2024臺灣兩棲類紅皮書名錄

The Red List of Amphibians of Taiwan, 2024

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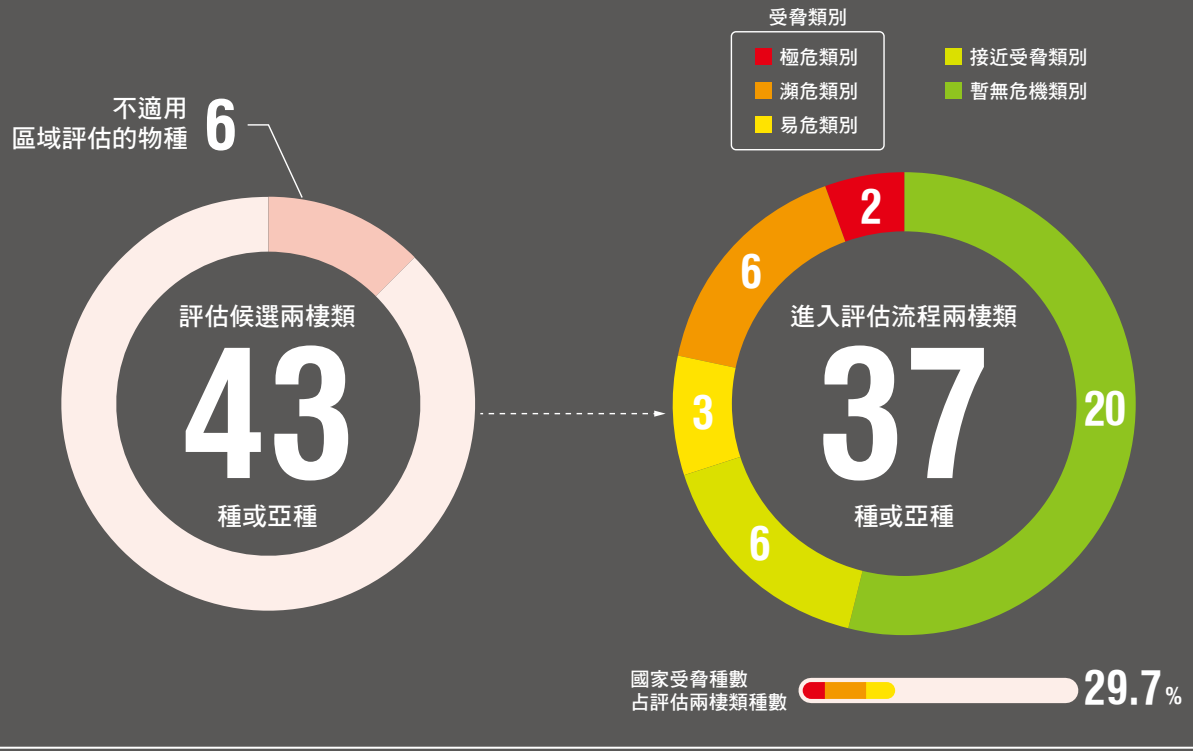
摘要

系統性地定期評估物種滅絕風險對於制定保育行動至關重要，尤其是分類學、威脅過程和研究的持續進展更凸顯了定期重新評估的必要性。本報告為臺灣第 2 次依據國際自然保育聯盟 (International Union for Conservation of Nature, IUCN) 建議類別與標準對所有臺灣兩棲類動物進行國家兩棲類紅皮書名錄評估。本次報告中納入評估候選的兩棲類共有 43 種，其中 6 種被評定為不適用 (Not Applicable) 於區域評估，計有 37 種兩棲類進入後續評估流程。在臺灣國家受脅 (Nationally Threatened) 兩棲類中，2 種屬於國家極危 (Nationally Critically Endangered) 類別，6 種屬於國家瀕危 (Nationally Endangered) 類別，3 種屬於國家易危 (Nationally Vulnerable) 類別，以上 11 種受脅物種占本次所有評估兩棲類種數的 29.7%。其餘 26 種兩棲類中，6 種屬於國家接近受脅 (Nationally Near-threatened) 類別，20 種屬於國家暫無危機 (Nationally Least Concern) 類別。本報告相較於 2017 年的臺灣兩棲類紅皮書名錄新增了周氏樹蛙與太田樹蛙，另有 4 種原屬於資料不足類別，已重新評定於其他紅皮書類別中。此外，有 2 種因滅絕風險提高而提升其紅皮書類別，另 1 種則因滅絕風險減輕而降低其類別。未來仍需持續多方評估，以闡明這些紅皮書類別的變動是來自該物種在不同時期所蒐集到生態背景資訊的落差，或是真實威脅狀態有所改變的結果。



1. 前言

物種或分類群 (taxon) 面臨滅絕的風險是保育經營管理的重要課題。依據受威脅程度所列出的清單是復育計畫、研究、監測與保育措施排列優先順序的參考依據，同時也是爭取社會支持棲地保護及輔助資源分配決策的重要工具 (Townsend et al. 2007; Pimm et al. 2014)。

由 IUCN 物種存續委員會 (Species Survival Commission) 負責的 IUCN 紅皮書名錄 (IUCN Red List of Threatened Species)， 自 1964 年開始發布以來，已逐步成為評估全球物種保育狀況與變化趨勢最重要的參考依據 (Rodrigues et al. 2006; IUCN Standards and Petitions Committee 2024)，另其類別 (圖 1) 及評估標準 (criteria) (IUCN 2012b)，乃至後續發布的 IUCN 紅皮書名錄地區及國家級評估標準應用指南 (IUCN 2012a)，亦成為許多國家評估其國境內受脅物種名錄的首要參考依據 (Townsend et al. 2007)。藉此標準化的評估方法，不僅有助於各國立法與執法，也讓全球紅皮書評估涵蓋的物種更加完整 (Rodrigues et al. 2006)。

兩棲類動物對生態環境的擾動非常敏感，是了解環境變化的重要指標。2004 年 IUCN 首次完成了全球兩棲類動物紅皮書名錄的評估作業，之後隨著物種資料的持續增加，分別在 2006 與 2008 年進行了兩次小規模的紅皮書名錄更新。2015 年 IUCN 再次啟動了第二次的全球兩棲類評估，在 2012 到 2014 年已重新評估的基礎上，該次更新了第一次全球評估中的 6,260 物種，並增加了 2,000 多種新描述物種的首次評估。至今已有近 1,000 位專家學者陸續參與此評估作業，為全球兩棲類族群下降與保育行動上提供了基礎的背景資料。由 2023 年 IUCN 彙整的兩棲類紅皮書名錄中顯示：全世界將近五分之二 (41%) 的兩棲類物種已被列為受脅物種 (包含極危、瀕危與易危類別)；兩棲類滅絕風險增加的主因也從 1980-2004 年期間的疾病 (蛙壺菌症) 轉向 2004-2022 年期間的氣候變遷所影響 (Luedtke et al. 2023) 。

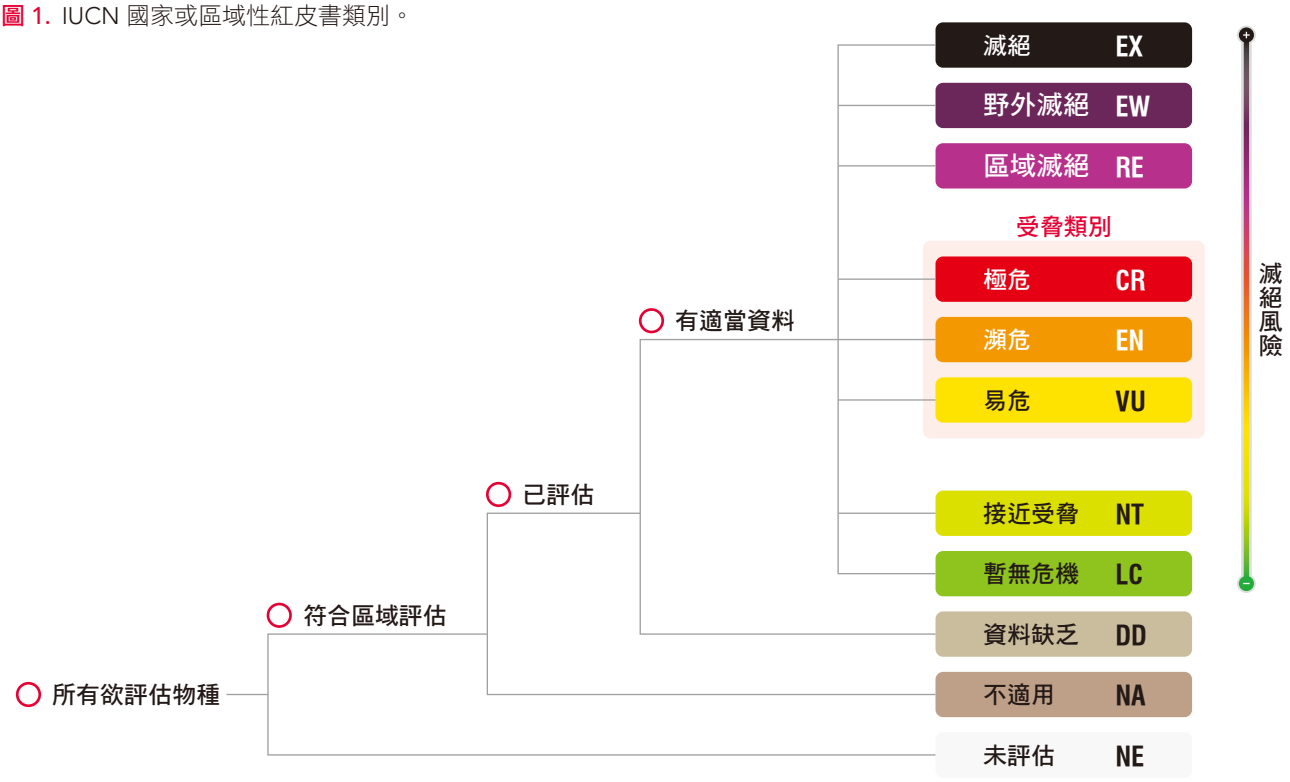
至於與臺灣兩棲類物種有關的紅皮書評估作業，首推 2004 年時由呂光洋老師 (時任職於國立臺灣師範大學) 與周文豪研究員 (國立自然科學博物館) 參與 IUCN 之 SSC 兩棲類專家群時，協同國外專家學者以全球的尺度評估了

Rana longicrus
長腳赤蛙 Long-legged Frog
NVU B1b(i,iii)c(i,iii)
葉大詮 / 攝

31 種有分布於臺灣的兩棲類，之後在 2008、2009、2016 與 2023 年則陸續有國外專家學者以全球的層級再度評估了與臺灣有關的許多兩棲類物種。在 2015 年間，由我國農業部林業及自然保育署與農業部生物多樣性研究所共同推動了以臺灣為尺度的脊椎動物紅皮書評估作業流程，並於 2017 年首次發布了以臺灣為尺度的第一版臺灣兩棲類紅皮書名錄。然而近年來，由於臺灣生態環境的快速變化，再加上新種的發表與物種學名的轉變，亟需再以臺灣的層級定期地對所有兩棲類動物的滅絕風險，進行重新的檢視與評估。

Nidirana okinavana
豎琴蛙 Harpist Brown Frog
NCR B1ab(iii)
林春富 / 攝

圖 1. IUCN 國家或區域性紅皮書類別。



2. 評估流程

本報告之臺灣兩棲類受脅狀態的評估流程與方法簡述如下：

2.1 界定納入評估之分類單元

本報告評估的範圍為臺灣本島的兩棲類物種，其分類標準與其學名主要參照美國自然史博物館 (American Museum of Natural History) 中的世界兩棲類物種 (Amphibian Species of the World, ASW) 為依據 (Frost 2024)。所有納入評估候選的兩棲類共 43 種，其中海蛙 (*Fejervarya cancrivora*)、美洲牛蛙 (*Aquarana catesbeianus*)、花狹口蛙 (*Kaloula pulchra*)、斑腿樹蛙 (*Polypedates megacephalus*)、海蟾蜍 (*Rhinella marina*) 與溫室蟾 (*Eleutherodactylus planirostris*) 等 6 種因屬於入侵臺灣本島的外來種，屬不適用 (Not Applicable) 區域評估的分類單元，因此計有 37 種兩棲類進入評估流程。

2.2 資訊蒐集與初步評估

完成評估對象篩選後，則依照 IUCN 評估標準所需資訊 (IUCN 2012b; IUCN Standards and Petitions Committee 2024)，廣泛蒐集各分類單元之學術報告、研究報告、資料庫或相關專家意見等資訊，製作成資料表。然後在彙整表中，填入生態數據，並標註引用資料的來源與說明。

每一受評分類群均依照 IUCN 紅皮書名錄類別與標準使用指南：16 版進行評估 (IUCN Standards and Petitions Committee 2024)。評估流程係由包括：A. 快速族群下降 (Rapid population reduction)、B. 地理分布範圍 (Geographic range)、C. 小族群且持續下降 (Small population size and decline)、D. 非常小且分布侷限之族群 (Very small or restricted

Hynobius arisanensis
阿里山山椒魚 Arisan Salamander
NVU B1ab(iii)
林春富 / 攝

population)，以及 E. 量化分析 (Quantitative analysis) 等五大標準及對應之次級標準 (Sub-criterion) 及資格限制 (Qualifiers) 所構成之決策樹 (logic tree) 進行 (表 1)。當現有最佳證據表明某物種符合極危 A 至 E 的任何一個標準時，該物種就被視為國家極危 (Nationally Critically Endangered, NCR)，亦即在野外面臨極高的滅絕風險。當現有最佳證據顯示某物種符合 A 至 E 中的任何一個瀕危標準時，該物種就被視為國家瀕危 (Nationally Endangered, NEN)，亦即在野外面臨非常高的滅絕風險。當最佳可用證據顯示某物種符合易危 A 至 E 的任何一個標準時，此物種就被視為國家易危 (Nationally Vulnerable, NVU)，亦即在野外面臨很高的滅絕風險。而國家受威脅物種指的就是包含國家極危、國家瀕危與國家易危的物種。當某物種已根據標準進行評估，目前雖不符合極危、瀕危或易危類別，但很接近或可能在不久的將來會符合受威脅類別的資格時，該物種就被視為國家接近受脅 (Nationally Near-Threatened, NNT)。當某物種已根據標準進行評估，但並不符合國家極危、國家瀕危、國家易危或國家接近受脅資格時，該物種就被視為國家暫無危機 (Nationally Least Concern, NLC)。而當某物種並沒有足夠的分佈或族群資料可直接或間接進行滅絕風險評估時，該物種就屬資料缺乏 (Data Deficient, DD) 類別。每個分類單元都會依所有準則進行評估，只要符合任一條準則者，即列入受脅物種的類別，並在文件報告中列出符合類別的準則及對應之次準則。

表 1. IUCN 紅皮書受脅 (極危、瀕危、易危) 及接近受脅類別評估標準簡要內容。修正自 IUCN Standards and Petitions Committee (2024).

受脅類別判斷標準 A-E	極危 (CR)	瀕危 (EN)	易危 (VU)	接近受脅 (NT)
A. 族群量下降 (時間區間為 10 年或 3 個世代，以較長者為準)				
A1	≥ 90%	≥ 70%	≥ 50%	≥ 30%
A2, A3 & A4	≥ 80%	≥ 50%	≥ 30%	≥ 20%

A1. 經由以下列舉任何方式所觀察、推估、推測或懷疑物種族群下降已經發生，而造成下降的原因明顯是可逆的且原因已知並且停止：
- (a) 直接觀察。〔A3 除外〕
- (b) 適合該分類群的物種豐度指數。
- (c) 分布範圍、占有面積或棲地品質減少或下降。
- (d) 實際或潛在的開發破壞。
- (e) 直接觀察受外來種、雜交種、病原、污染源、競爭者或寄生物之影響。

A2. 經由 A1 所列舉任何方式所觀察、推估、推測或懷疑物種族群降低已經發生，但造成降低的原因仍未停止、不明或不可逆。

A3. 經由 A1 所列舉任何方式所推估、推測或懷疑物種族群未來近期內會降低。(最長可達 100 年)。

A4. 經由 A1 所列舉任何方式所觀察、推估、推測或懷疑物種族群未來任何一段時間會降低， 造成降低的原因仍未停止、不明或不可逆。

B. 分布範圍之判定標準 (至少具備 B1 或 B2 其中之一的條件)				
B1. 分布範圍 (EOO)	< 100 km²	< 5,000 km²	< 20,000 km²	< 20,000 km²
B2. 占有面積 (AOO)	< 10 km²	< 500 km²	< 2,000 km²	< 2,000 km²

且需遭遇以下 3 種情況中的至少 2 種；僅符合 1 種情況時，可判定為 NT。

受脅類別判斷標準 A-E	極危 (CR)	瀕危 (EN)	易危 (VU)	接近受脅 (NT)
(a) 嚴重破碎化或居留區數目為右項數值者	= 1	≤ 5	≤ 10	≤ 10
(b) 經由觀察、推估、推測或預估，下列各項情況之一的數值仍持續下降者： (i) 分布範圍；(ii) 占有面積； (iii) 棲地之區域、實際面積或品質；(iv) 生長地點或亞族群之數目；(v) 能繁殖之成熟個體數				
(c) 下列各項情況其中之一的數值呈現劇烈變動時： (i) 分布範圍；(ii) 占有面積；(iii) 生長地點或亞族群之數目；(iv) 能繁殖之成熟個體數				

C. 族群量小且下降之判定標準

族群內之成熟個體數	< 250	< 2,500	< 10,000	< 20,000
且具備 C1 或 C2 其中之一的條件				
C1. 經由觀察、推估或預估物種族群成熟個體數持續下降。(時間至少為未來 100 年)	3 年或一代 下降 25% (以長者為準)	5 年或二代 下降 20% (以長者為準)	10 年或三代 下降 10% (以長者為準)	10 年或三代 下降 10% (以長者為準)
C2. 經由觀察、推估或預估，能繁殖成熟個體數持續下降，而且其族群結構遭遇下列至少一種情況者：				
a(i) 每個亞族群能繁殖之成熟個體數	≤ 50	≤ 250	≤ 1,000	≤ 1,000
a(ii) 成熟個體都生長在一個單獨的小族群內所占比例	90%-100%	95%-100%	100%	100%
(b) 成熟個體呈現劇烈變動				

D. 族群數量極少且分布侷限之判定標準

族群遭遇以下情況：				
D. 成熟個體數	< 50	< 250	D1. < 1,000	D1. < 2,500
且 / 或遭遇以下情況：				
D2. 出現面積受限或位於居留區的物種族群在未來有可能會面臨威脅，使之受脅程度提升至極危或瀕危類別 (此準則只用於評估易危及接近受脅類別)。	-	-	D2. 占有面積 < 20 km² 或分布地點數 ≤ 5	D2. 占有面積 < 50 km² 或分布地點數 ≤ 10

E. 量化分析

在野外絕種之機率	10 年內或三個世代內在野外絕種之機率超過 50% (以長者為準，但不超過 100 年)	20 年內或五個世代內在野外絕種之機率超過 20% (以長者為準，但不超過 100 年)	100 年內在野外絕種之機率超過 10%	-

2.3 公開意見徵詢

上述程序得出的評估結果經由各兩棲專家的嚴格評估，在確保所蒐集數據的完整性並補充遺漏的資料後，於 2024 年 9 月 24 日召開公開徵詢意見會議，並將紅皮書初稿與相關評估數據公開給兩棲類觀察社群進行評論。於最後階段，將更新的數據集再次執行步驟 2.1 至 2.2 的評估流程後產生本報告。

Hylarana taipehensis
臺北赤蛙 Taipei Grass Frog
NEN B2ab(ii,iii,iv)c(ii,iii)
林春富 / 攝

3. 臺灣兩棲類紅皮書名錄評估結果

結果顯示在臺灣兩棲類動物中，有 2 種屬國家極危 (Nationally Critically Endangered) 類別，有 6 種屬國家瀕危 (Nationally Endangered) 類別，有 3 種屬國家易危 (Nationally Vulnerable) 類別，以上 11 種受脅兩棲類占本次所有評估兩棲類種數的 29.7%。另 6 種屬於國家接近受脅 (Nationally Near-threatened) 類別，其餘 20 種屬於國家暫無危機 (Nationally Least Concern) 類別。

在以下的表格中，每個分類單元末有新增一欄 "2017 年臺灣紅色書類別 "，以利兩次評估結果的檢視與比對。根據 IUCN 紅皮書名錄指數 - 國家和地區使用指南 (IUCN Red List Index - Guidance for National and Regional Use) (Bubb et al. 2009) 的說明，對於不同年份評估結果之紅皮書類別的改變，有可能源自於其受威脅狀態隨著時間的真實變化，或者是源自於不同時期所蒐集生態背景資訊的落差，或對於數據重新詮釋所引起。因此，本報告重新檢視了每個分類單元的兩次評估的結果。對於不同時期的威脅狀況有所改善的分類單元，其紅皮書類別以粗體標示；對於那些滅絕風險增加的分類單元，其紅皮書類別則以下劃底線方式標示；至於紅皮書類別屬於非真實改變的分類單元，則不會有任何額外的標示。此外，本報告也提供了 2024 年全球紅皮書名錄類別，以利於不同空間尺度紅皮書評估結果之比對與參考。本報告所有兩棲類評估資料及結果可洽通訊作者索取。

3.1 臺灣受脅兩棲類物種（包含國家極危 NCR、國家瀕危 NEN 與國家易危 NVU 類別）名錄

分類單元	中文名	2024 臺灣紅皮書類別	2024* 全球紅皮書類別	2017 臺灣紅皮書類別
Hynobius glacialis Lai and Lue, 2008	南湖山椒魚	NCR B2ab(iii)	CR B1ab(iii)	NCR B1ab(iii)
Nidirana okinavana (Boettger, 1895)	豎琴蛙	NCR B1ab(iii)	EN B1ab(iii)	NCR B1ab(iii)
Hynobius fucus Lai and Lue, 2008	觀霧山椒魚	NEN B2ab(ii,iii)	NT B1ab(iii)	NEN B1ab(ii,iii)
Hynobius formosanus Maki, 1922 **	臺灣山椒魚	NEN B2ab(iii)	EN B1ab(iii)	NEN B1ab(iii)
Hynobius sonani (Maki, 1922) **	楚南氏山椒魚	NEN B2ab(iii)	EN B1ab(iii)	NEN B1ab(iii)
Hylarana taipehensis (Van Denburgh, 1909)	臺北赤蛙	NEN B2ab(ii,iii,iv)c(ii,iii)	LC	NEN B2ab(ii,iii,iv)c(ii,iii)
Zhangixalus arvalis (Lue, Lai, and Chen, 1995)	諸羅樹蛙	NEN B1ab(i,iii,iv)c(iii)	EN B1ab(iii)	NEN B1ab(i,iii,iv)c(iii)
Zhangixalus aurantiventris (Lue, Lai, and Chen, 1994)	橙腹樹蛙	NEN B2ab(iii)	EN C2a(i)	NEN B2ab(iii)
Hynobius arisanensis Maki, 1922	阿里山山椒魚	NVU B1ab(iii)	EN B1ab(iii)	NVU B2ab(iii)
Rana longicrus Stejneger, 1898	長腳赤蛙	NVU B1b(i,iii)c(i,iii)	VU B1ab(iii,v)	NNT B1b(iii)
Zhangixalus taipeianus (Liang and Wang, 1978)	臺北樹蛙	NVU B1ab(iii)	VU B1ab(iii)	NVU B1ab(i)

* 本欄位中的 2024 是指檢查該文獻的年份，並非各分類單元全球紅皮書名錄評估的最後時間點。

** 分類說明：Nishikawa 等人 (2021) 根據最早的文獻描述與和測量資料，確認 2021 年前原本普遍認定的 *H. sonani* 應為 *H. formosanus*，反之亦然。本紅皮書名錄之這兩種山椒魚學名已依前篇文獻修正，其相對應之中文名亦隨之一併更換。

3.2 臺灣國家接近受脅類別之兩棲類物種名錄

分類單元	中文名	2024 臺灣紅皮書類別	2024 全球紅皮書類別	2017 臺灣紅皮書類別
Kurixalus wangi Wu, Huang, Tsai, Li, Jhang, and Wu, 2016	王氏樹蛙	NNT B1a	DD	DD
Polypedates braueri (Vogt, 1911)	布氏樹蛙	NNT B2b(iii)	LC	LC
Zhangixalus prasinatus (Mou, Risch, and Lue, 1983)	翡翠樹蛙	NNT B1b(iii)	NT B1ab(iii)	NNT B1b(iii)
Microhyla butleri Boulenger, 1900	巴氏小雨蛙	NNT B1b(iii)	LC	DD
Micryletta steinegeri (Boulenger, 1909)	史丹吉氏小雨蛙	NNT B1b(iii)	VU B1ab(iii)	NVU B1b(i,iii)c(iii)
Pelophylax fukienensis (Pope, 1929)	福建金線蛙	NNT B2b(iii)	LC	NNT B1c(iii)

3.3 臺灣國家暫無危機類別之兩棲類物種名錄

分類單元	中文名	2024 臺灣紅皮書類別	2024 全球紅皮書類別	2017 臺灣紅皮書類別
Bufo bankorensis Barbour,1908	盤古蟾蜍	NLC	LC	NLC
Duttaphrynus melanostictus (Schneider, 1799)	黑眶蟾蜍	NLC	LC	NLC
Fejervarya limnocharis (Gravenhorst, 1829)	澤蛙	NLC	LC	NLC
Hoplobatrachus chinensis (Osbeck, 1765)	虎皮蛙	NLC	LC	NLC
Limnonectes fujianensis Ye and Fei, 1994	福建大頭蛙	NLC	LC	NLC
Hyla chinensis Günther, 1858	中國樹蟾	NLC	LC	NLC
Microhyla fissipes Boulenger, 1884	小雨蛙	NLC	LC	NLC
Microhyla heymonsi Vogt, 1911	黑蒙西氏小雨蛙	NLC	LC	NLC
Nidirana adenopleura (Boulenger, 1909)	腹斑蛙	NLC	LC	NLC

分類單元	中文名	2024 臺灣紅皮書類別	2024 全球紅皮書類別	2017 臺灣紅皮書類別
Hylarana guentheri (Boulenger, 1882)	貢德氏赤蛙	NLC	LC	NLC
Hylarana latouchii (Boulenger, 1899)	拉都希氏赤蛙	NLC	LC	NLC
Odorrana swinhoana (Boulenger, 1903)	斯文豪氏赤蛙	NLC	LC	NLC
Rana sauteri Boulenger, 1909	梭德氏赤蛙	NLC	VU B1ab(iii)	NLC
Buergeria choui Matsui and Tominaga, 2020	周氏樹蛙	NLC	LC	–
Buergeria otai Wang, Hsiao, Lee, Tseng, Lin, Komaki, and Lin, 2020	太田樹蛙	NLC	LC	–
Buergeria robusta (Boulenger, 1909)	褐樹蛙	NLC	LC	NLC
Kurixalus berylliniris Wu, Huang, Tsai, Li, Jhang, and Wu, 2016	碧眼樹蛙	NLC	DD	DD
Kurixalus eiffingeri (Boettger, 1895)	艾氏樹蛙	NLC	LC	DD
Kurixalus idiootocus (Kuramoto and Wang, 1987)	面天樹蛙	NLC	LC	NLC
Zhangixalus moltrechti (Boulenger, 1908)	莫氏樹蛙	NLC	LC	NLC

Hynobius sonani
楚南氏山椒魚 Sonan's Salamander
NEN B2ab(iii)
游崇瑋 / 攝

4. 臺灣之全球受脅兩棲類

本報告納入評估候選之 37 種兩棲類中，有 11 種為全球受脅兩棲類 (IUCN 2024)。此 11 種中有 9 種屬臺灣國家受脅類別 (包含 NCR, NEN 及 NVU)，1 種屬臺灣國家接近受脅類別，1 種屬臺灣國家暫無危機類別。

分類單元	中文名	2024 臺灣紅皮書類別	2024 全球紅皮書類別
Hynobius glacialis Lai and Lue, 2008	南湖山椒魚	NCR B2ab(iii)	CR B1ab(iii)
Nidirana okinavana (Boettger, 1895)	豎琴蛙	NCR B1ab(iii)	EN B1ab(iii)
Hynobius formosanus Maki, 1922	臺灣山椒魚	NEN B2ab(iii)	EN B1ab(iii)
Hynobius sonani (Maki, 1922)	楚南氏山椒魚	NEN B2ab(iii)	EN B1ab(iii)
Zhangixalus arvalis (Lue, Lai, and Chen, 1995)	諸羅樹蛙	NEN B1ab(i,iii,iv)c(iii)	EN B1ab(iii)
Zhangixalus aurantiventris (Lue, Lai, and Chen, 1994)	橙腹樹蛙	NEN B2ab(iii)	EN B1ab(v)+2ab(v); C2a(i)
Hynobius arisanensis Maki, 1922	阿里山山椒魚	NVU B1ab(iii)	EN B1ab(iii)
Micryletta steinegeri (Boulenger, 1909)	史丹吉氏小雨蛙	NNT B1b(iii)	VU B1ab(iii)
Zhangixalus taipeianus (Liang and Wang, 1978)	臺北樹蛙	NVU B1ab(iii)	VU B1ab(iii)
Rana longicrus Stejneger, 1898	長腳赤蛙	NVU B1b(i,iii)c(i,iii)	VU B1ab(iii,v)
Rana sauteri Boulenger, 1909	梭德氏赤蛙	NLC	VU B1ab(iii)

5. 謝誌

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The Red List of Amphibians of Taiwan, 2024

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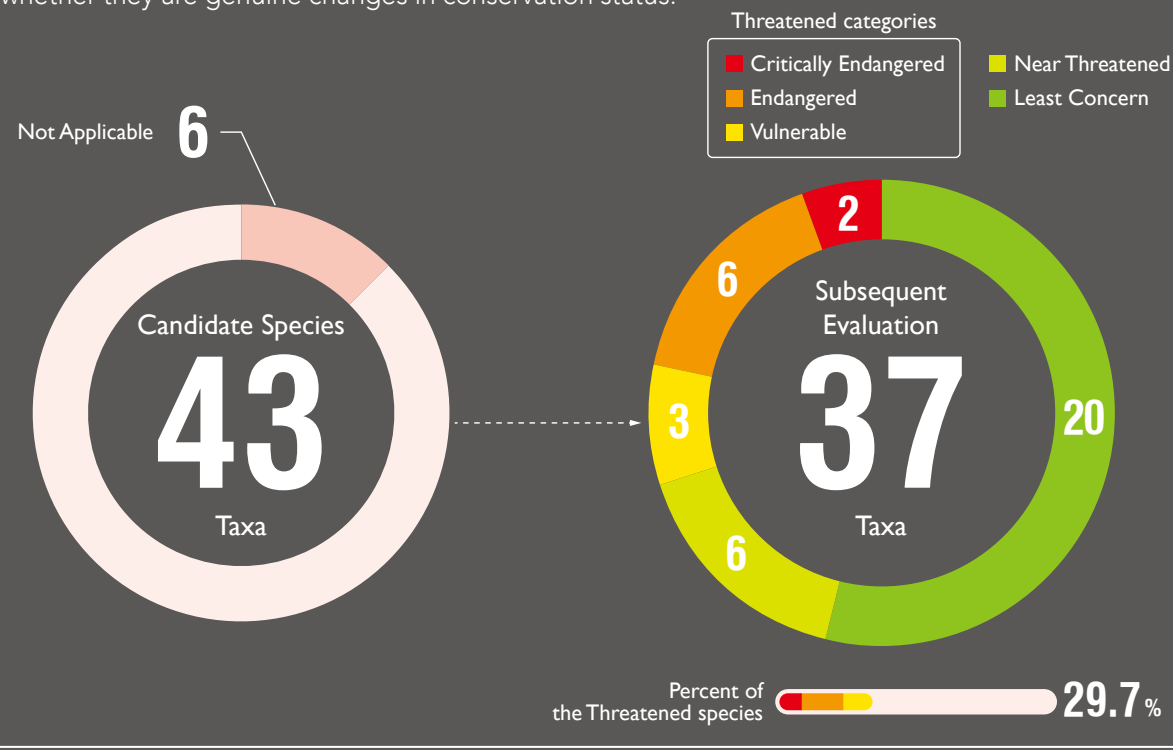
Abstract

Systematic assessments of species extinction risk at regular intervals are useful because the results can inform conservation action. Ongoing developments in taxonomy and related research and threats to species underscore the need for periodic reassessments. This report describes the second Red List of Amphibians of Taiwan, 2024. In accordance with the suggested guidelines and criteria of the International Union for Conservation of Nature, a list of amphibians in Taiwan was compiled. A total of 43 amphibian species were selected, 6 of which did not fulfill the inclusion criteria and were categorized as not applicable. The remaining 37 taxa were then assessed. Specifically, eleven taxa were categorized as Nationally Threatened, two taxa were classified as Nationally Critically, six taxa were categorized as Nationally Endangered, and three taxa were categorized as Nationally Vulnerable. These threatened species comprised 29.7% of all the species evaluated in this study. Among the remaining 26 species, 6 taxa were categorized as Nationally Near-Threatened, and 20 taxa were categorized as Nationally Least Concern. Compared with the *Red List of Amphibians of Taiwan, 2017, Buergeria choui* and *B. otai* were added to the second Red List of Amphibians as per the current assessment. Additionally, four species previously classified as Data Deficient were reassigned to other Red List categories. Notably, two species were elevated to higher categories due to their increased extinction risk, whereas one species was downgraded due to its decreased extinction risk. Ongoing evaluations are needed to clarify whether these changes in categories are due to variations in ecological background information collected at different times or whether they are genuine changes in conservation status.



1. Introduction

In the field of conservation management, assessments of the risk of extinction for species or taxa are critical. The succinct categorization of taxa according to their threat levels forms the basis for prioritizing recovery initiatives and scientific research, assessing the effectiveness of existing conservation strategies, securing funding support for habitat preservation, and rationalizing the allocation of resources (Townsend et al. 2007; Pimm et al. 2014).

The Species Survival Commission under the International Union for Conservation of Nature (IUCN) is responsible for compiling the Red List of Threatened Species (i.e., the Red List). Since its inception in 1964, the Red List has evolved into a pivotal reference for assessing the status and trends of globally threatened species (Rodrigues et al. 2006; IUCN Standards and Petitions Committee 2024). Additionally, the categorization framework, assessment criteria, and regional guidelines established by the IUCN have been widely adopted by countries as the bases for designating threatened species within their jurisdictions (Townsend et al. 2007; IUCN 2012a; IUCN 2012b). The standardized assessment methodology employed by the IUCN for compiling the Red List enhances not only the development and implementation of conservation policies around the world but also the thoroughness of assessments of the worldwide conservation status of both plant and animal species (Rodrigues et al. 2006).

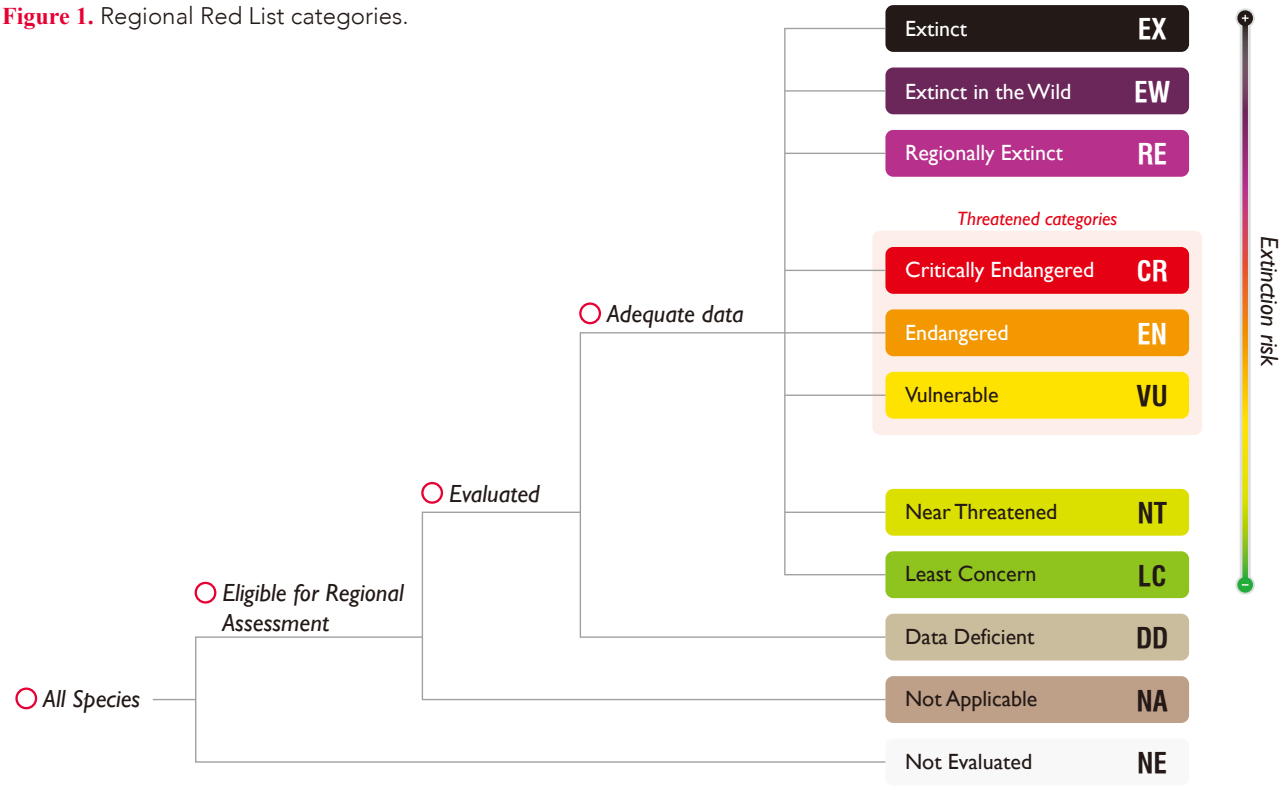
Amphibians are sensitive to ecosystem disturbances and can serve as indicators of environmental changes. In 2004, the IUCN completed the first evaluation of amphibians on the Red List. The Red List is continually revised. In 2006 and 2008, the IUCN conducted two minor updates of the Red List due to exponential increases in the amount of amphibian data collected. In 2015, the IUCN initiated the second Global Amphibian Assessment. Building on reassessment efforts during 2012-2014, it updated the 6,260 species from the first evaluation and added 2,000+ first-time assessments for newly described species. At present, approximately 1,000 expert scholars have conducted evaluations to systematically determine the decline in the amphibian population

Micryletta steinegeri
史丹吉氏小雨蛙
Steineger's Narrow-mouthed Frog
NNT B1b(iii)
林春富 / 攝

globally and consequently implement appropriate conservation actions. Among the amphibians listed in the 2023 Red List, 41% of global amphibian species are threatened (critically endangered, endangered, and vulnerable). The leading cause of increases in extinction risk in amphibians shifts from disease (chytridiomycosis) during the 1980–2004 period to climate change effects during 2004–2022 (Luedtke et al. 2023).

Dr. Kuang-Yang Lue (former professor at National Taiwan Normal University) and Dr. Wen-Hao Chou (researcher at National Taiwan Museum of Natural Science) are the first experts from Taiwan to be a part of the IUCN Species Survival Commission amphibian expert team (they joined in 2004). Together with other international experts, they evaluated 31 native amphibian species of Taiwan. International experts evaluated many amphibian species of Taiwan in 2008, 2009, 2016, and 2023. In 2015, the Forestry and Nature Conservation Agency of the Ministry of Agriculture and the Taiwan Biodiversity Research Institute of the Ministry of Agriculture jointly promoted the assessment process of the vertebrates of Taiwan at the national scale for compiling the Red List. Moreover, in 2017, the first edition of the *Red List of Amphibians of Taiwan* was published. However, recent rapid changes in Taiwan's ecosystems, ongoing publications of new species, and taxonomic revisions have greatly increased the urgency for a national-level re-evaluation and review of the risk of extinction to the amphibians of Taiwan.

Figure 1. Regional Red List categories.



2. Assessment process

The assessment process and methodology for evaluating the threatened status of amphibians in Taiwan are summarized as follows:

2.1 Defining the Taxa Included in the Evaluation

The scope of the evaluation was all amphibian species in Taiwan. The categorization criteria and scientific names of the species were based on *Amphibian Species of the World* published by the American Museum of Natural History (Frost 2024). In this study, 43 amphibian species were considered as candidates for evaluation. Among these species, *Fejervarya cancrivora*, *Aquarana catesbeianus*, *Kaloula pulchra*, *Polypedates megacephalus*, *Rhinella marina*, *and Eleutherodactylus planirostris* are invasive species; thus, they were listed as not applicable for region-based evaluations. Therefore, 37 species were selected for evaluation.

Zhangixalus arvalis
諸羅樹蛙 Farmland Treefrog
NEN B1ab(i,iii,iv)c(iii)
林春富 / 攝

Hylarana taipehensis
臺北赤蛙 Taipei Grass Frog
NEN B2ab(ii,iii,iv)c(ii,iii)
林春富 / 攝

2.2 Data Collection and Preliminary Evaluation

After species were selected for assessment, ecological information was collected from academic reports, research papers, databases, and relevant expert opinions on each taxonomic unit following the IUCN assessment standards (IUCN 2012b; IUCN Standards and Petitions Committee 2024). Ecological data were obtained, and citations and explanations of sources used were provided.

Every targeted species was assigned a preliminary threat category in accordance with the guidelines in the *Red List Categories and Criteria Version 16* (IUCN Standards and Petitions Committee 2024). The assessment process involved constructing a logic tree in accordance with the following criteria: A. Rapid population reduction; B. Geographic range; C. Small population size and decline; D. Very small or restricted population; and E. Quantitative analysis. Each criterion also comprised several subcriteria and qualifiers (Table 1). A taxon was Nationally Critically Endangered when the best available evidence indicated that it met any of the criteria A to E for Critically Endangered, and it was therefore considered to be facing an extremely high risk of extinction in the wild. A taxon was Nationally Endangered when the best available evidence

indicated that it met any of the criteria A to E for Endangered, and it was therefore considered to be facing a very high risk of extinction in the wild. A taxon was Nationally Vulnerable when the best available evidence indicated that it met any of the criteria A to E for Vulnerable, and it was therefore considered to be facing a high risk of extinction in the wild. Nationally threatened species were those in categories NCR, NEN and NVU. A taxon was Nationally Near-Threatened when it had been evaluated against the criteria but does not qualify for Critically Endangered, Endangered or Vulnerable now, but is closed to qualifying for or was likely to qualify for a threatened category in the near future. A taxon was Nationally Least Concern when it had been evaluated against the criteria and does not qualify for Critically Endangered, Endangered, Vulnerable or Near Threatened. A taxon was Data Deficient when there was inadequate information to make a direct, or indirect, assessment of its risk of extinction based on its distribution or population status. Each taxon was analyzed against each criterion and was considered to be threatened if they satisfied one or more of the criteria. The taxa were then listed under the appropriate categories, and corresponding criteria and subcriteria were listed under each taxon.

Table 2. Overview of Red List criteria adopted in this study. Modified from IUCN Standards and Petitions Committee (2024).

Use any of the criteria A-E	Critically Endangered	Endangered	Vulnerable	Near Threatened
A. Population size reduction (declines measured over the longer of 10 years or 3 generations)				
A1	≥ 90%	≥ 70%	≥ 50%	≥ 30%
A2, A3 & A4	≥ 80%	≥ 50%	≥ 30%	≥ 20%

A1. Population reduction observed, estimated, inferred, or suspected in the past where the causes of the reduction are clearly reversible AND understood AND have ceased, based on and specifying any of the following:

(a) direct observation. [except A3]

(b) an index of abundance appropriate to the taxon.

(c) a decline in area of occupancy (AOO), extent of occurrence (EOO) and/or habitat quality.

(d) actual or potential levels of exploitation.

(e) effects of introduced taxa, hybridization, pathogens, pollutants, competitors or parasites.

A2. Population reduction observed, estimated, inferred, or suspected in the past where the causes of the reduction may not have ceased OR may not be understood OR may not be reversible.

A3. Population reduction projected, inferred or suspected to be met in the future (up to a maximum of 100 years) [(a) cannot be used for A3]

A4. An observed, estimated, inferred, projected or suspected population reduction where the time period must include both the past and the future (up to a max. of 100 years in the future), and where the causes of reduction may not have ceased OR may not be understood OR may not be reversible.

Use any of the criteria A-E	Critically Endangered	Endangered	Vulnerable	Near Threatened
B. Geographic range in the form of either B1 (extent of occurrence) AND/OR B2 (area of occupancy)				
B1. Extent of occurrence (EOO)	< 100 km²	< 5,000 km²	< 20,000 km²	< 20,000 km²
B2. Area of occupancy (AOO)	< 10 km²	< 500 km²	< 2,000 km²	< 2,000 km²
AND at least 2 of the following 3 conditions (one for Near-threatened category):				
(a) Severely fragmented OR # locations	= 1	≤ 5	≤ 10	≤ 10
(b) Continuing decline observed, estimated, inferred or projected in any of: (i) extent of occurrence; (ii) area of occupancy; (iii) area, extent and/or quality of habitat; (iv) number of locations or sunpopulations; (v) number of mature individuals				
(c) Extreme fluctuations in any of: (i) extent of occurrence; (ii) area of occupancy; (iii) number of locations or sunpopulations; (iv) number of mature individuals				
C. Small population size and decline				
Number of mature individuals	< 250	< 2,500	< 10,000	< 20,000
AND at least one of C1 or C2				
C1. An observed, estimated or projected continuing decline of at least (up to a max. of 100 years in future):	25% in 3 years or 1 generation	20% in 5 years or 2 generations	10% in 10 years or 3 generations	10% in 10 years or 3 generations
C2. An observed, estimated, projected or inferred continuing decline AND at least one of the following 3 conditions:				
a(i) Number of mature individuals in each subpopulation	≤ 50	≤ 250	≤ 1,000	≤ 1000
a(ii) % of mature individuals in one subpopulation =	90-100%	95-100%	100%	100%
(b) Extreme fluctuations in the number of mature individuals				
D. Very small or restricted population Either:				
D. Number of mature individuals	< 50	< 250	D1. < 1,000	D1. < 2,500
AND/OR				
D2. Only applies to the VU and NT category. Restricted area of occupancy or number of locations with a plausible future threat that could drive the taxon to CR or EX in a very short time	-	-	AOO < 20 km² or number of locations ≤ 5	AOO < 50 km² or number of locations ≤ 10
E. Quantitative analysis				
Indicating the probability of extinction in the wild to be:	≥ 50% in 10 years or 3 generations (100 years max.)	≥ 20% in 20 years or 5 generations (100 years max.)	≥ 10% in 100 years	-

2.3 Expert opinions

The categorization outcomes derived from the abovementioned procedures underwent rigorous evaluation by amphibian experts. This process was aimed at ensuring the comprehensiveness of the data collected and supplementing any missing information. Subsequently, a special workshop was convened on September 24, 2024. Concurrently, the draft list and data pertinent to the assessment were circulated among the frogwatching community for public comment. In the final stage, the categorizations were scrutinized again by reapplying Steps 2.1-2.3 of the process, culminating in the completion of this report.

Zhangixalus aurantiventris
橙腹樹蛙 Orange Belly Treefrog
NEN B2ab(iii)
林春富 / 攝

3. Red List of Amphibians of Taiwan

Among the amphibian species in Taiwan, two were classified as Nationally Critical, six were classified as Nationally Endangered, and three were classified as Nationally Vulnerable. These 11 threatened species comprised 29.7% of all the species evaluated in this report. In addition, six species were classified as Nationally Near-Threatened, and 20 were classified as Nationally Least Concern.

In Table 3.1, 3.2 and 3.3, an additional column titled "Taiwanese Red List Category in 2017" has been added for each taxon to facilitate the review and comparison of the assessment results from the two different years. According to the "Red List Index-Guidance for National and Regional Use" (Bubb et al. 2009), changes in the Red List categories across different years may result from genuine changes in the threat status over time. Alternatively, they may arise from discrepancies in the ecological background information collected at different time points or from the reinterpretation of the data. Thus, in this report, the threat information of each taxon from both assessments was reviewed. The Red List categories of taxa showing genuine improvement are highlighted in bold, whereas those with increased extinction risk are underlined. No additional markings were made for taxa with nongenuine changes in their categories. Additionally, this report included the 2024 Global Red List categories to facilitate the comparison and reference of the Red List assessment results across different spatial scales. The evaluation data and results summarized in this report are available from the corresponding author.

Hynobius formosanus
臺灣山椒魚 Formosan Salamander
NEN B2ab(iii)
林春富 / 攝

3.1 List of Threatened Amphibian Taxa in Taiwan (Incl.: Nationally Critically Endangered, Nationally Endangered, and Nationally Vulnerable)

Taxon	Common Name	Taiwanese Red List Category in 2024	Global Red List Category in 2024*	Taiwanese Red List Category in 2017
Hynobius glacialis Lai and Lue, 2008	Nanhu Salamander	NCR B2ab(iii)	CR B1ab(iii)	NCR B1ab(iii)
Nidirana okinavana (Boettger, 1895)	Harpist Frog	NCR B1ab(iii)	EN B1ab(iii)	NCR B1ab(iii)
Hynobius fucus Lai and Lue, 2008	Taiwan Lesser Salamander	NEN B2ab(ii,iii)	NT B1ab(iii)	NEN B1ab(ii,iii)
Hynobius formosanus Maki, 1922 **	Formosan Salamander	NEN B2ab(iii)	EN B1ab(iii)	NEN B1ab(iii)
Hynobius sonani (Maki, 1922) **	Sonan's Salamander	NEN B1ab(iii)	EN B1ab(iii)	NEN B1ab(iii)
Hylarana taipehensis (Van Denburgh, 1909)	Taipei Grass Frog	NEN B2ab(ii,iii,iv) c(ii,iii)	LC	NEN B2ab(ii,iii,iv) c(ii,iii)
Zhangixalus arvalis (Lue, Lai, and Chen, 1995)	Farmland Treefrog	NEN B1ab(i,iii,iv)c(iii)	EN B1ab(iii)	NEN B1ab(i,iii,iv)c(iii)
Zhangixalus aurantiventris (Lue, Lai, and Chen, 1994)	Orange Belly Treefrog	NEN B2ab(iii)	EN C2a(i)	NEN B2ab(iii)
Hynobius arisanensis Maki, 1922	Arisan Salamander	NVU B1ab(iii)	EN B1ab(iii)	NVU B2ab(iii)
Rana longicrus Stejneger, 1898	Long-legged Frog	NVU B1b(i,iii)c(i,iii)	VU B1ab(iii,v)	NNT B1b(iii)
Zhangixalus taipeianus (Liang and Wang, 1978)	Taipei Treefrog	NVU B1ab(iii)	VU B1ab(iii)	NVU B1ab(i)

* In this section, "2024" refers to the year in which the literature was reviewed, rather than the final assessment date of each taxon's global Red List evaluation.

** Taxonomic notes: Based on the earliest literature descriptions and measurement data, Nishikawa et al. (2021) confirmed that what was commonly identified as *Hynobius sonani* prior to 2021 should actually be *H. formosanus*, and vice versa. The scientific names of these two salamander species in the Red List have been corrected accordingly, along with their corresponding Chinese names.

Pelophylax fukienensis
福建金線蛙 Fukien Gold-striped Pond Frog
NNT B2b(iii)
林春富 / 攝

3.2 List of Near-Threatened Amphibian Taxa in Taiwan

Taxon	Common Name	Taiwanese Red List Category in 2024	Global Red List Category in 2024	Taiwanese Red List Category in 2017
Kurixalus wangi Wu, Huang, Tsai, Lin, Jhang, and Wu, 2016	Wang's treefrog	NNT B1a	DD	DD
Polypedates braueri (Vogt, 1911)	Brauer's Treefrog	NNT B2b(iii)	LC	NLC
Zhangixalus prasinatus (Mou, Risch, and Lue, 1983)	Emerald Treefrog	NNT B1b(iii)	NT B1ab(iii)	NNT B1b(iii)
Microhyla butleri Boulenger,1900	Butler's Narrow-mouthed Frog	NNT B1b(iii)	LC	DD
Micryletta steinegeri (Boulenger, 1909)	Steineger's Narrow-mouthed Frog	**NNT** B1b(iii)	VU B1ab(iii)	**NVU** B1b(i,iii)c(iii)
Pelophylax fukienensis (Pope, 1929)	Fukien Gold-striped Pond Frog	NNT B2b(iii)	LC	NNT B1c(iii)

3.3 List of Least Concern Amphibian Taxa in Taiwan

Taxon	Common Name	Taiwanese Red List Category in 2024	Global Red List Category in 2024	Taiwanese Red List Category in 2017
Bufo bankorensis Barbour, 1908	Bankor Toad	NLC	LC	NLC
Duttaphrynus melanostictus (Schneider, 1799)	Black-spectacled Toad	NLC	LC	NLC
Fejervarya limnocharis (Gravenhorst, 1829)	Rice Field Frog	NLC	LC	NLC
Hoplobatrachus chinensis (Osbeck, 1765)	Chinese Bullfrog	NLC	LC	NLC
Limnonectes fujianensis Ye and Fei, 1994	Fujian Large-headed Frog	NLC	LC	NLC
Hyla chinensis Günther, 1858	Chinese Tree Toad	NLC	LC	NLC
Microhyla fissipes Boulenger, 1884	Ornate Narrow-mouthed Frog	NLC	LC	NLC
Microhyla heymonsi Vogt, 1911	Heymon's Narrow-mouthed Frog	NLC	LC	NLC
Nidirana adenopleura (Boulenger, 1909)	Olive Frog	NLC	LC	NLC
Hylarana guentheri (Boulenger, 1882)	Guenther's Frog	NLC	LC	NLC
Hylarana latouchii (Boulenger, 1899)	Latouche's Frog	NLC	LC	NLC
Odorrana swinhoana (Boulenger, 1903)	Swinhoe's Brown Frog	NLC	LC	NLC
Rana sauteri Boulenger, 1909	Sauter's Brown Frog	NLC	VU B1ab(iii)	NLC
Buergeria choui Matsui and Tominaga, 2020	Yaeyama Kajika Frog	NLC	LC	–
Buergeria otai Wang, Hsiao, Lee, Tseng, Lin, Komaki, and Lin, 2020	Ota's Stream Treefrog	NLC	LC	–

Hyla chinensis
中國樹蟾 Chinese Tree Frog
NLC
葉大詮 / 攝

Taxon	Common Name	Taiwanese Red List Category in 2024	Global Red List Category in 2024	Taiwanese Red List Category in 2017
Buergeria robusta (Boulenger, 1909)	Strong Stream Treefrog	NLC	LC	NLC
Kurixalus eiffingeri (Boettger, 1895)	Eiffinger's Treefrog	NLC	LC	DD
Kurixalus berylliniris Wu, Huang, Tsai, Lin, Jhang, and Wu, 2016	Emerald-eyed treefrog	NLC	DD	DD
Kurixalus idiootocus (Kuramoto and Wang, 1987)	Mientien Treefrog	NLC	LC	NLC
Zhangixalus moltrechti (Boulenger, 1908)	Moltrecht's Green Treefrog	NLC	LC	NLC

4. Globally Threatened Amphibian Species of Taiwan

Of the 37 candidate species, 11 were classified as Globally Threatened by the IUCN in 2024 (IUCN 2024). Of these, 9 were classified as Nationally Threatened, 1 was classified as Nationally Near-Threatened, and 1 was classified as Nationally Least Concern.

Taxon	Common Name	Taiwanese Red List Category in 2024	Global Red List Category in 2024
Hynobius glacialis Lai & Lue, 2008	Nanhu Salamander	NCR B2ab(iii)	CR B1ab(iii)
Nidirana okinavana (Boettger, 1895)	Harpist Frog	NCR B1ab(iii)	EN B1ab(iii)
Hynobius formosanus Maki, 1922	Formosan Salamander	NEN B2ab(iii)	EN B1ab(iii)
Hynobius sonani (Maki, 1922)	Sonan's Salamander	NEN B2ab(iii)	EN B1ab(iii)
Zhangixalus arvalis (Lue, Lai, and Chen, 1995)	Farmland Treefrog	NEN B1ab(i,iii,iv)c(iii)	EN B1ab(iii)
Zhangixalus aurantiventris (Lue, Lai, and Chen, 1994)	Orange Belly Treefrog	NEN B2ab(iii)	EN B1ab(v)+2ab(v); C2a(i)
Hynobius arisanensis Maki, 1922	Arisan Salamander	NVU B1ab(iii)	EN B1ab(iii)
Micryletta steinegeri (Boulenger, 1909)	Steineger's Narrow-mouthed Frog	NNT B1b(iii)	VU B1ab(iii)
Zhangixalus taipeianus (Liang and Wang, 1978)	Taipei Treefrog	NVU B1ab(iii)	VU B1ab(iii)
Rana longicrus Stejneger, 1898	Long-legged Frog	NVU B1b(i,iii)c(i,iii)	VU B1ab(iii,v)
Rana sauteri Boulenger, 1909	Sauter's Brown Frog	NLC	VU B1ab(iii)

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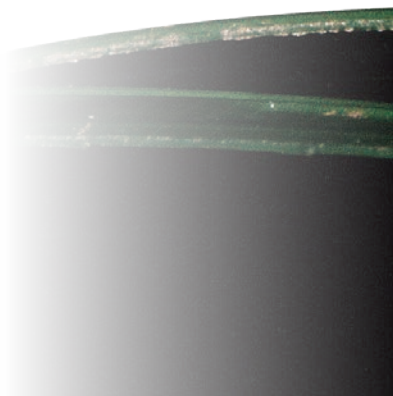

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封底照片 /

1 2 3 4

1 *Hynobius glacialis*
南湖山椒魚 Nanhu Salamander
NCR B2ab(iii)
游崇瑋 / 攝

2 *Nidirana okinavana*
豎琴蛙 Harpist Brown Frog
NCR B1ab(iii)
林春富 / 攝

3 *Polypedates braueri*
布氏樹蛙 Brauer's Treefrog
NNT B2b(iii)
林春富 / 攝

4 *Rana longicrus*
長腳赤蛙 Long-legged Frog
NVU B1b(i,iii)c(i,iii)
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