CANDIDATE ASSESSMENT AND LISTING PRIORITY ASSIGNMENT FORM

SCIENTIFIC NAME: *Hypolimnas octucula mariannensis*

COMMON NAME: Mariana eight spot butterfly

LEAD REGION: 1

INFORMATION CURRENT AS OF: February 2003

STATUS/ACTION (Check all that apply):
___ New candidate
_X_ Continuing candidate
_X_ Non-petitioned
___ Petitioned - Date petition received: ___
___ 90-day positive - FR date: ___
___ 12-month warranted but precluded - FR date: ___
___ Listing priority change
Former LP: ___
New LP: ___
Latest date species first became a Candidate: September 19, 1997
___ Candidate removal: Former LP: ___ (Check only one reason)
___ A - Taxon more abundant or widespread than previously believed or not subject to a degree of threats sufficient to warrant issuance of a proposed listing or continuance of candidate status.
___ F - Range is no longer a U.S. territory.
___ M - Taxon mistakenly included in past notice of review.
___ N - Taxon may not meet the Act's definition of "species."
___ X - Taxon believed to be extinct.

ANIMAL/PLANT GROUP AND FAMILY: Butterfly (Nymphalidae)

HISTORICAL STATES/TERRITORIES/COUNTRIES OF OCCURRENCE: Guam; Commonwealth of the Northern Mariana Islands (Saipan)

CURRENT STATES/COUNTIES/TERRITORIES/COUNTRIES OF OCCURRENCE: Guam

LEAD REGION CONTACT (Name, phone number): Scott McCarthy, 503-231-6131

LEAD FIELD OFFICE CONTACT (Office, name, phone number): Pacific Islands (Ecological Services), Mike Richardson, 808-541-3441

BIOLOGICAL INFORMATION:

This subspecies is endemic to the islands of Guam and Saipan in the Mariana archipelago. The larvae of this butterfly feed on two native plants, *Procris pedunculata* and *Elatostema calcareum*. Both of these forest herbs (Family Urticaceae) grow only on karst limestone, thus

limiting the breeding habitat of this butterfly. The Mariana eight spot butterfly was apparently always uncommon on Guam but is currently in decline due to a recent drought and browsing of the host plants by alien deer (Schreiner and Nafus 1996). Recent surveys of the remote northern Mariana islands did not find this species (Miyano 1994). During a recent survey of Saipan, several areas were found that supported good populations of the host plants, but no individuals of *Hypolimnas octucula mariannensis* were seen (Schreiner and Nafus 1996); the species is considered to be extinct on that island. Although the island of Rota has no records of the Mariana eight spot butterfly, this island was also surveyed but no butterflies were found (Schreiner and Nafus 1996).

Recent surveys on the island of Guam located 10 populations of *Hypolimnas octucula mariannensis* (Schreiner and Nafus 1996). The major threats to these remaining populations are browsing of the host plants by alien deer, development of lands in or near areas that currently support populations, wildfires in the southern mountains where two populations remain, and extremely high mortality (99+ percent) of eggs and larvae due to predation by alien ants and wasps.

THREATS:

A. <u>The present or threatened destruction, modification, or curtailment of its habitat or range</u>.

The host plant of this butterfly is still present on Guam but has severely declined as result of development, browsing by feral deer, and displacement by alien species. Loss of habitat plus the predation by alien parasitoids have probably been the major factors in the decline and extinction of this butterfl

Prior to the arrival of humans, the Mariana Islands were believed to be mostly forested (Fosberg 1960, 1971). The intact structure of native Mariana forests has four general levels: the high trees; the shrubs and *Panadanus*; the cycads and taller ferns; and the succulent herbs (Crampton 1925; Fosberg 1960, 1971). With the arrival and population growth of the aboriginal Chamorro people 4,000 years ago (Carano and Sanchez 1964), native forests began to be cleared and savanna grasslands began to develop (Mueller-Dumbois 1981). During the Spanish occupation of the Mariana Islands (1521-1899), alien goats, pigs, cattle, and deer were introduced. Extensive herds of cattle were noted on the main islands, with some herds numbering in excess of 10,000 head. Large numbers of pigs, goats and deer were also present (Engbring *et al.* 1986, Carano and Sanchez 1964). In 1742, the forested areas on the island of Tinian were described as park-like and open (Engbring *et al.* 1986 citing Anson's journal as cited by Walter 1928). These animals along with extensive logging further contributed to the expansion of savanna grasslands and directly altered the understory plant community and overall forest microclimate. All of these changes resulted in a continuing decline in area and quality of butterfly habitat.

The German occupation of the Mariana Islands (1899-1914) resulted in few ecological changes, although there was a recorded increase in the populations of Chamorros and Carolinians that settled on Saipan and actively developed coconut orchards (Engbring *et al*. 1986).

Sweeping ecological changes took place during the Japanese occupation from 1914-1944 (Kanehira 1936; Fosberg 1960; 1971; Engbring *et al*. 1986). Extensive removal of native forests for the development of sugar cane was pursued on all of the main islands. These fields covered

almost all of Tinian and much of Guam, Saipan, Rota, and Aguijan. In 1920, Crampton (1925) stated that much deforestation had occurred in the southern half of Guam and that the savanna grassland habitat(which is unsuitable for this butterfly) had greatly expanded during "recent centuries". He also notes that extensive wood cutting has reduced the forest canopy.

During and after World War II, dramatic reductions in butterfly forest habitat occurred on the islands of Guam, Tinian, Rota, and Saipan where major military operations, bombing, and landings were conducted. Following the war, open agricultural fields and other areas prone to erosion were seeded with tangantangan (*Leucaena leucocephala*) by the U.S. Military (Fosberg 1960). Tangantangan grows as a single species stand with no substantial understory. The microclimatic conditions are dry, with little accumulation of leaf litter humus (Hopper and Smith 1992), and is particularly unsuitable as butterfly habitat. In addition, native forest cannot reinvade and grow where this alien weed has become established (Hopper and Smith 1992). The post-war establishment and operation of large military bases has also prevented the return of native forest that could support Partulid tree snails. Today on the island of Guam, the U.S. military occupies approximately 17,500 hectares (ha) (708 acres (ac)) or 30 percent of the island, most (90+ percent) of which once was forested habitat that supported this endemic butterfly.

The native butterfly habitat on the main islands of the Commonwealth of the Northern Mariana Islands has been greatly reduced by development and agricultural activities (Engbring *et al*. 1986). For instance, most of the island of Rota was forested in 1932, but by 1935 almost all level areas has been cleared of forest to support sugar cane production and phosphate mining (Kanehira 1936). The only areas left undisturbed were too steep for agriculture, generally along the base of cliffs, which are an extensive geological feature of the island. These areas still support native limestone forests (Fosberg 1960). During World War II, Rota was heavily bombed (Farrell 1991) and aerial photos from this period show that most of the island was riddled with bomb craters and denuded of vegetation. Following the War, much of this area was given over to cattle grazing, urban growth, and airport development. In some areas, native forest has reestablished (Engbring *et al*. 1986; Falanruw et al. 1989). In 1988, supertyphoon Roy hit Rota with winds in excess of 240 kilometers per hour (150 miles per hour), defoliating almost all of the forested areas and downing trees, especially along the southeast and northern cliff slopes of the central Sabana (Fancy and Snetsinger 1996). Vegetation changes associated with this storm have opened up forested areas to desiccation and invasion by alien weeds, making them unsuitable as butterfly habitat.

Events and changes similar to those described for Rota also apply to the island of Saipan where most of the native forest is gone. Falanruw *et al*. (1989) reported that only 4% of the native forest that would support habitat for this butterfly is left on Saipan. The remaining area has been replaced by mixed second growth forests, savanna grasslands, dense thickets of tangantangan (due to military aerial seeding), agroforests, and urban areas. None of these vegetation types provide suitable habitat for the Mariana eight spot butterfly.

B. <u>Overutilization for commercial, recreational, scientific, or educational purposes</u>.

Rare butterflies and moths are highly prized by collectors (Morris *et al*. 1991), who often take all individuals obtainable (59 FR 18350; U.S. Department of Justice, *in litt*. 1993). For instance, there has been a standing reward for specimens of the rare Hawaiian sphinx moth (*Tinostoma smargditis*) (Zimmerman 1958), and specimens of the rare Blackburn's sphinx moth (*Manduca*

blackburni) have already been secured and traded by collectors (David Preston, B.P. Bishop Museum, pers. comm., 1994). The listing of butterflies as Federally endangered may increase its attractiveness to collectors of rare species (U.S. Department of Justice, *in litt.*, 1993). Unrestricted collecting and handling are known to impact populations of other species of rare Lepidoptera (Murphy 1988) and are considered significant threats to the Mariana eight spot butterfly.

C. Disease or predation.

Numerous alien predators and parasitoids of Lepidoptera have become established, purposefully or adventively, in the Mariana Islands and these have been documented to attack and significantly impact other species of native butterflies (Nafus 1989, 1992, 1993 a,b,c; Peterson 1957; Schreiner and Nafus 1986). These alien predators and parasitoids undoubtedly contribute to the decline of this butterfly. In addition, on average, two new alien species of arthropods become established each year in the Marianas, and the possibility of the establishment of additional predators and parasitoid that will attack this species is a significant threat.

Ants can be particularly destructive predators because of their high densities, recruitment behavior, aggressiveness, and broad range of diet (Reimer 1993). The latter attribute allows some ants to affect prey populations independent of prey density, and ants can therefore locate and destroy isolated individuals and populations (Nafus 1993a). Ants prey on all immature stages of Lepidoptera and can completely exterminate populations (Illingworth 1915; Zimmerman 1958). During some times of the year, alien ants destroyed virtually all the eggs of the related butterfly *Hypolimnas bolina* in Guam (Nafus 1992) and predation by alien ants is the primary cause of mortality (>90 percent) in *H. octocula marianensis* (Schreiner and Nafus 1996).

Small wasps in the family Trichogrammatidae parasitize insect eggs, with numerous adults sometimes developing within a single host egg. The taxonomy of this group is confusing but at least two native species attack the eggs of butterflies in the Mariana islands, including *H. octocula marianensis* (Schreiner and Nafus 1996). Several alien species are established in the Mariana islands, including, *Trichogramma chilonis* which effectively limits populations of the sweetpotato hornworm in Guam (Nafus and Schreiner 1986) and is a potential threat to the Mariana eight spot butterfly.

The introduced biological control agent, *Brachymeria lasus*, parasitizes up to 20 percent of the pupae of the related butterfly *H. bolina* in Guam (Nafus 1992). While this wasp has not been observed to attack *H. octocula marianensis*, only 16 pupae have been studied in the field, and this wasp is a potential threat to this rare butterfly (Drost and Carde 1992).

D. The inadequacy of existing regulatory mechanisms.

Listing of this animal species would provide legal protection for this species and should eventually lead to recovery efforts. Alien predatory and parasitic insects are one of the primary cause of the reduction in range and abundance of this butterfly. Some of these alien species have been purposefully introduced by the Territorial agricultural agencies (Nafus and Schreiner 1989) and importations and augmentations of lepidopteran parasitoids continues. Federal regulations for the introductions of biocontrol agents are inadequate (Howarth 1991; Lockwood

1993). Presently, there are no Federal statutes that require biocontrol agents to be reviewed before they are introduced, and the limited Federal review process requires consideration of potential harm only to economically important species (Miller and Aplet 1993). Existing regulations do not require post-release impacts on non-target organisms, and host range cannot be predicted from laboratory studies (Gonzalez and Gilstrap 1992; Roderick 1992). The purposeful release or augmentation of any lepidopteran predator or parasitoid is a potential threat to this butterfly (Simberloff 1992).

E. Other natural or manmade factors affecting its continued existence.

The ten remaining populations of the Mariana eight spot butterfly increases the potential for extinction from stochastic events. These butterflies are good fliers and in an undisturbed setting probably existed as a series of metapopulations (Harrison *et al*. 1988), with considerable movement between demes and continued colonizations and extinctions in disparate localities. Alien predators and parasitoids, and the loss of its host plant, have extirpated all populations of this butterfly on Saipan and have greatly reduced its numbers on Guam. If the Guam populations are severely reduced or eliminated, there will be less potential for recolonization or "rescue" (Brown and Kodric-Brown 1977) of the remaining population by immigrants (Arnold 1983). The current distances between populations represents a severe threat to gene flow and the maintenance of genetically healthy populations.

New purposeful introductions or augmentative releases of existing parasitoids for control of pest Lepidoptera pose a great threat to this species. The small geographic areas where this species still exists puts it at risk of stochastic extinction from natural events (typhoons) and normal population fluctuations.

FOR RECYCLED PETITIONS:

a. Is listing still warranted? ___
b. To date, has publication of a proposal to list been precluded by other higher priority listing actions? __
c. Is a proposal to list the species as threatened or endangered in preparation? __
d. If the answer to c. above is no, provide an explanation of why the action is still precluded.

LAND OWNERSHIP:

The lands that support populations of this butterfly are owned by private landowners (three populations), the Government of Guam (one population), and the U.S. Government (six populations).

PRELISTING:

On Guam, the U.S. Fish and Wildlife Service is pursuing the establishment of an 11,395 ha (28,158 ac) refuge overlay on military lands. This would cover 19.6 percent of the total land area of the island of Guam, and would include five of the 10 remaining populations of this species.

REFERENCES:

Arnold, R.A. 1983. Ecological studies of six endangered butterflies (Lepidoptera, Lycaenidae): Island biogeography, patch dynamics, and design of habitat preserves. Univ. Calif. Pub. Entomol. 99:1-161.

Brown, J.H. and A. Kodric-Brown. 1977. Turnover rates in insular biogeography: effect of immigration on extinction. Ecology 58:445-449.

Carano, P. And P.C. Sanchez. 1964. A complete history of Guam. Charles E. Tuttle, Inc., Rutland, Vermont. 452pp.

Crampton, H.E. 1925. Studies on the variation, distribution, and evolution of the genus *Partula*. The species of the Mariana Islands, Guam and Saipan. Carnegie Institute of Washington Publication 228A. vii + 116 p., 14 pl.

Drost, Y.C., and R.T. Carde. 1992. Host switching in *Brachymeria intermedia* (Hymenoptera: Chalcididae), a pupal endoparasitoid of *Lymantria dispar* (Lepidoptera: Lymantriidae). Environ. Entomol. 21: 760-766.

Engbring, J., F.L. Ramsey, and V.J. Wildman. 1986. Micronesian forest bird survey, 1982: Saipan, Tinian, Agiguan, and Rota. U.S. Fish Wildl. Serv., Region 1, Portland, Oregon.

Falanruw, M.C., T.G. Cole, and A.H. Ambacher. 1989. Vegetation survey of Rota, Tinian, and Saipan, Commonwealth of the Northern Mariana Islands. Resour. Bull. PSW-27. Berkeley, CA: Pacific Southwest Forest and Range Experiment Station, Forest Service, U.S. Department of Agriculture. 11pp +13 maps.

Fancy, S.G. and T.J. Snetsinger. 1996. Potential reasons for the decline of the bridled white-eye population on Rota, Mariana Islands. Unpublished report, U.S. Geological Survey, Biological Resources Division, Pacific Islands Ecosystems Research Center, Hawaii National Park, Hawaii.

Farrell, D.A. 1991. History of the Northern Mariana Islands. Public School system, Commonwealth of the Northern Mariana Islands.

Fosberg, F.R. 1960. The vegetation of Micronesia. Bull. Am. Mus. Nat. Hist. 119:1-75.

Fosberg, F.R. 1971. On present conditions and conservation of forests in Micronesia. In: Pacific Science Association Standing committee on Pacific Botany. Symposium: Planned utilization of the lowland tropical forests. Bogor, Indonesia.

Gonzalez, D. and F.E. Gilstrap. 1992. Foreign Exploration: Assessing and prioritizing natural enemies and consequences of preintroduction studies: in Kauffman, W.C. and J.E. Nechols (eds), Selection Criteria and Ecological Consequences of Importing Natural Enemies. Thomas Say Publications in Entomology: Proceedings. Entomol. Soc. Am., Lanham, Maryland. pp. 53-70.

Harrison, S., D.D. Murphy, and P.R. Ehrlich. 1988. Distribution of the Bay checkerspot butterfly, Euphydryas editha bayensis: Evidence for a metapopulation model. Am. Nat. 132:360-382.

Hopper, D.R., and B.D. Smith. 1992. The status of tree snails (Gastropoda: Partulidae) on Guam, with a resurvey of sites studied by H. E. Crampton in 1920. Pacific Science 46:77-85.

Howarth, F.G. 1991. Environmental impacts of classical biological control. Ann. Rev. Entomol. 36:485-509.

Illingworth. 1915.

Kanehira, R. 1936. Forests of Rota. Bot. Zool. 4:63-70.

Lockwood, J.A. 1993. Environmental issues involved in biological control of rangeland grasshoppers (Orthoptera: Acrididae) with exotic agents. Environ. Entomol. 22:503-518.

Miller, M. and G. Aplet. 1993. Biological control: A little knowledge is a dangerous thing. Rutgers Law Rev. 45:285-334.

Miyano, S. 1994. Insects of the northern Mariana Islands, Micronesia, collected during the expedition. Nat. Hist. Res. Spec. Iss. No. 1:199-215.

Morris, M.G., N.M. Collins, R.I. Vane-Wright, and J. Waage. 1991. The utilization and value of non-domesticated insects: in Collins, N.M. and J.A. Thomas (eds), The Conservation of Insects and Their Habitats, Academic Press, London. pp. 319-347.

Mueller-Dombois. D. 1981. Fire in tropical ecosystems, In: Fire regimes and ecosystem properties. U.S. For. Serv. Tech. Rep. WO-26.

Murphy, D.D. 1988. Are we studying our endangered butterflies to death? J. Research Lep. 26:236-239.

Nafus, D.M. 1989. Biological control activities in the Mariana Islands form 1911 to 1988. Micronesica 22:65-106.

Nafus, D.M. 1992. Impact of intentionally and accidentally introduced biological control agents on unitended hosts, *Hypolimnas anomala* and *H. Bolina* (Lepidoptera: Nymphalidae) on Guam. Pac. Sci. 46:394 (abstract)

Nafus, D.M. 1993a. Movement of introduced biological control agents onto nontarget butterflies, *Hypolimnas* spp. (Lepidoptera: Nymphalidae). Environ. Entomol. 22:265-272.

Nafus, D.M. 1993b. Biological control agents and native parasitoids in the population system of the butterfly *Hypolimnas bolina* (L.) (Lepidopetera: Nymphalidae). Micronesica, Suppl.

4:17-23.

Nafus, D.M. 1993c. Extinction, biological control, and insect conservation on islands. In: Gaston, K.J., T.R. New, and M.J. Samways (eds.) Perspectives on Insect Conservation. Intercept Ltd. Andover, U.K.

Nafus, D.M. and I. Schreiner. 1986. Intercropping maize and sweet potatoes. Effects on parasitization of Ostrina furnicalis eggs by Trichogramma chilonis. Agric. Ecosyst. Environ. 15:189-200.

Nafus, D.M. and I. Schreiner. 1989.

Peterson, Jr., G.D. 1957. An annotated checklist of parasites and predators introduced into Guam during the years 1950-1955. Hawaiian Entomol. Soc. 16:199-202.

Pollard, E. and T.J. Yates. 1992. The extinction and foundation of local butterfly populations in relation to population variability and other factors. Ecol. Entomol. 17:249-254.

Reimer, N.J. 1993. Distribution and impact of alien ants in vulnerable Hawaiian ecosystems: in D.F.Williams (ed), Exotic Ants: Biology, Impact, and Control of Introduced Species. Westview Press, Boulder, Colorado. Pp. 11-22.

Roderick, G.K. 1992. Postcolonization evolution of natural enemies: in: Kauffman, W.C. and J.E. Nechols (eds), Selection Criteria and Ecological Consequences of Importing Natural Enemies. Thomas Say Publications in Entomology: Proceedings. Entomological Society of America, Lanham, Maryland. pp. 53-70.

Schreiner, I.H. and D.M. Nafus. 1986. Accidental introductions of insect pests to Guam, 1945-1985. Proc. Hawaii. Entomol. Soc. 27:45-52.

Schreiner, I.H. and D.M. Nafus. 1996. Survey of rare butterflies in the Mariana Islands. Preliminary report. U.S. Fish Wildl. Serv. unpublished report. 10pp.

Simberloff, D. 1992. Conservation of pristine habitats and unintended effects of biological control: in Kauffman, W.C. and J.E. Nechols (eds), Selection Criteria and Ecological Consequences of Importing Natural Enemies. Thomas Say Publications in Entomology: Proceedings. Entomol. Soc. Am., Lanham, Maryland. pp. 103-117.

United States Department of Justice. 1993. Press release, San Jose, California, December 14, 1993. Announcing indictments for poaching of federally protected butterflies.

Zimmerman, E.C. 1958. Macrolepidoptera. Insects of Hawaii, Vol. 7. Univ. Hawaii Press, Honolulu.

LISTING PRIORITY (* after number)

THREAT

Magnitude	Immediacy	Taxonomy	Priority
High	Imminent	Monotypic genus	1
		Species	2
		Subspecies/population	3 *
	Non-imminent	Monotypic genus	4
		Species	5
		Subspecies/population	6
Moderate to Low	Imminent	Monotypic genus	7
		Species	8
		Subspecies/population	9
	Non-imminent	Monotypic genus	10
		Species	11
		Subspecies/population	12

Rationale for listing priority number:

Magnitude:

Imminence:

APPROVAL/CONCURRENCE: Lead Regions must obtain written concurrence from all other Regions within the range of the species before recommending changes to the candidate list, including listing priority changes; the Regional Director must approve all such recommendations. The Director must concur on all additions of species to the candidate list, removal of candidates, and listing priority changes.

Approve: Rowan Gould March 6, 2003
Regional Director, Fish and Wildlife Service Date

Concur: _____ _____
Director, Fish and Wildlife Service Date

Do not concur:_____ _____
Director, Fish and Wildlife Service Date

Director's Remarks:

-

-

Date of annual review: 2/03
Conducted by:_____

Comments:

-

-