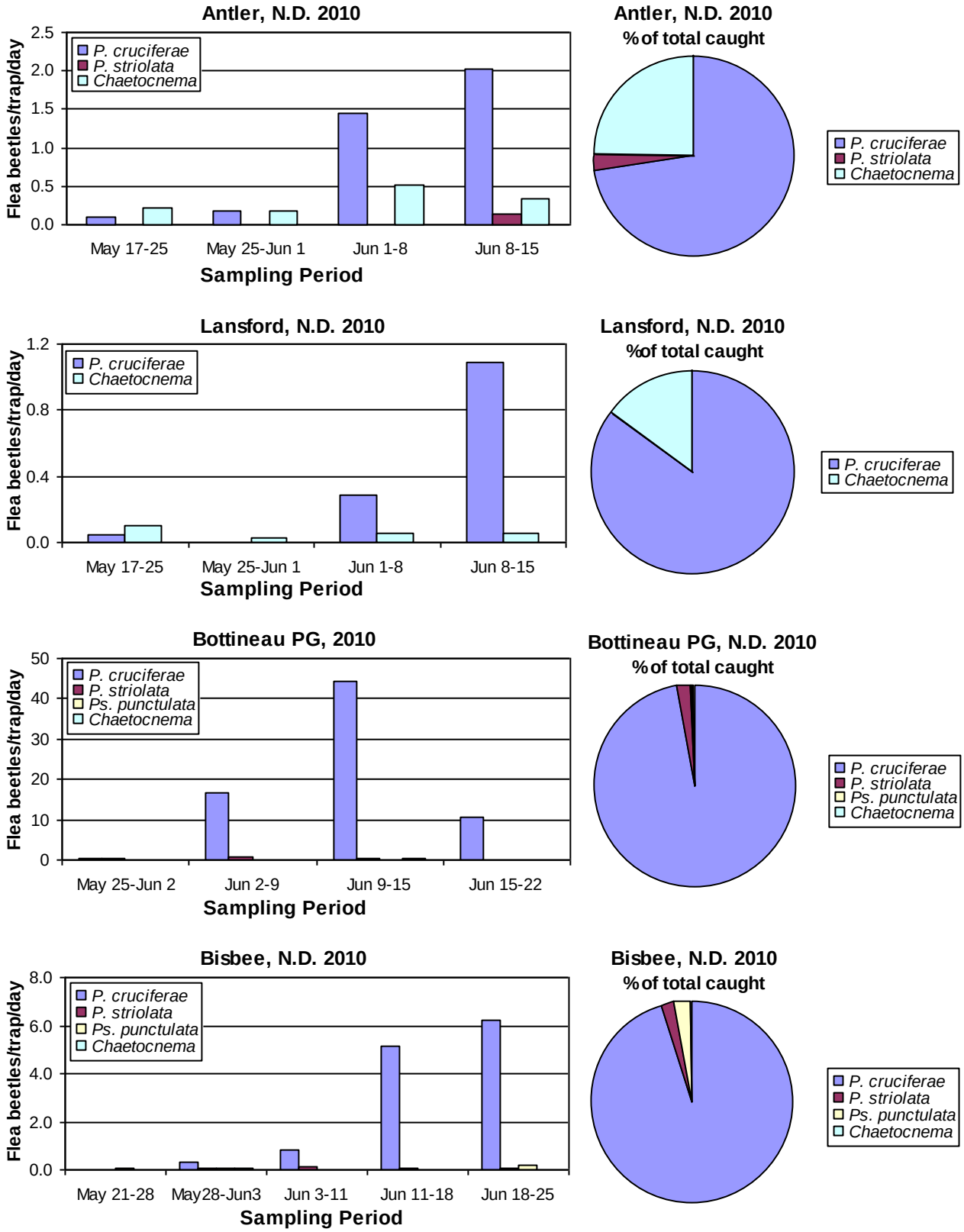


Figure 14. Flea beetle numbers and species composition on yellow sticky traps placed in or near canola fields in North Dakota, 2010.



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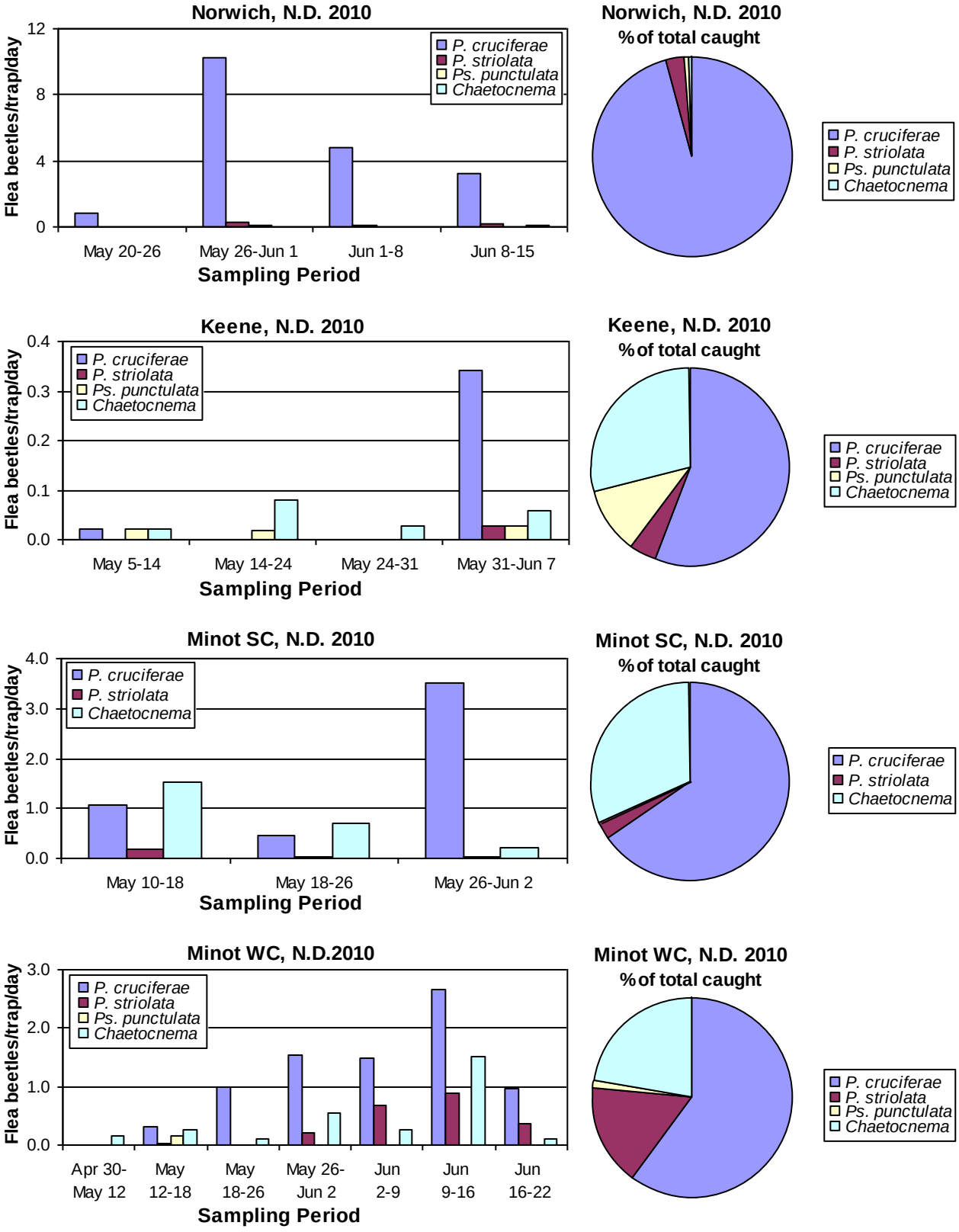

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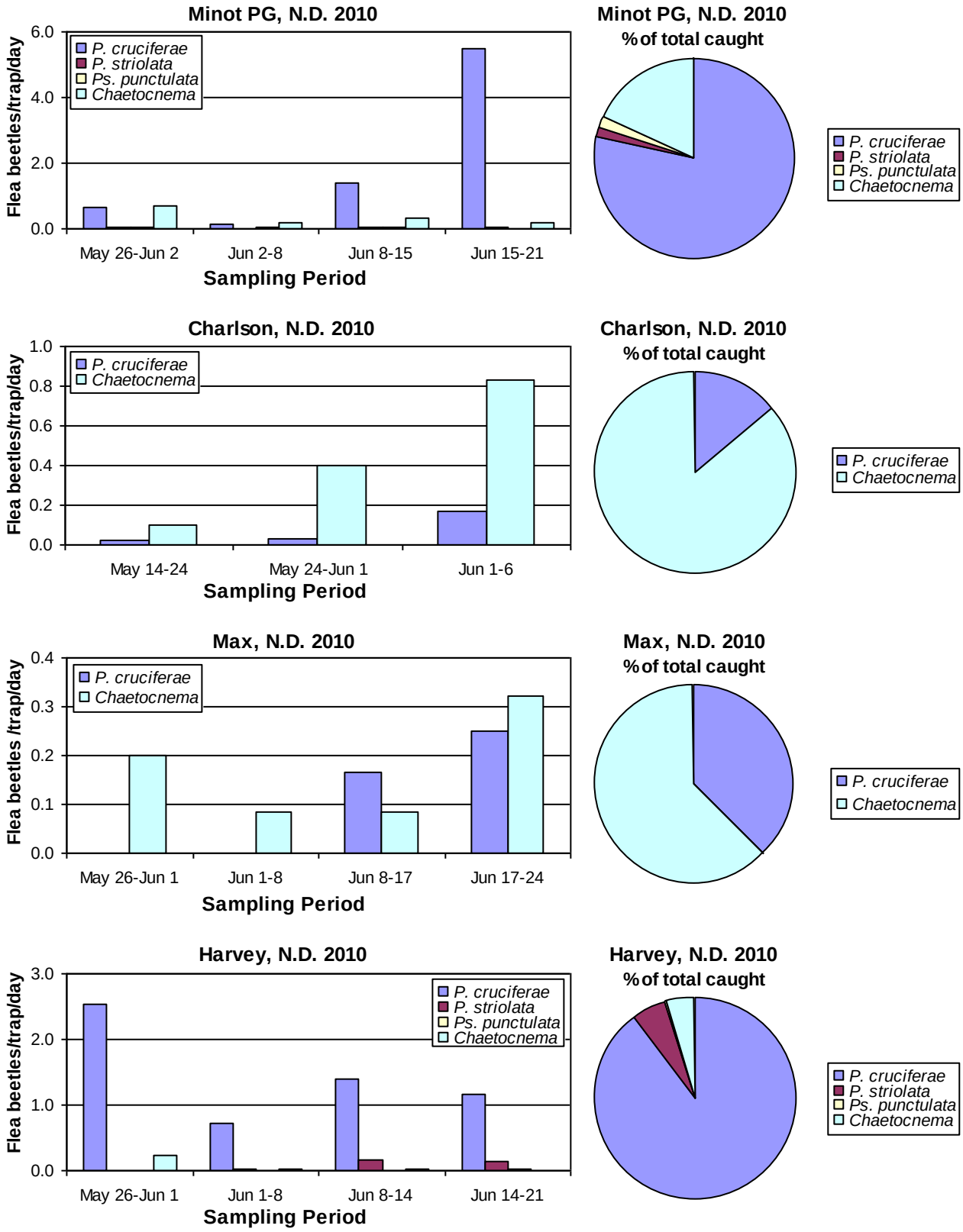

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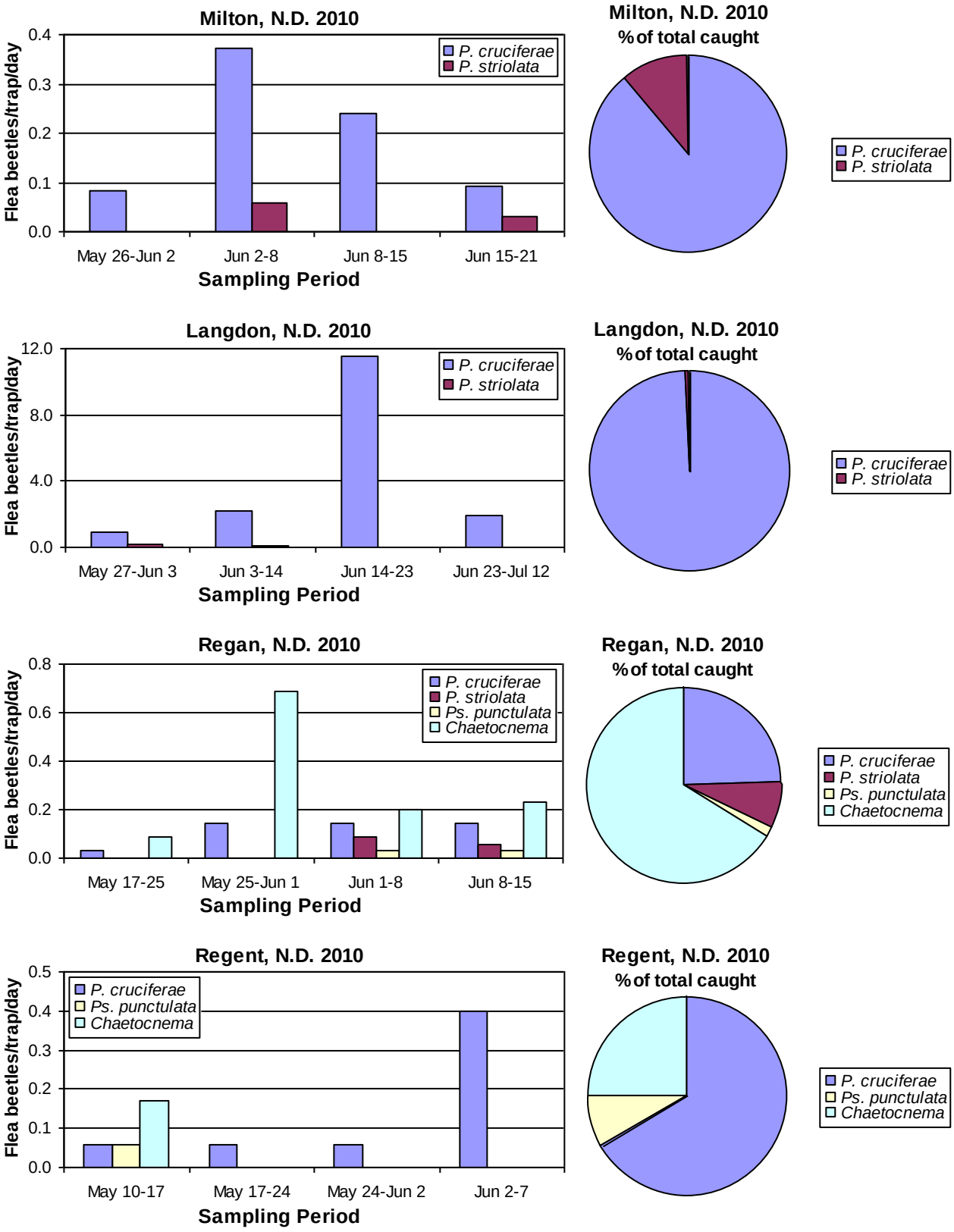

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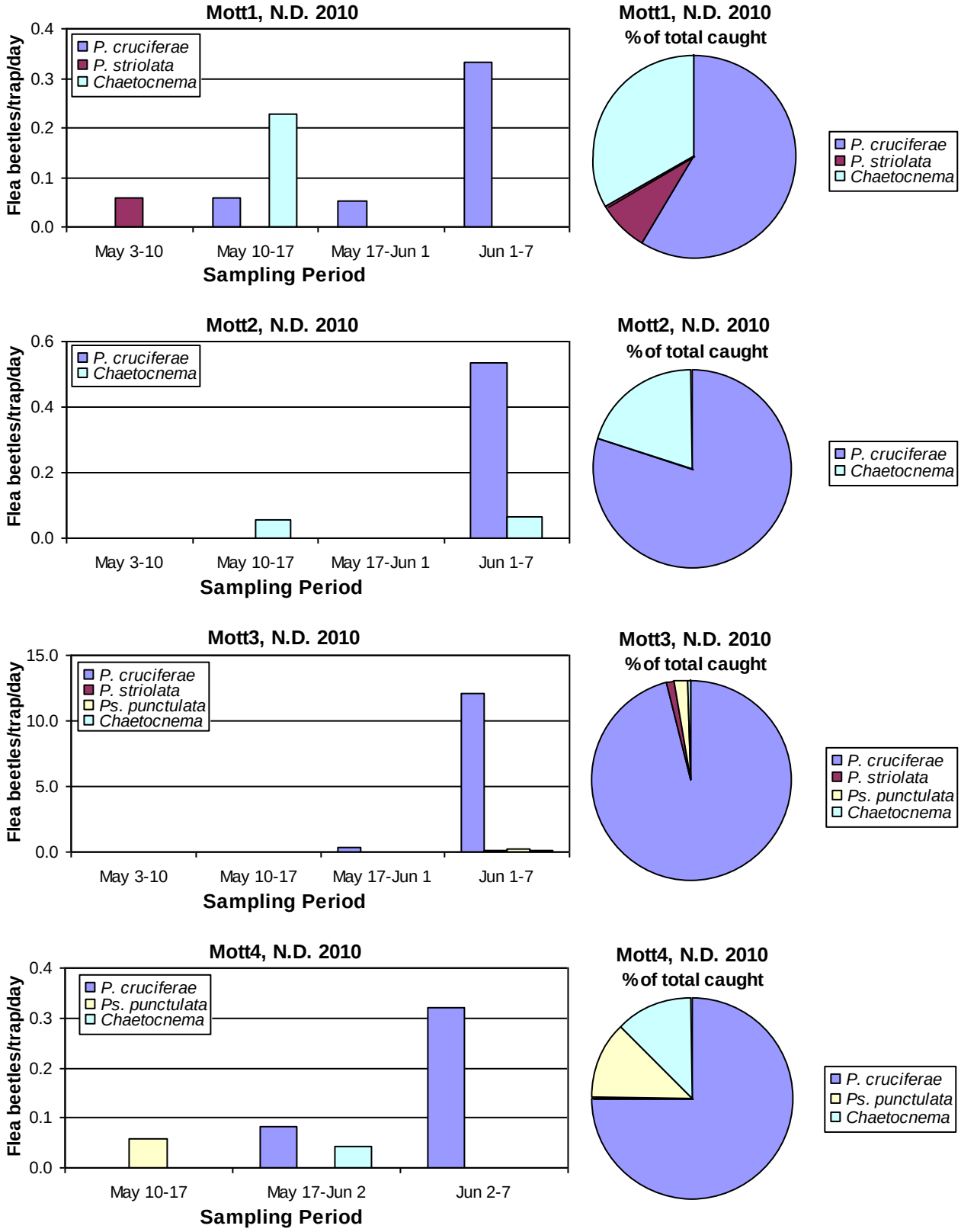

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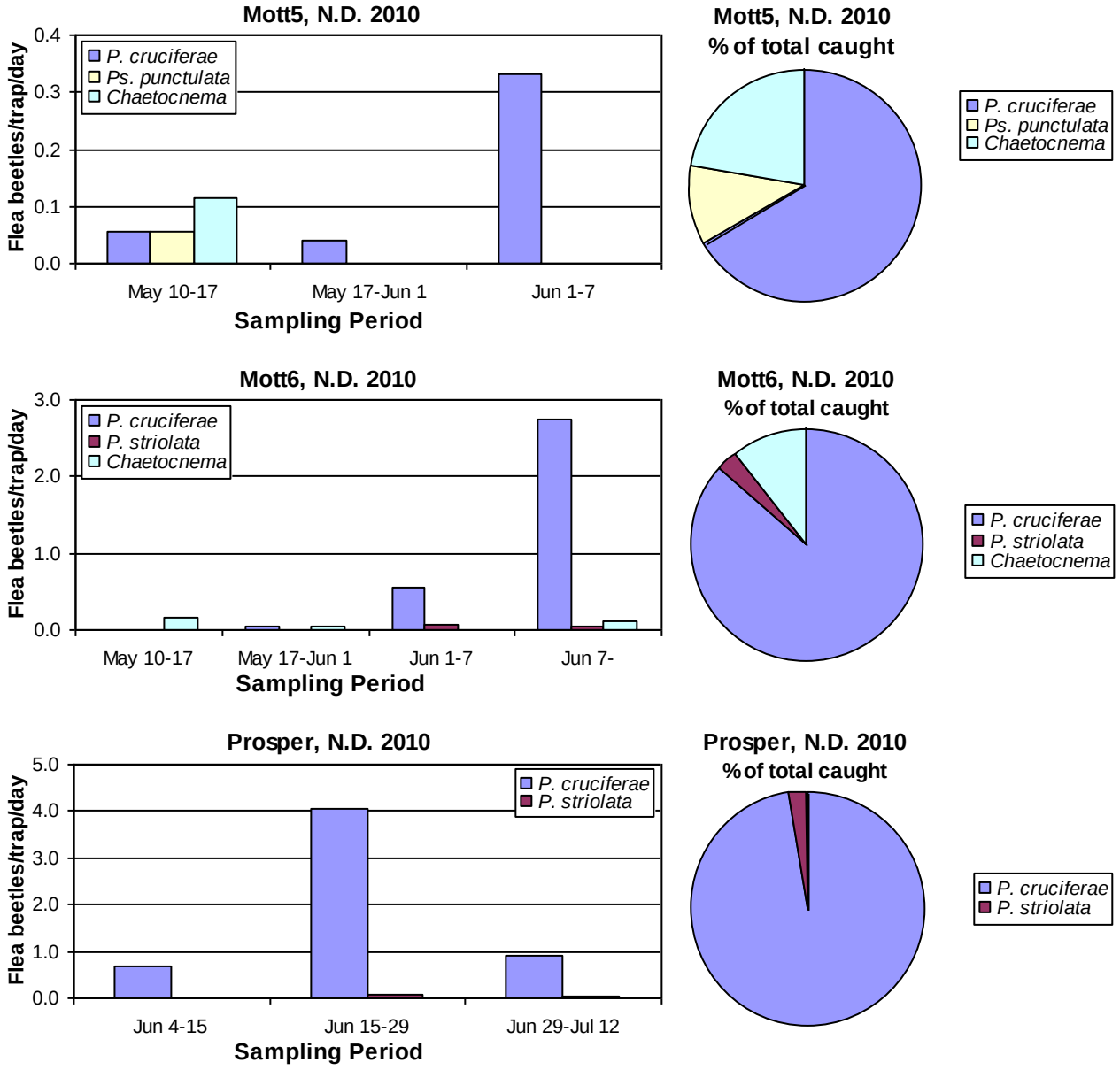
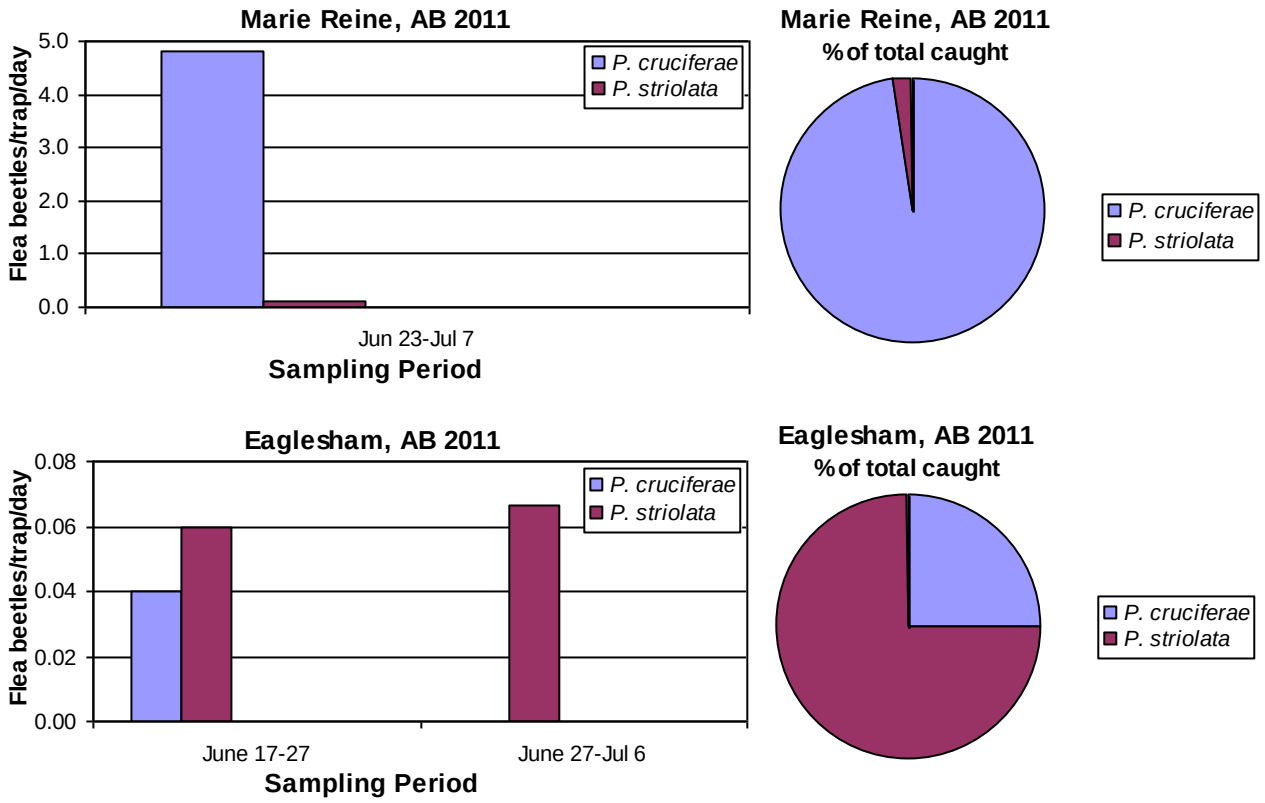
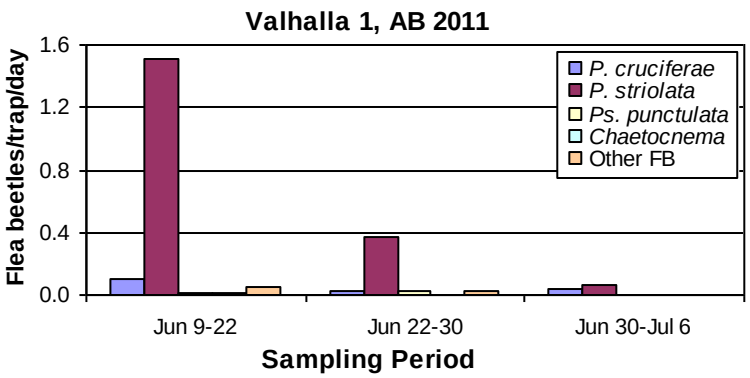
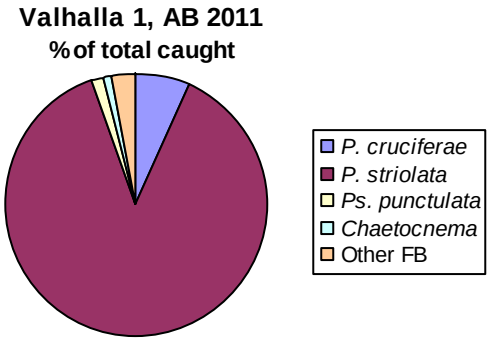
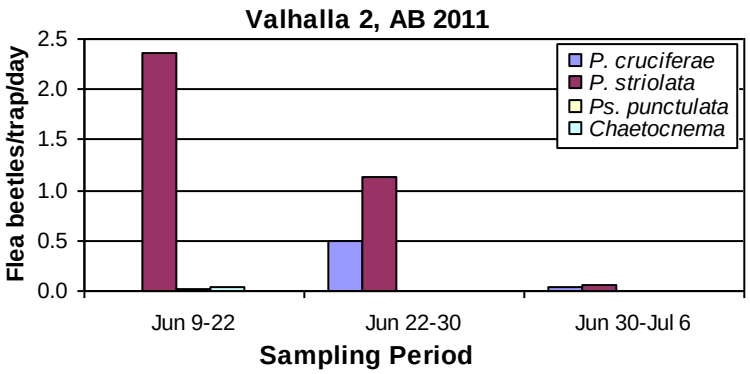


Figure 15. Flea beetle numbers and species composition on yellow sticky traps placed in or near canola fields in Alberta, 2011.




Valhalla 1, AB 2011
Flea beetles/trap/day
1.6
1.2
0.8
0.4
0.0
P. cruciferae
P. striolata
Ps. punctulata
Chaetocnema
Other FB
Jun 9-22
Jun 22-30
Jun 30-Jul 6
Sampling Period


Valhalla 1, AB 2011
% of total caught
P. cruciferae
P. striolata
Ps. punctulata
Chaetocnema
Other FB


Valhalla 2, AB 2011
Flea beetles/trap/day
2.5
2.0
1.5
1.0
0.5
0.0
P. cruciferae
P. striolata
Ps. punctulata
Chaetocnema
Jun 9-22
Jun 22-30
Jun 30-Jul 6
Sampling Period

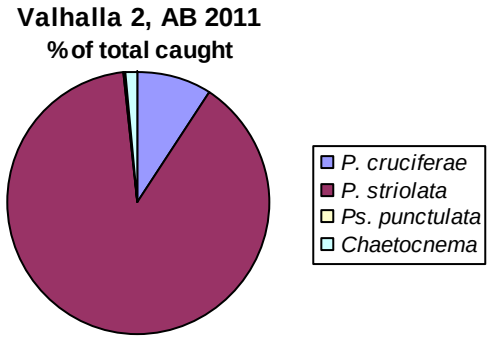

Valhalla 2, AB 2011
% of total caught
P. cruciferae
P. striolata
Ps. punctulata
Chaetocnema

Figure 15 continued

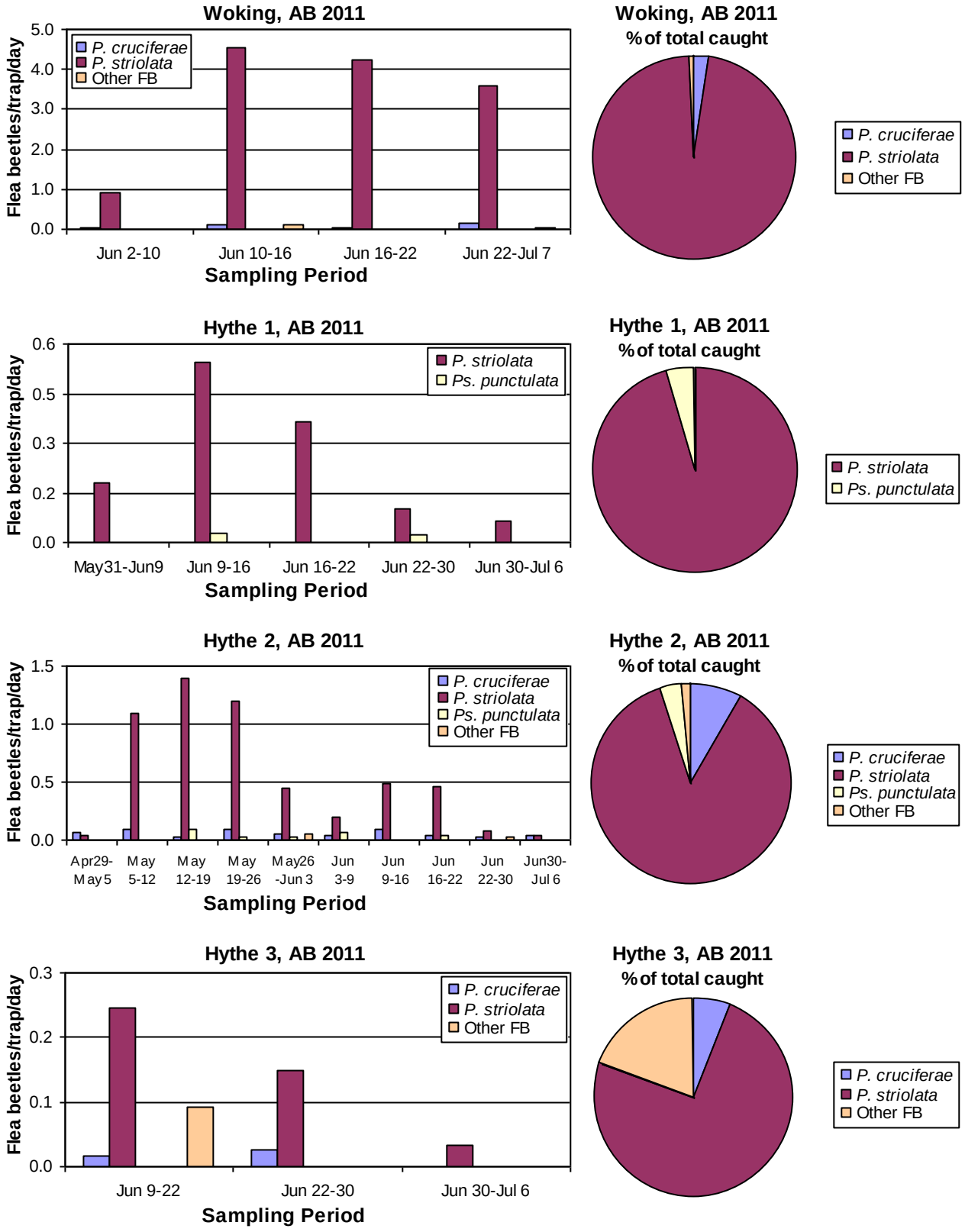


Figure 15 continued

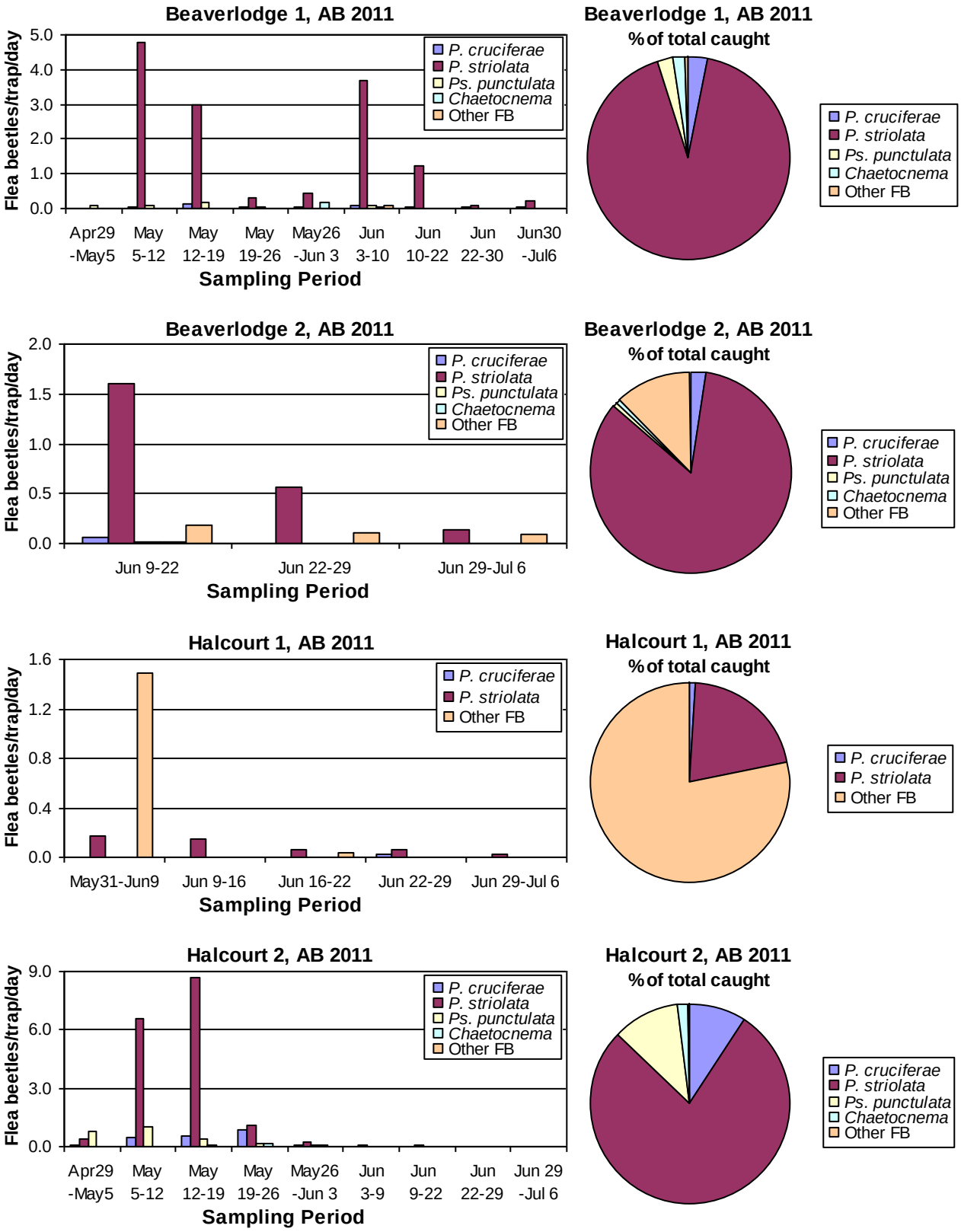


Figure 15 continued

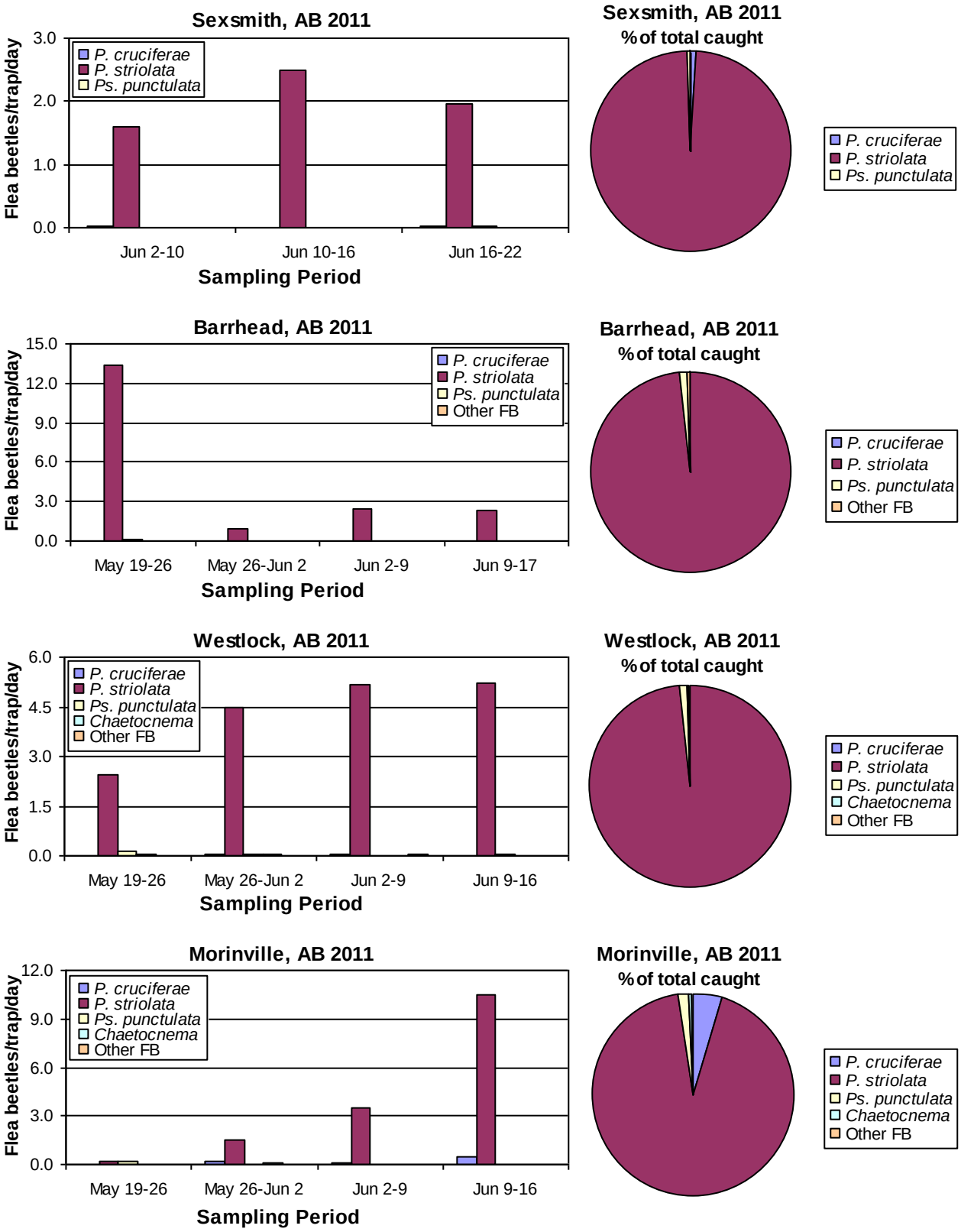


Figure 15 continued

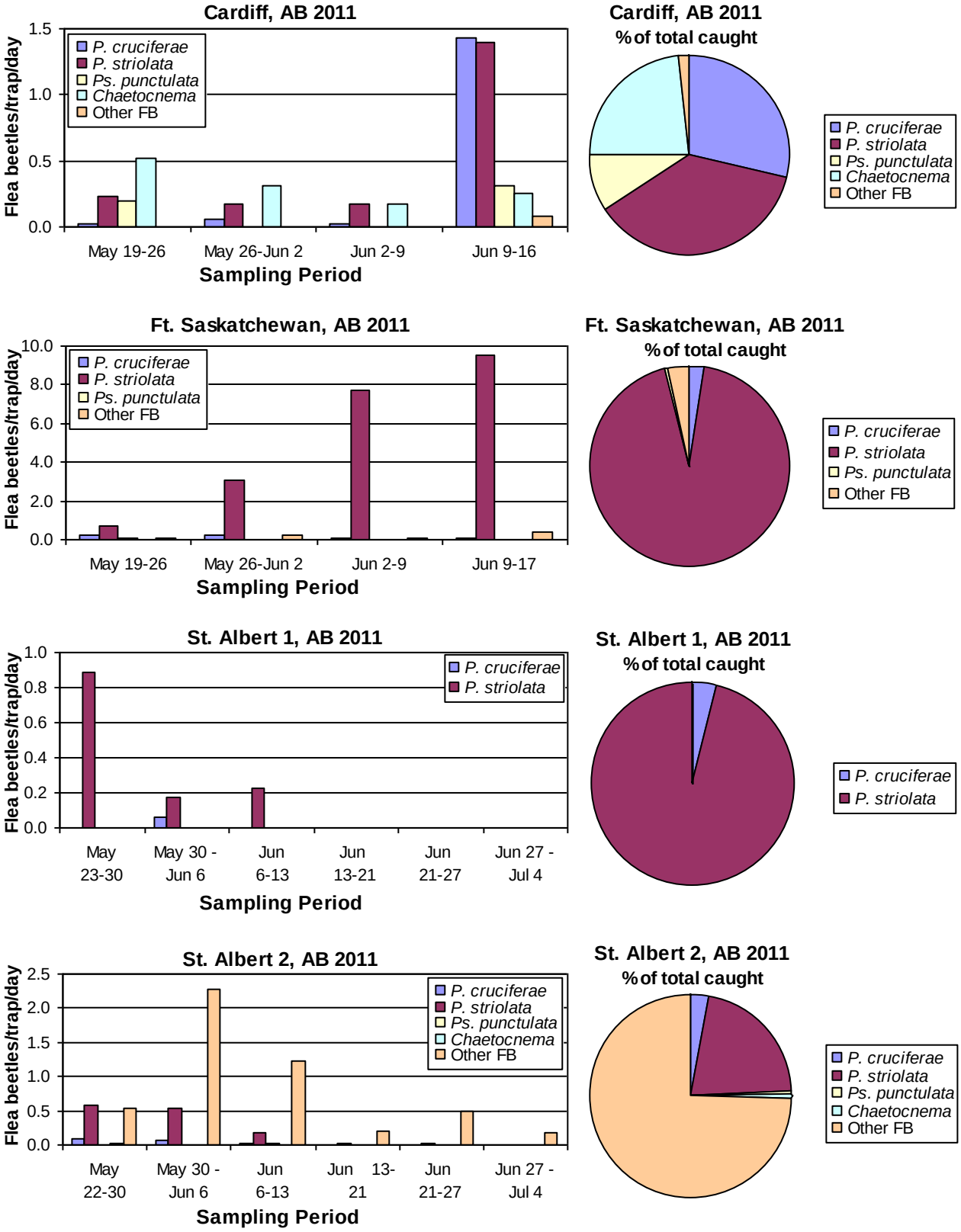


Figure 15 continued

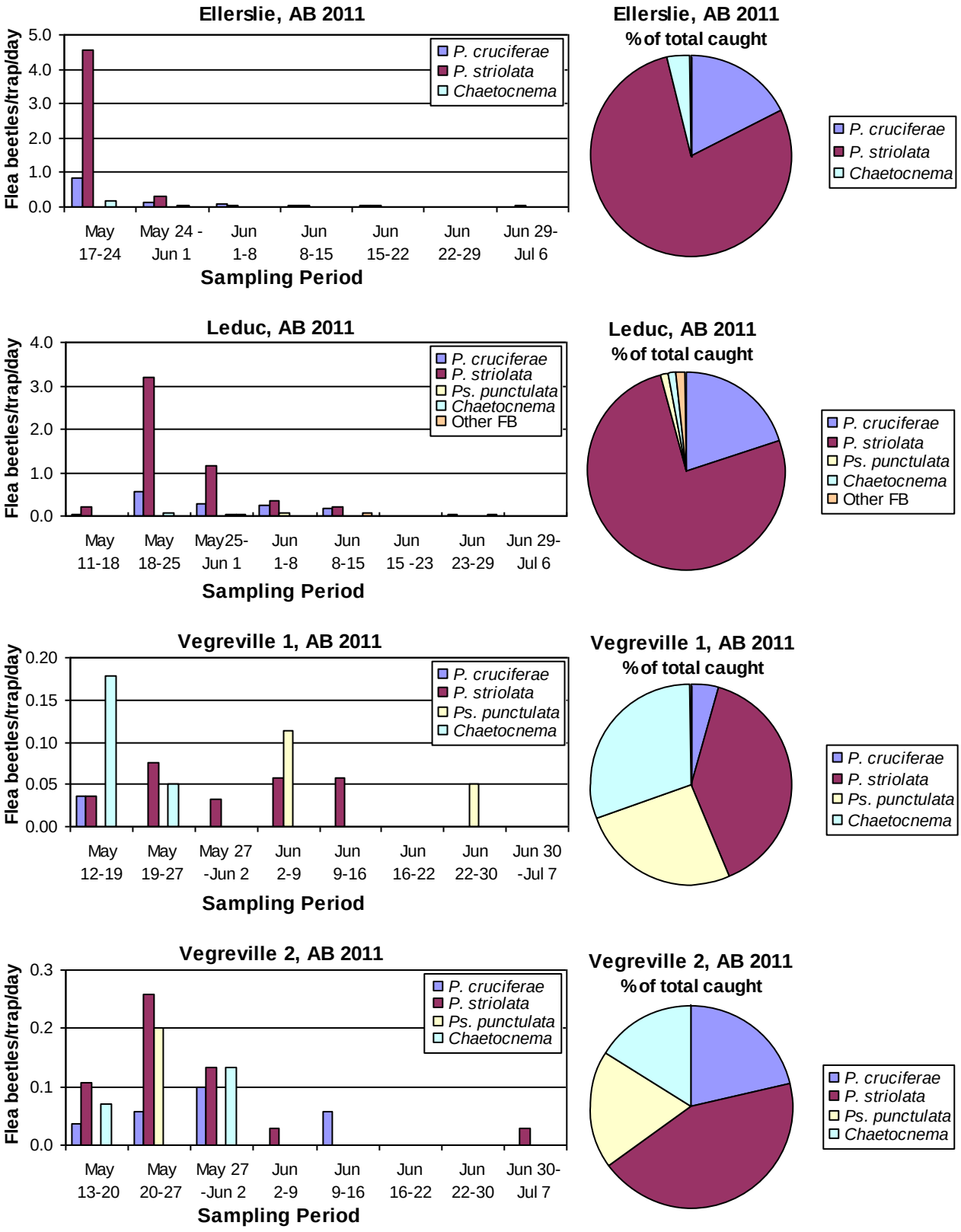
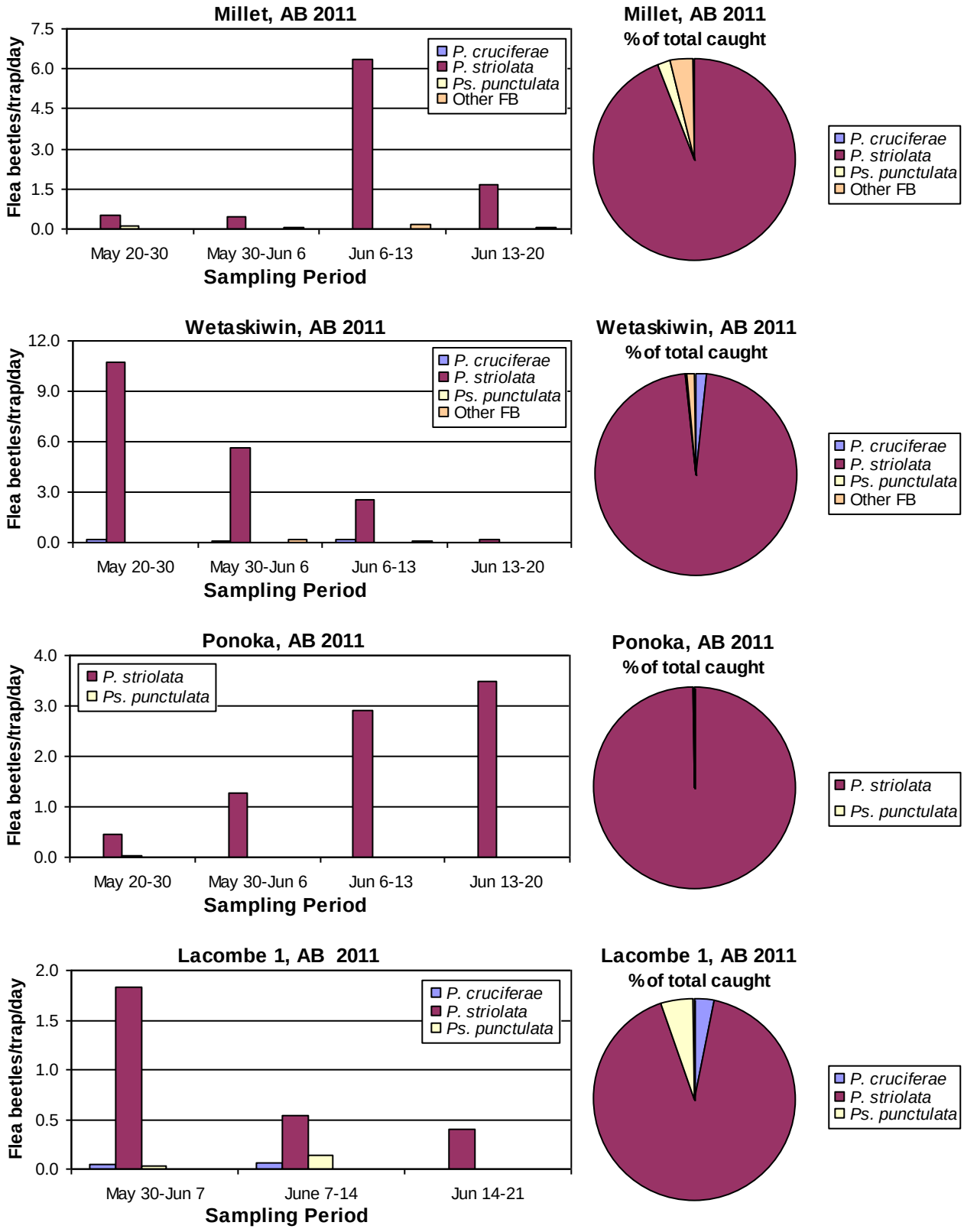


Figure 15 continued



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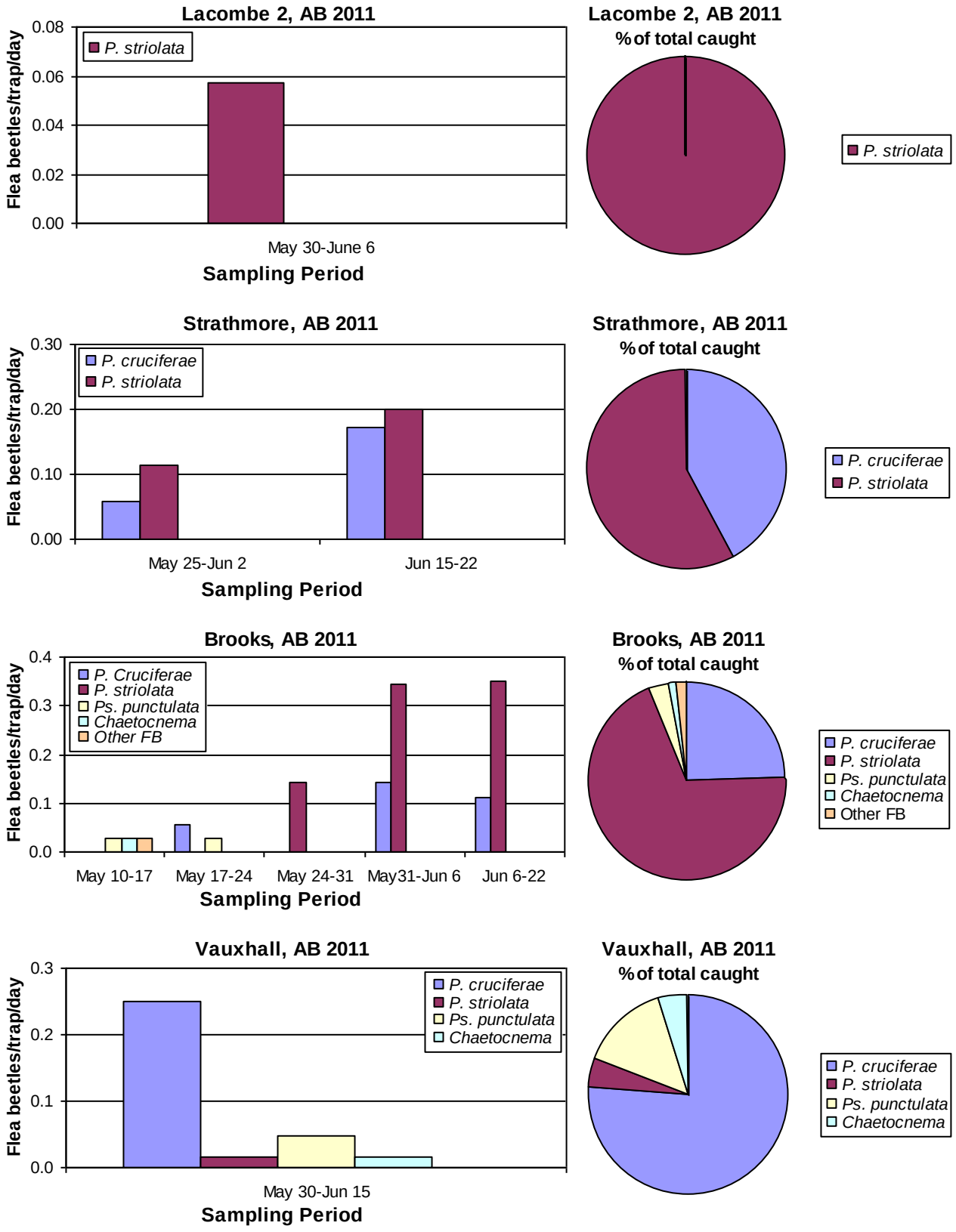


Figure 15 continued

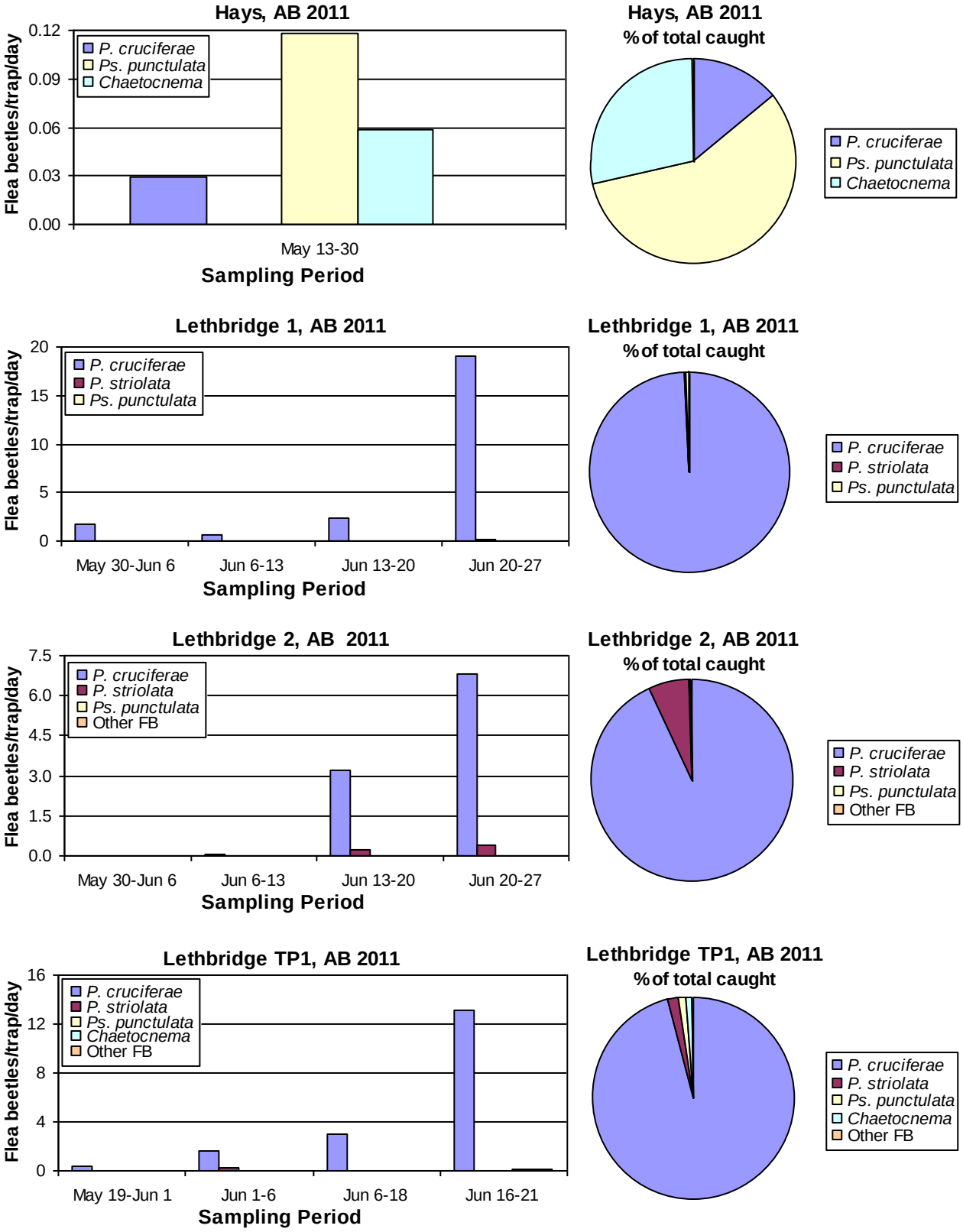


Figure 15 continued

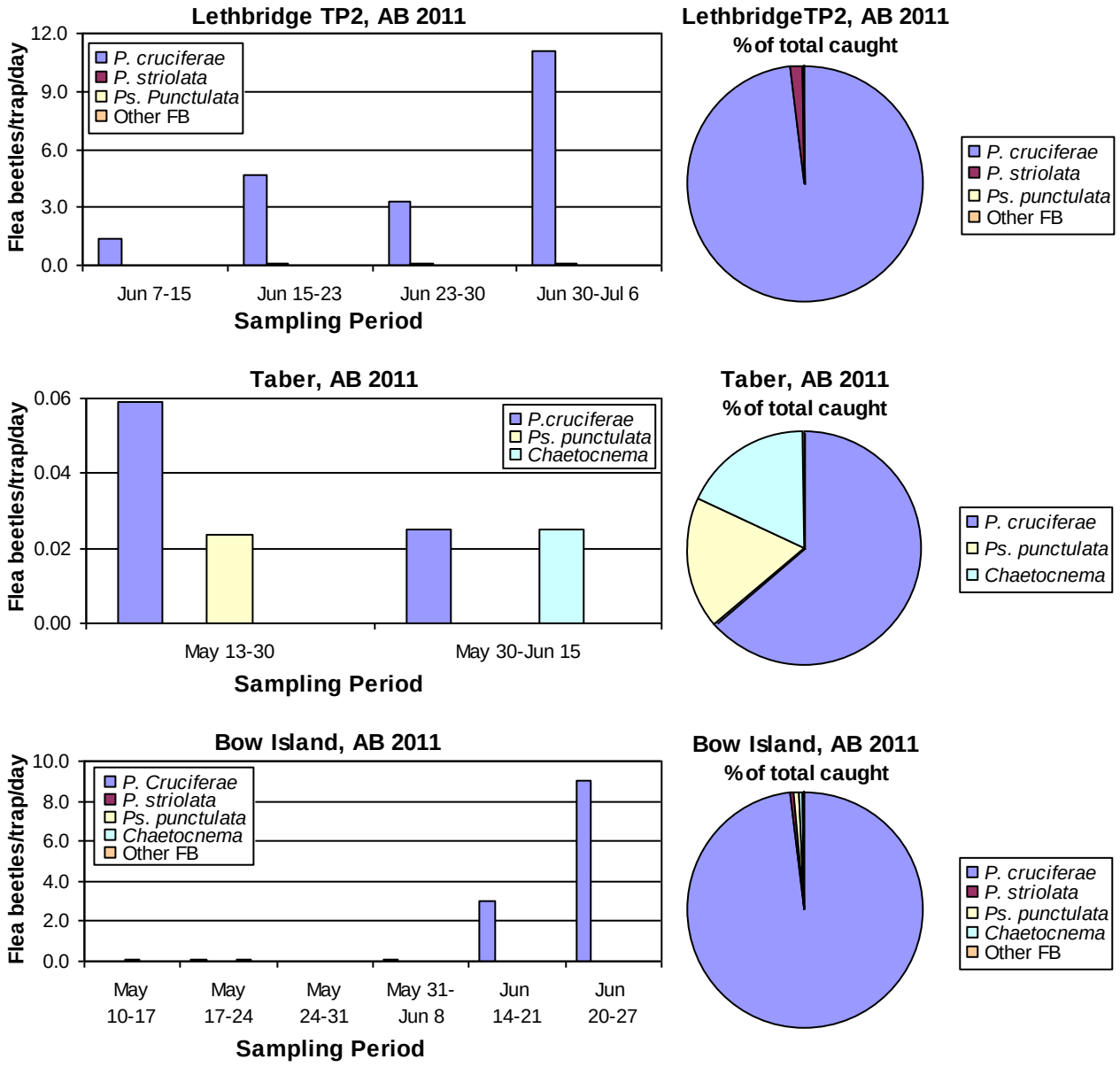


Figure 16. Flea beetle numbers and species composition on yellow sticky traps placed in or near canola fields in Saskatchewan, 2011.

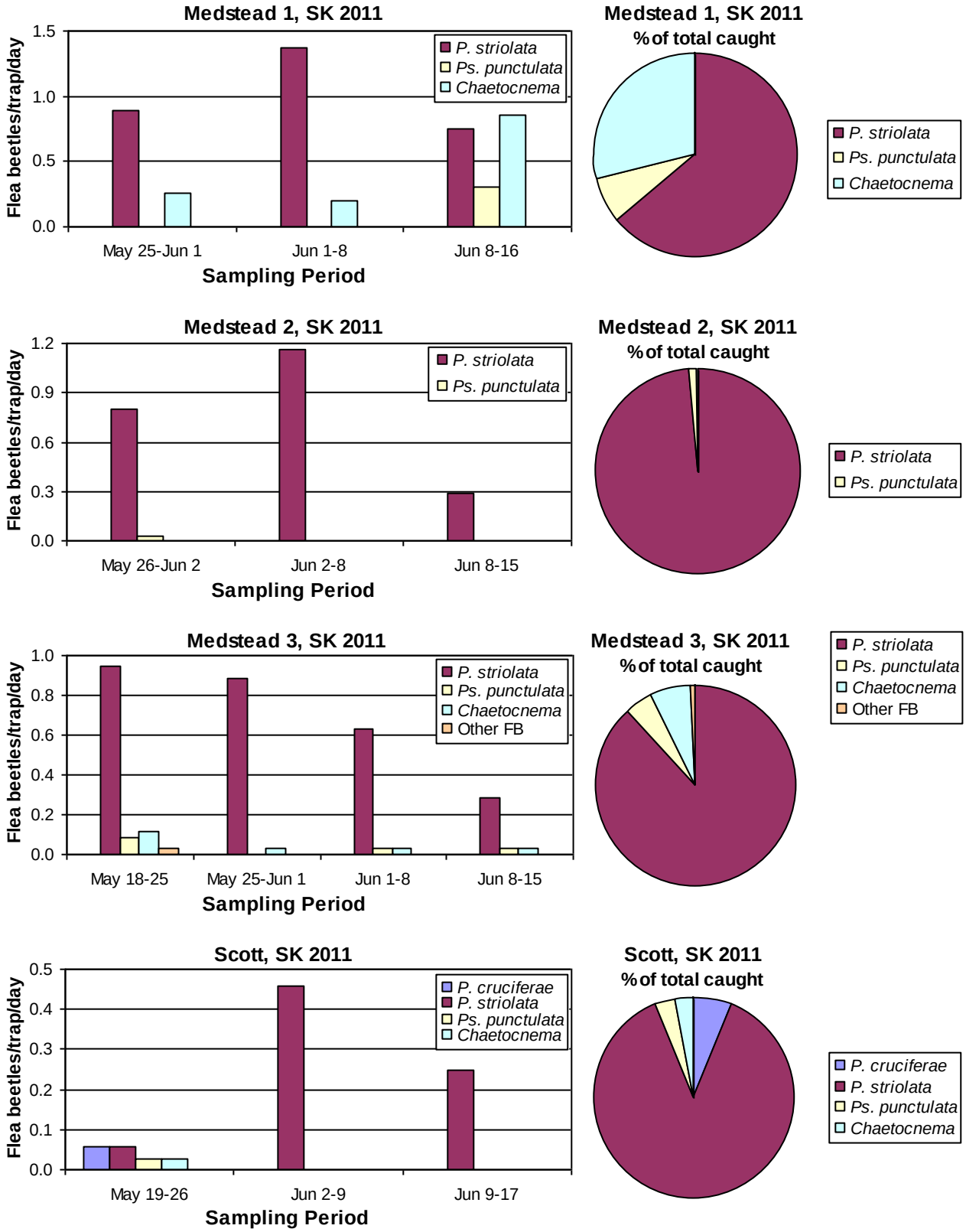


Figure 16 continued

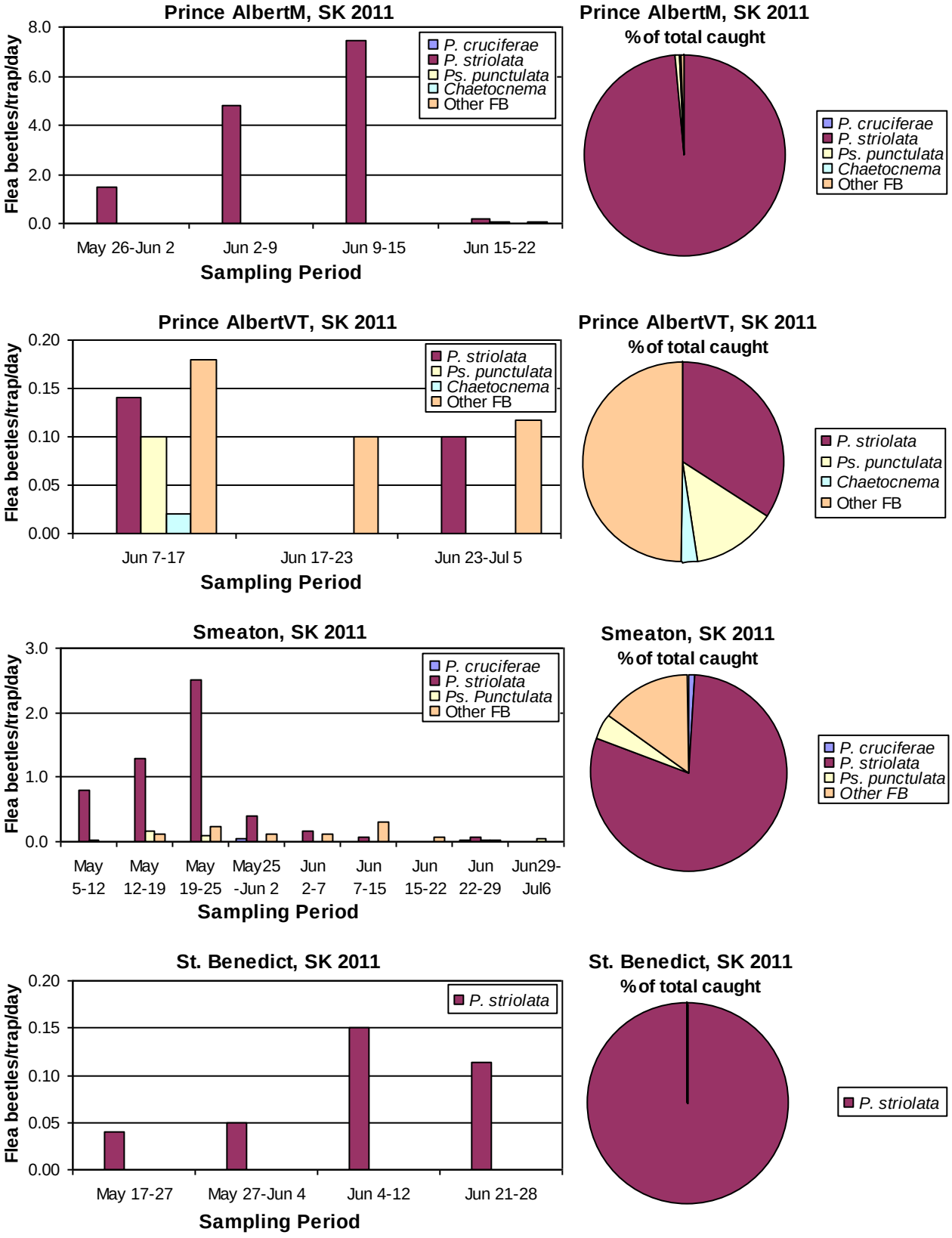
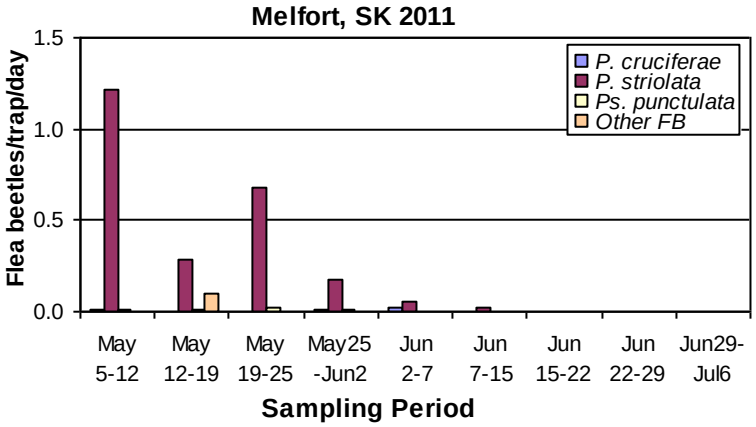
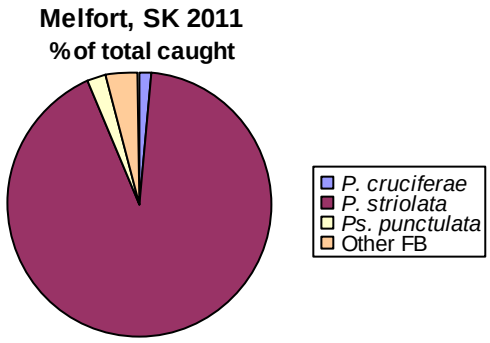
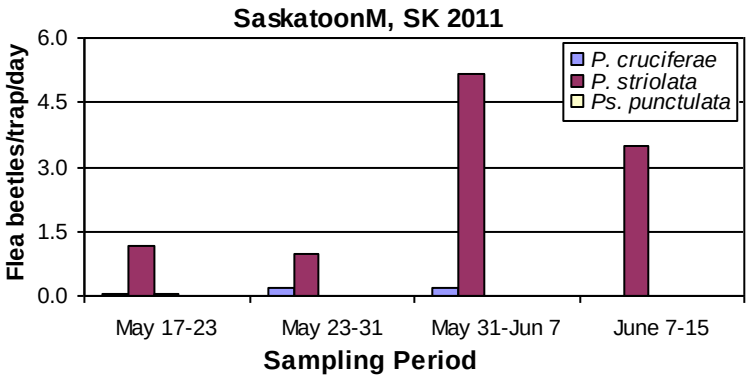
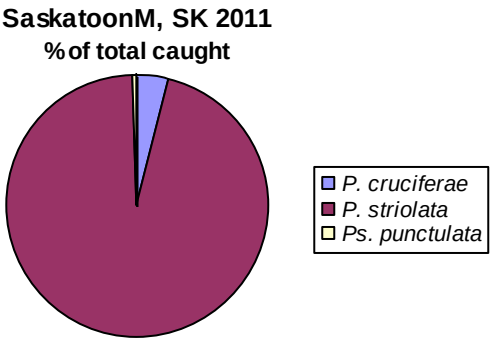


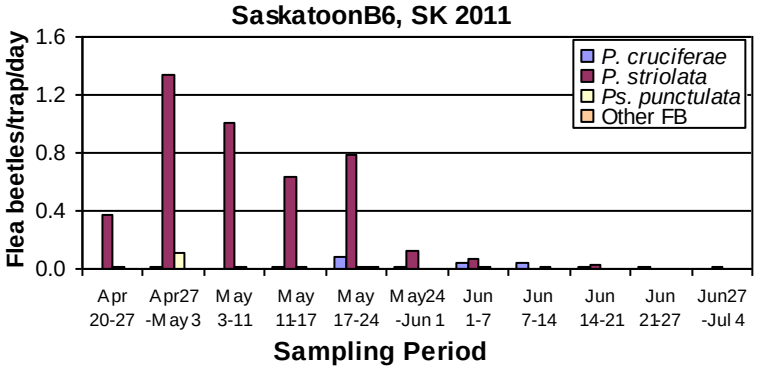
Figure 16 continued

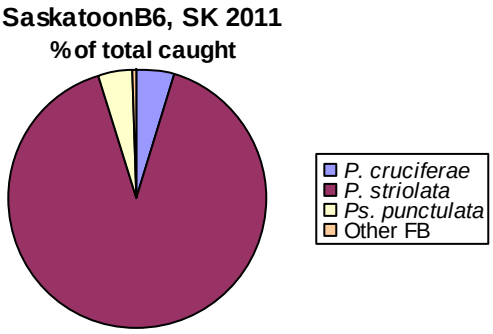


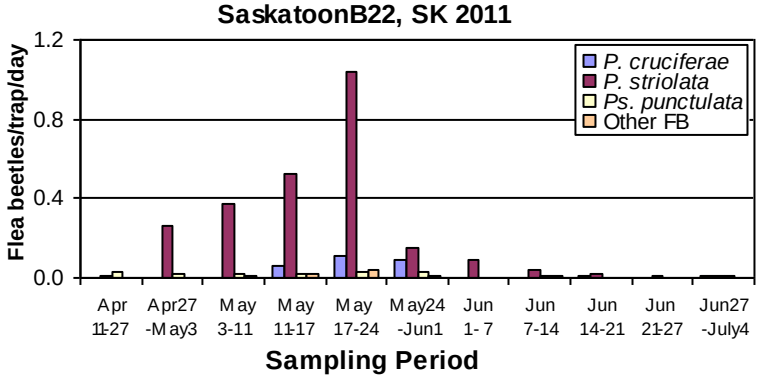


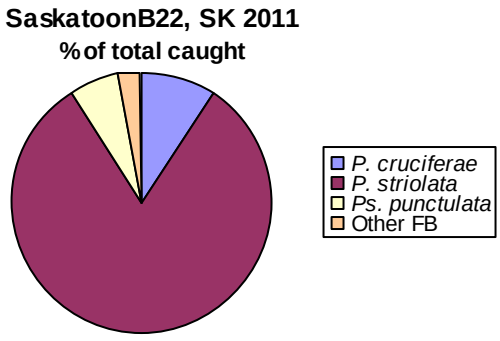












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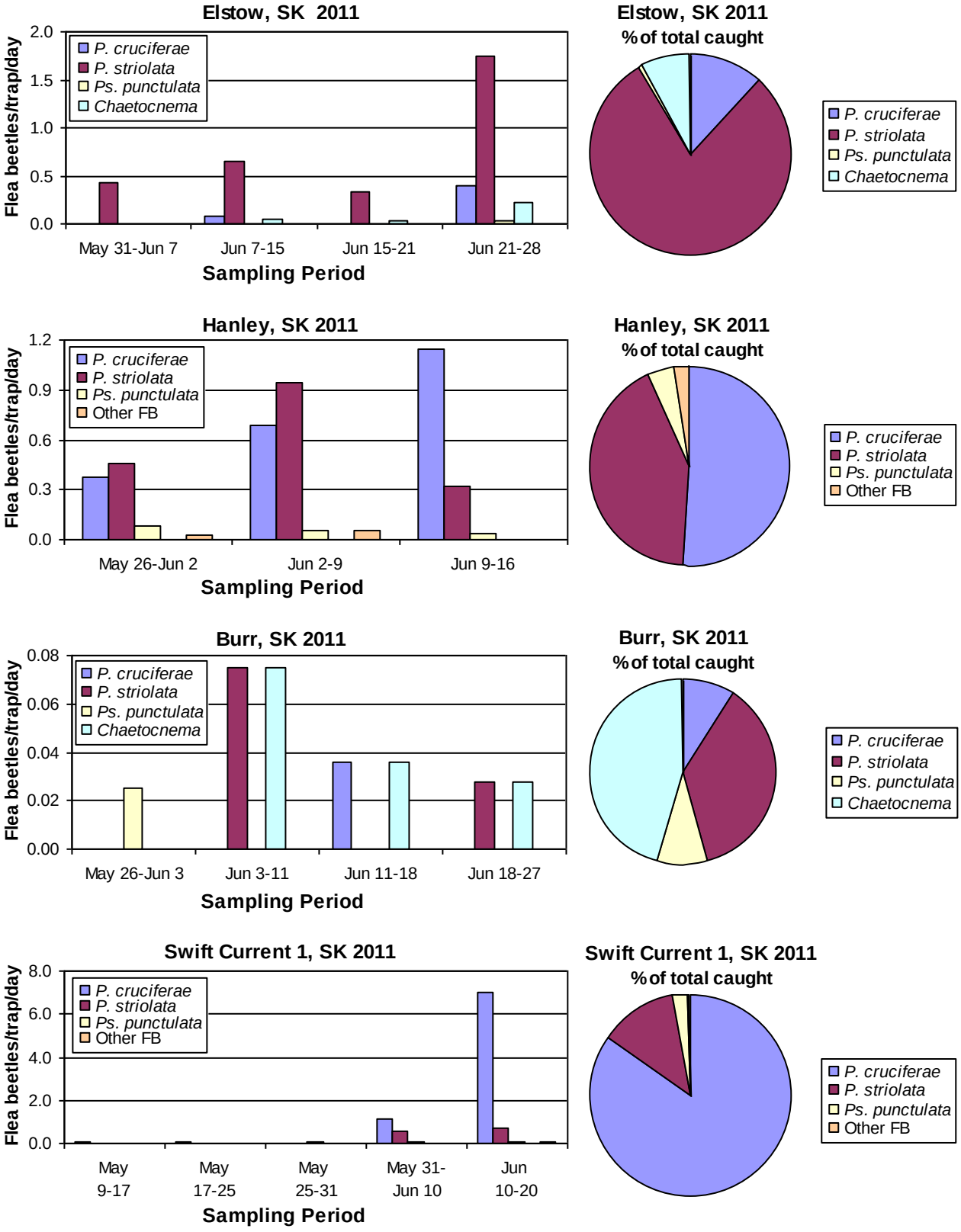

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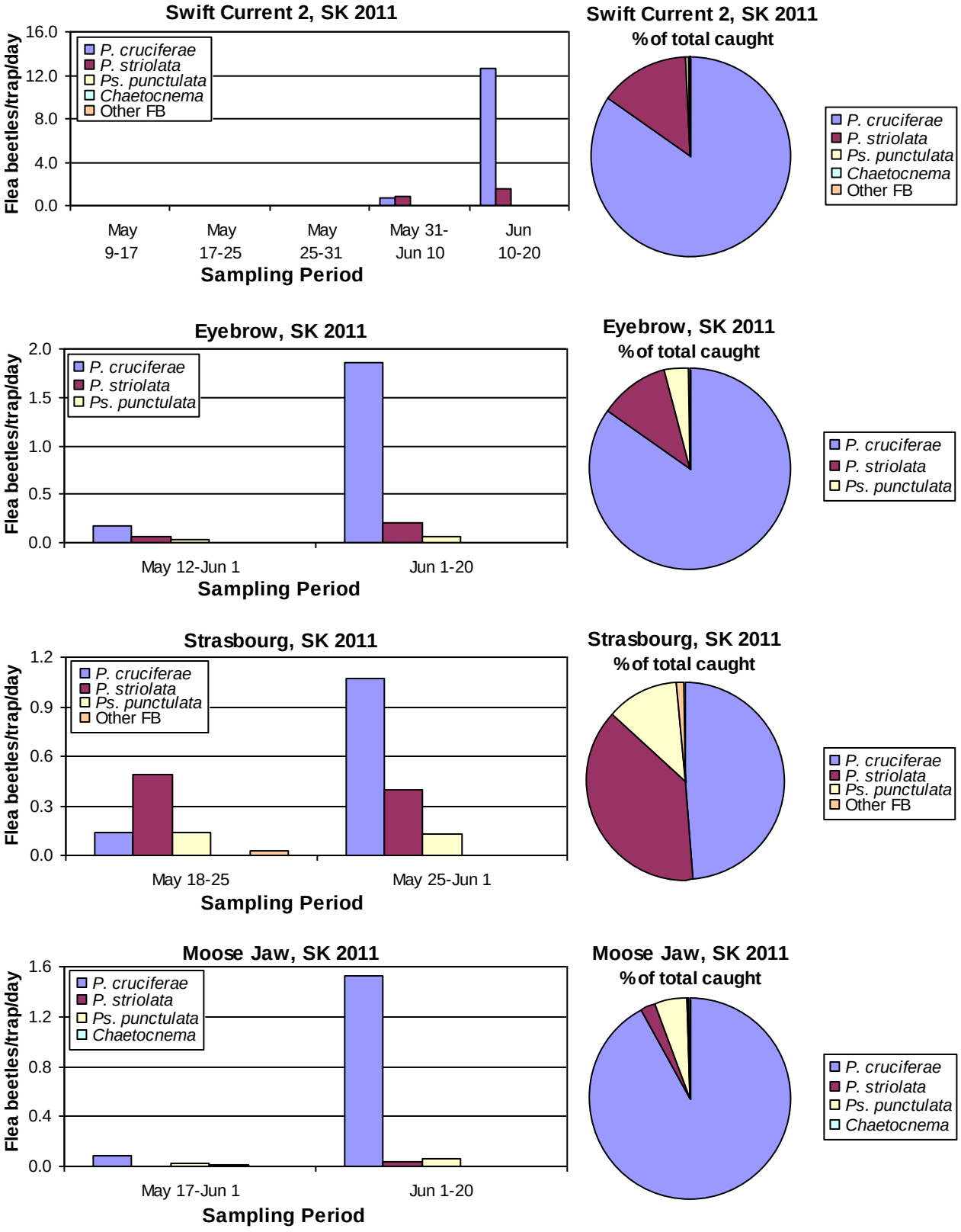

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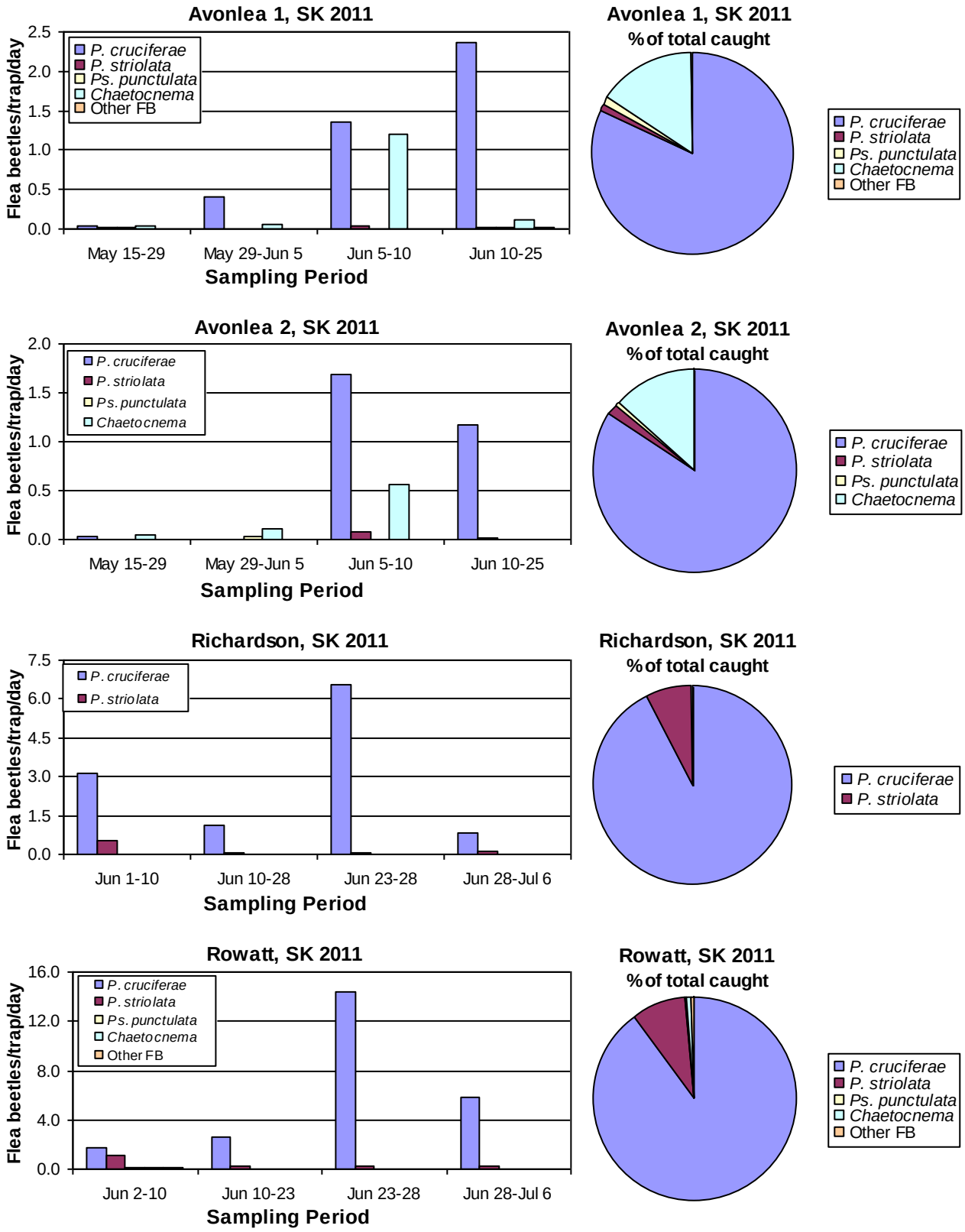

Figure 16 continued

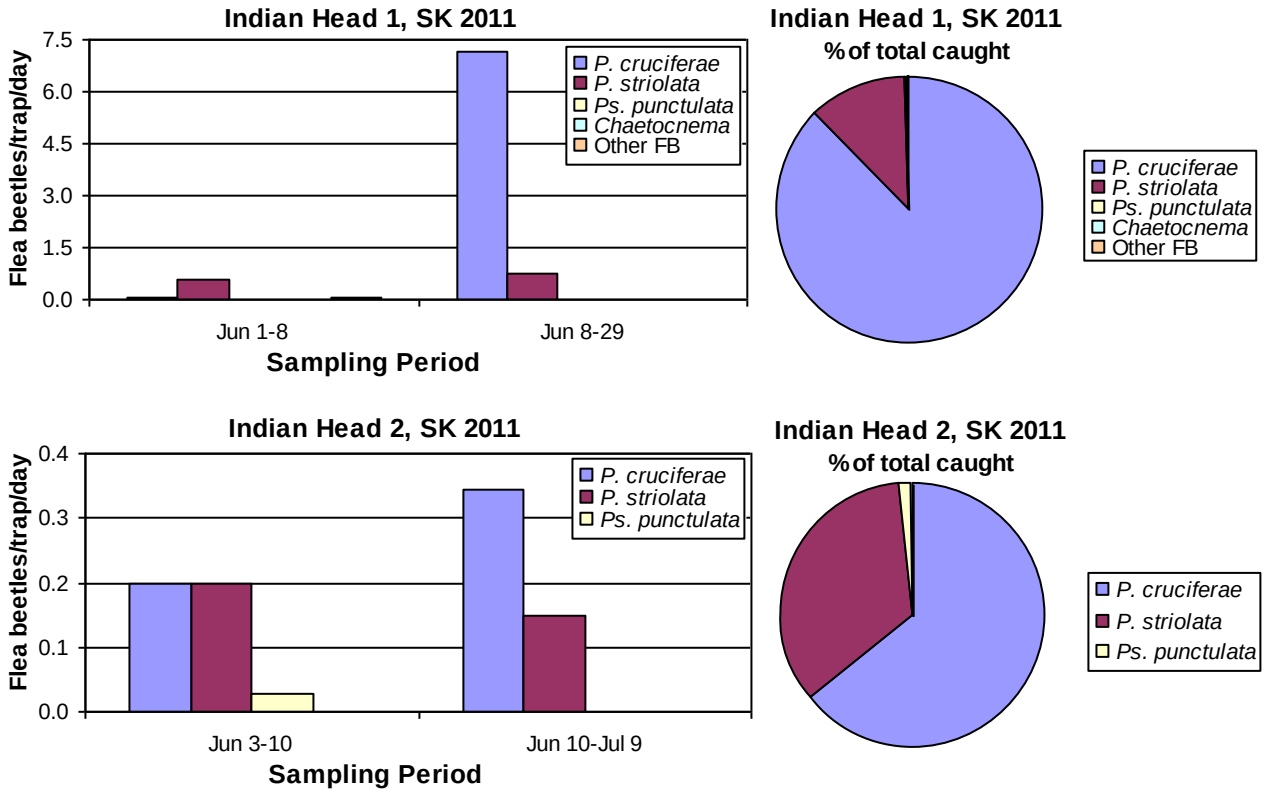

Figure 17. Flea beetle numbers and species composition on yellow sticky traps placed in or near canola fields in Manitoba, 2011.

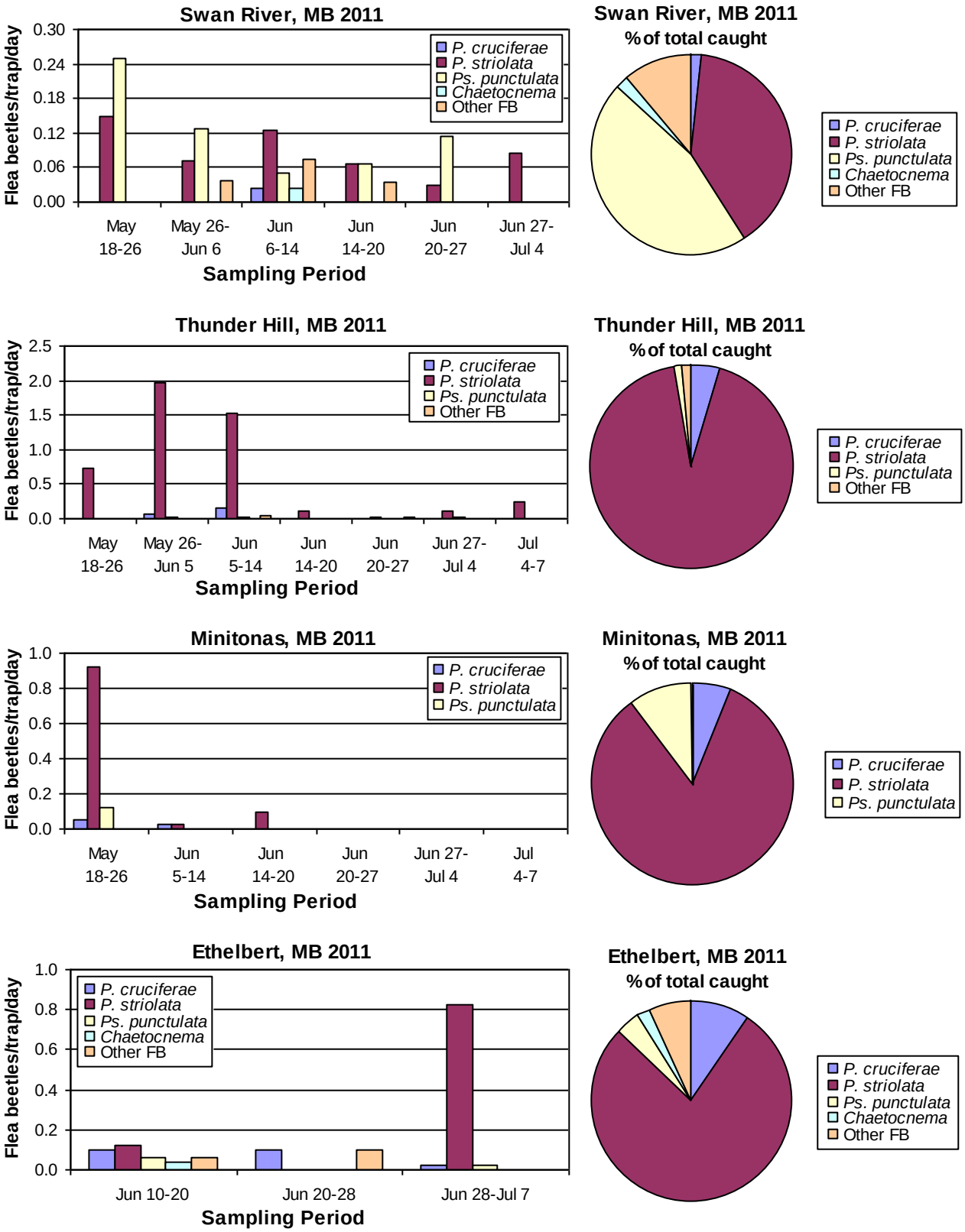

Figure 17 continued

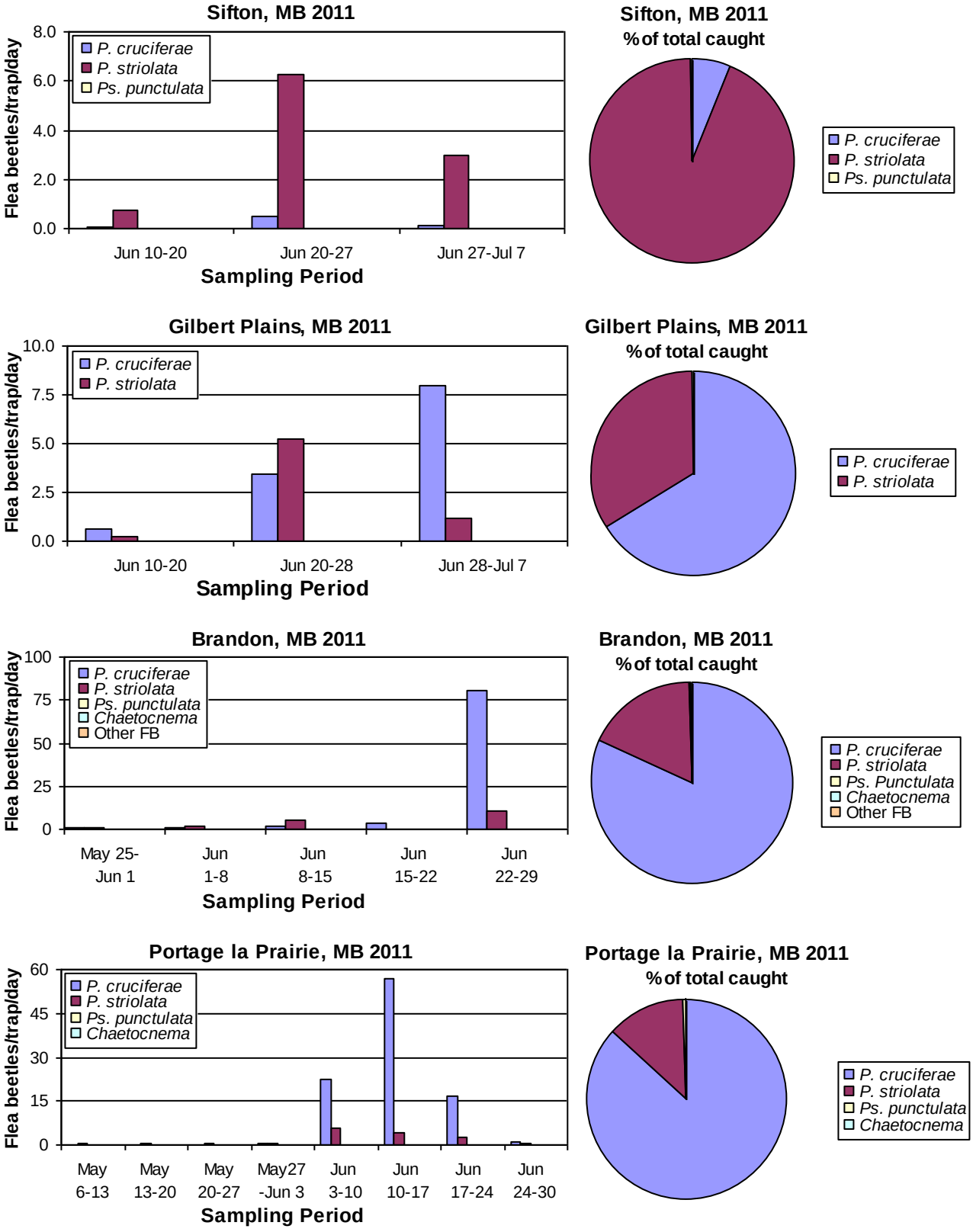

Figure 17 continued

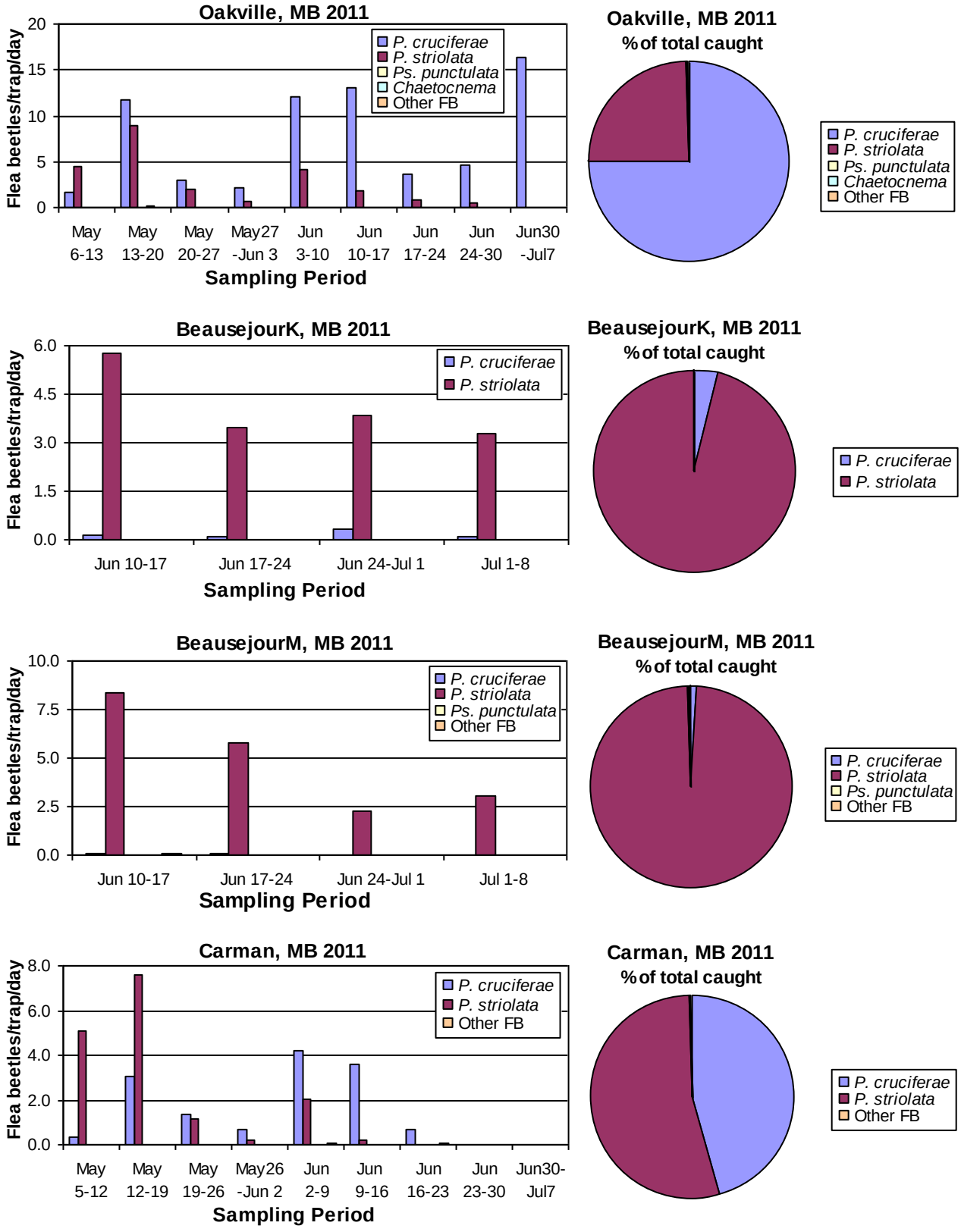

Figure 17 continued

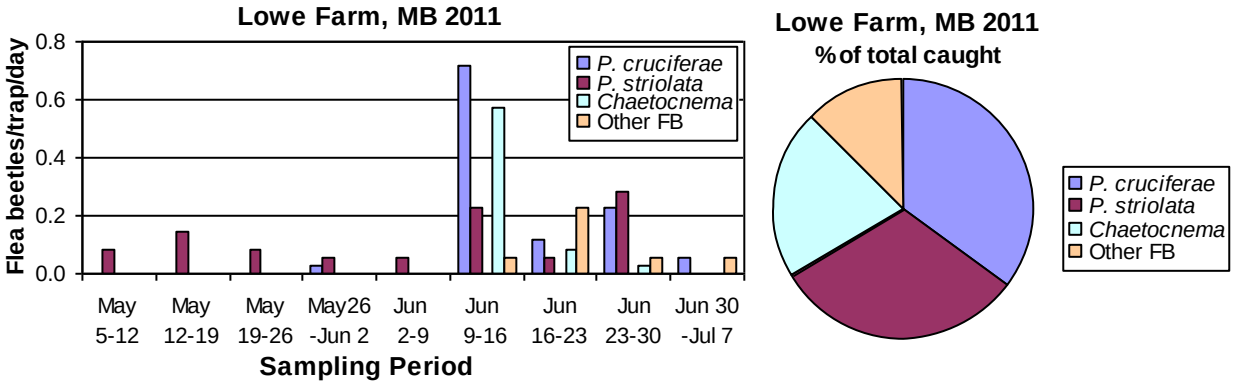

Figure 18. Flea beetle numbers and species composition on yellow sticky traps placed in or near canola fields in North Dakota, 2011.

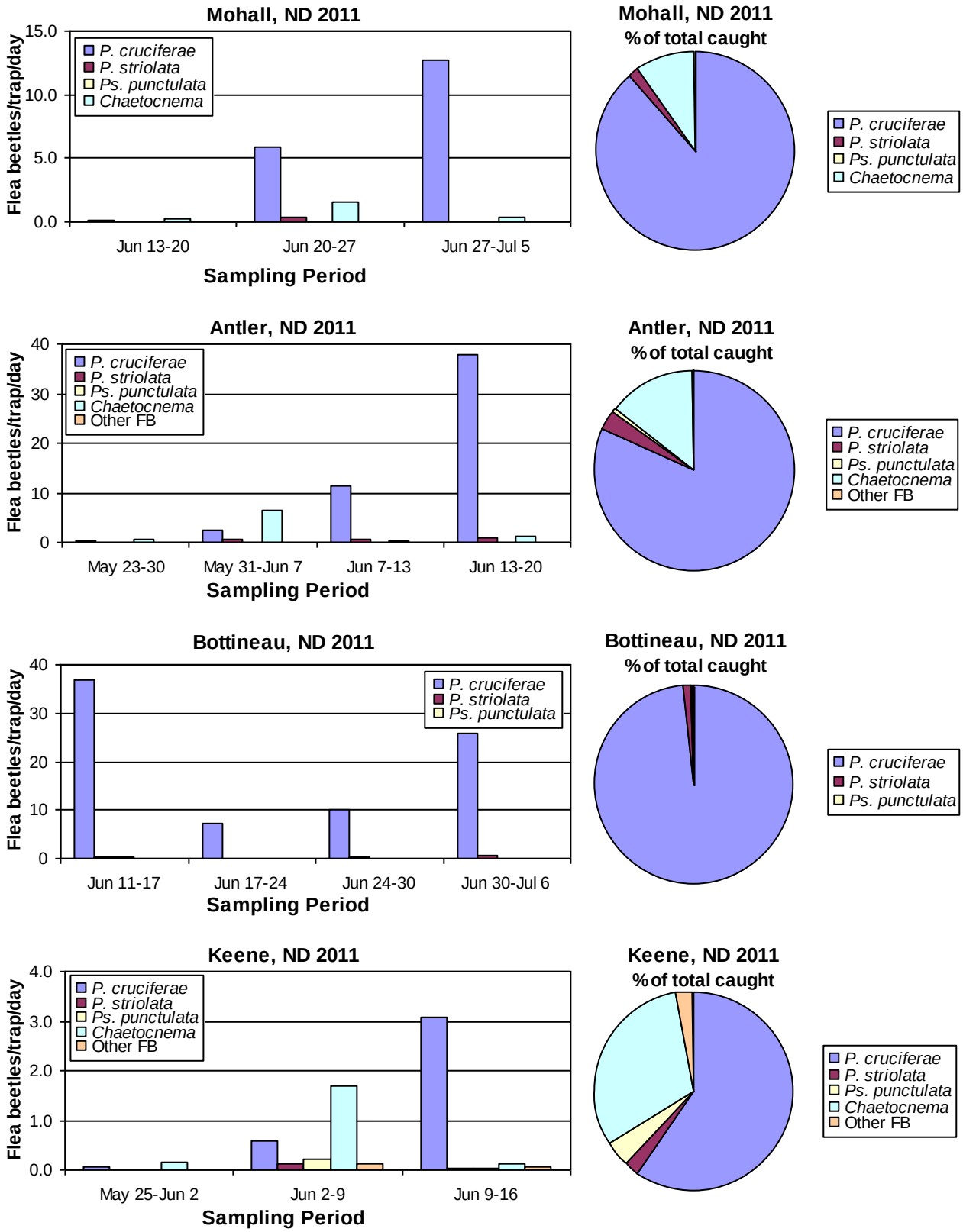

Figure 18 continued

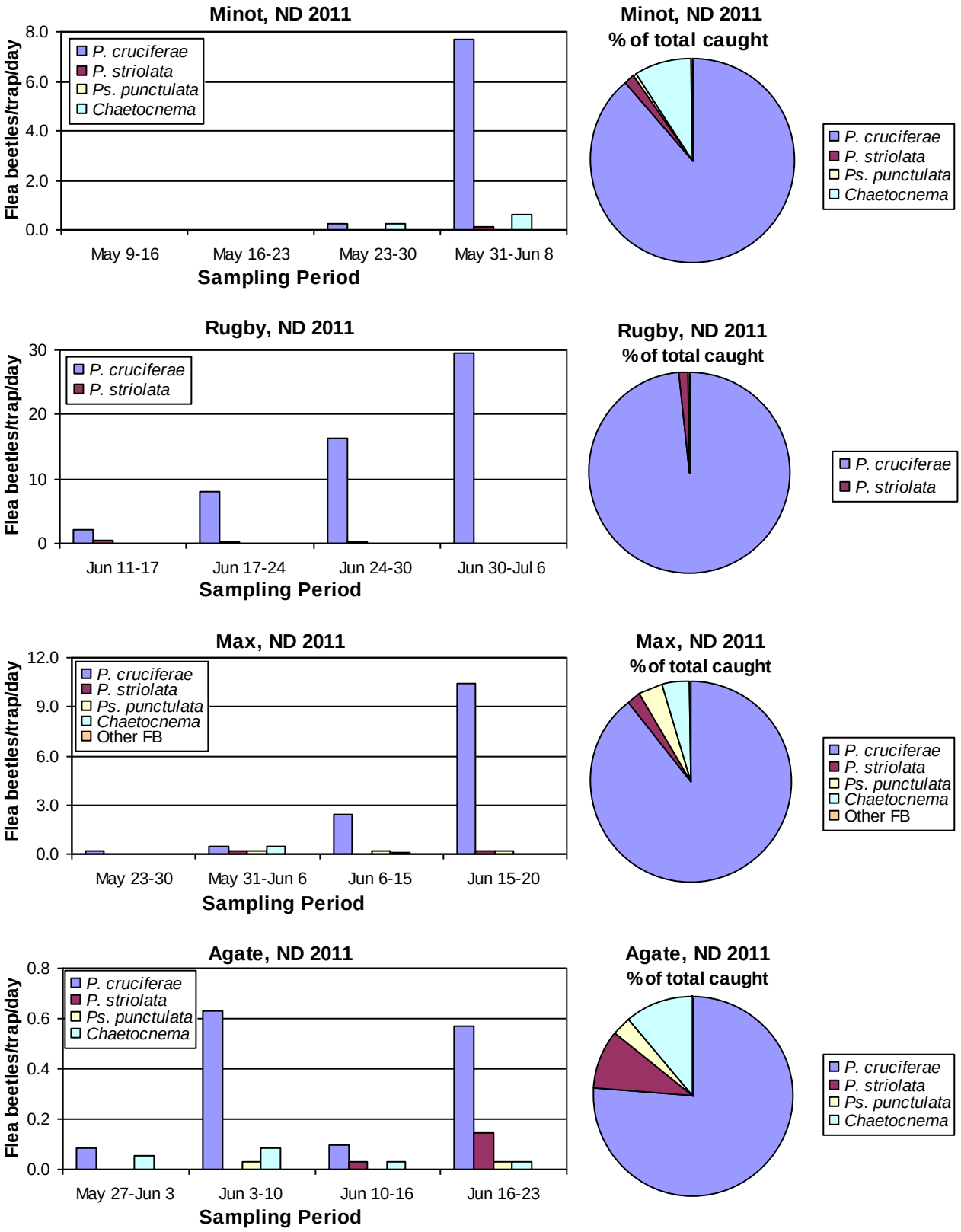

Figure 18 continued

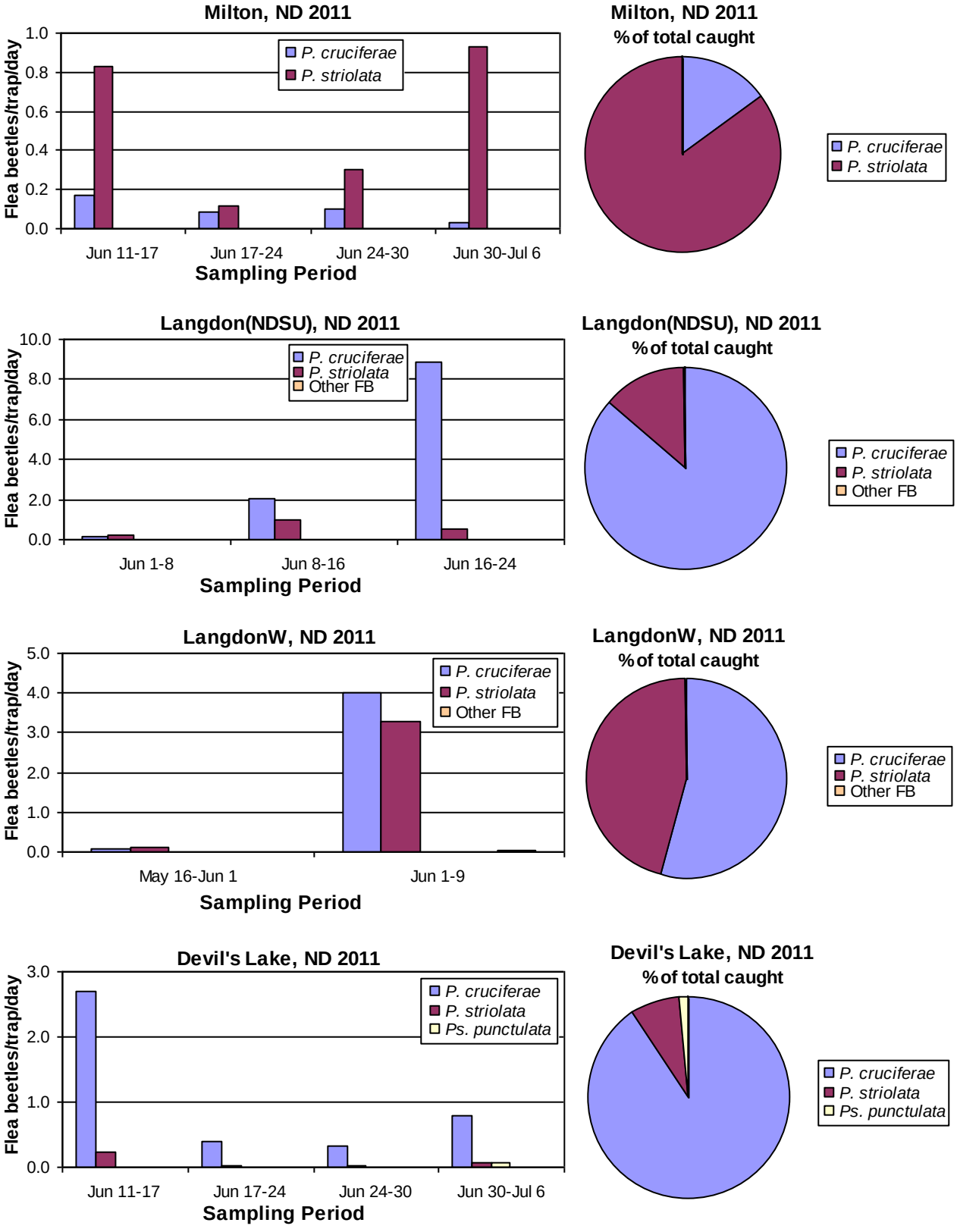

Figure 18 continued

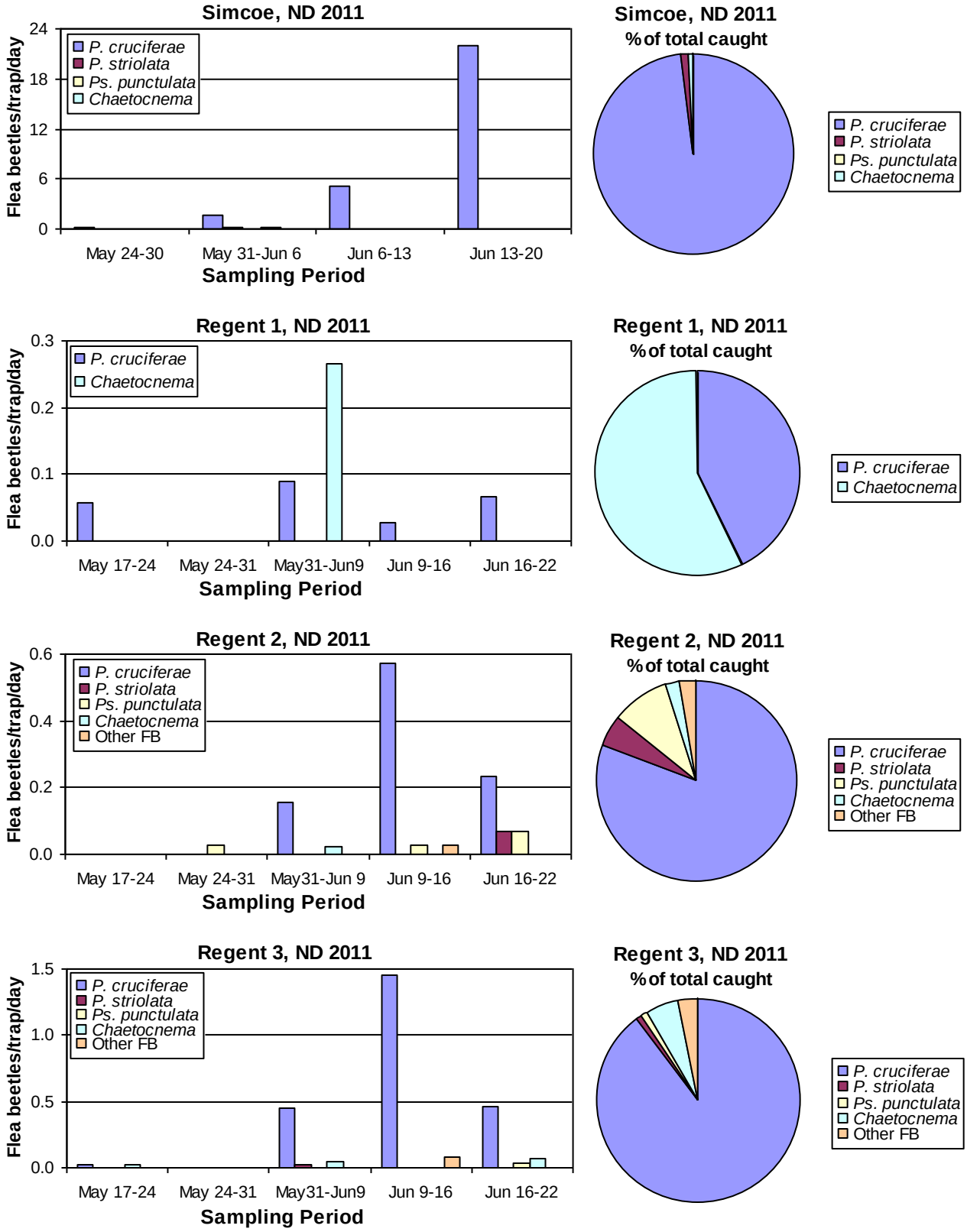

Figure 18 continued

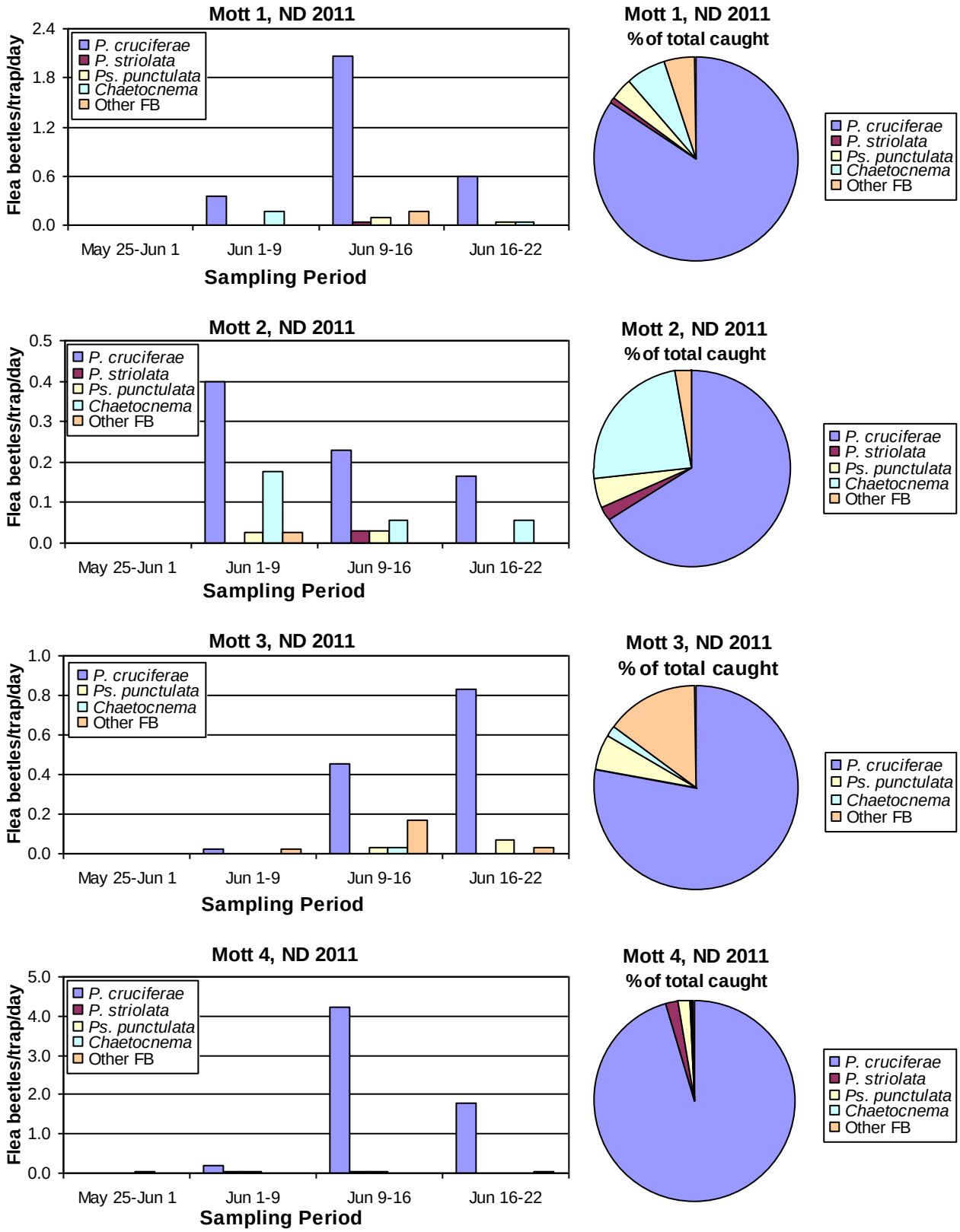

Figure 18 continued