This guide is intended to provide basic information for newcomers to keeping killifish. The information provided here was derived largely from the AKA's Beginners Guide, by Alan C. Markis and Roger W. Langton. The latest edition of this booklet, edited by EddKray, is more complete than this online version and contains more photos. It is provided free to all new members of the AKA. Click on **Join AKA** at the top of the page to access an online application.

這本指南旨在提供給鱂魚新手基礎的資訊，這些資訊多擷取自 Alan C. Markis 與 Roger W. Langton 所寫的「美國鱂魚協會（AKA）新手指南」，由 EddKray 編輯的最新版新手指南是免費提供給所有協會新會員的，它具有比本線上版更完整的內容與更多圖片。點擊本頁最上方的 **Join AKA** 即可線上申請。[1]

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[1] 本文件版權由 AKA 所有，中文版由 EAKC 會員 C.Y. Pai / NorthernStar / Vic Hsueh 共同翻譯。

Selecting Killifishes

選擇鱂魚

Pet shops, with some exceptions, do not carry many killifishes. They may occasionally have *Aphyosemion australe*, *Fundulopanchax gardneri*, or *Fundulopanchax sjoestedti* (Blue Gularis) and once in a while other species may be found. The best source of killies is the Fish and Egg Listing (F&EL) found in the *Business Newsletter* of the AKA. The BNL is sent to all members of the AKA each month. For more unusual or rare species, the New and Rare Species Committee of the AKA is a good source. Finally, if you become acquainted with other killie enthusiasts, or if you can join a local killie group (see the Affiliate Clubs link at the top of the page), this is an excellent source of both fish and advice.

出人意料地，水族寵物店沒有怎麼賣鱂魚。他們頂多販售黃金火焰（*Aphyosemion australe* ，簡稱 AUS）、藍彩鱂（*Fundulopanchax gardneri* ，簡稱 GAR）或三叉琴尾鱂（*Fundulopanchax sjoestedti* ，簡稱 SJO），偶爾才有其他品種。最好的鱂魚來源是「美國鱂魚協會商業快報」中的魚隻與卵清單(F&EL)，美國鱂魚協會每個月會將快報寄送至所有協會會員。對於其他罕見的品種，「美國鱂魚協會新種與罕見品種委員會」是很好的來源。最後，如果你開始認識其他鱂魚狂熱者或者參加當地鱂魚社團（可參閱網頁上方的相關社團超連結），他們將會是絕佳魚隻與諮詢的來源。

It can be difficult for beginners to know exactly what fish to purchase because killifish are generally referred to (especially amongst enthusiasts) by their scientific names and some familiarity is needed to know what fish these names represent. As you read about the various species in publications like the *Journal of the American Killifish Association* (JAKA) and a variety of books that are available, you will develop a sense for the fish.

對於入門者而言，知道究竟該買什麼魚很困難的，因為鱂魚通常跟學名有關，入門者需要花時間來熟悉哪個名字代表哪隻魚。當你閱讀像是美國鱂魚協會期刊（JAKA）與其他各種鱂魚書籍等出版品時，你將逐漸建立對這些魚隻的認知。

When the time comes to choose your first killies, do so with care. Needless to say, choose healthy fish, but be careful also to choose fish that are correctly identified. Many species and strains of killifish look very similar and killies sold in pet stores are frequently misidentified. Furthermore, many killifish are maintained as known locality strains. For example *Nothobranchius rachovii* Beira '91, a very beautiful fish, represents a particular strain of this species identified by the locality and the year in which it was collected. It is strongly felt, in the killie hobby, that such strains not be crossed with others, even when they appear to be the same fish. Such crossings can produce hybrids, which may be sterile, or at least are fish that nature never produced.

當挑選你的第一隻鱂魚時，請務必謹慎。要挑選健康的魚自然不在話下，也該注意的是魚隻有沒有被正確地標示名稱。很多鱂魚品種與品系間看起來十分相似，水族寵物店販售牠們時常標錯名。更有甚者，許多鱂魚是以特定品系被保存，[2]例如漂亮寶貝 Beira '91（*Nothobranchius rachovii* Beira '91）用以指涉被採集於特定地點與年份的品系。鱂魚愛好者強烈堅持不同品系間不該混種雜交，即使牠們看起來是同一種魚。不同品系間的雜交可能產生不孕的混種，混種亦是違背自然的。

The remainder of this section will briefly discuss some of the genera of killifish, and some of the species found within them, with a particular emphasis on those that are suitable for beginners.

本章節剩餘部分將簡短地討論一些鱂魚的屬別以及該屬別的一些品種，並會特別強調哪些是比較適合入門的。

Aphyosemion

琴尾鱂屬

This is one of the most popular of the killifish genera among hobbyists, and it contains a large number of species that are maintained in the

[2] 又被稱為地方型，用以表示該款魚是什麼時候、被誰、採集於何處。

hobby. These species hail from west Africa, many are beautiful and relatively easy to maintain and breed. Most are spawned on floating mops (see below).

這是最受飼養者歡迎的屬別之一，有大量的品種被愛好者所持有。這些品種來自西非，許多是既漂亮又相對好生好養的。大部分在漂浮拖把布上產卵（見後述）。

One of the most commonly seen and a suitable beginner's fish, is *Aphyosemion australe*, one the few killies that does have a common name, the Lyretail. This species spawns in floating mops. It comes in three color strains. The Chocolate is the natural form, while the Gold and the Orange were developed in aquarium populations. Other species in this genus that are suitable for beginners are *A. calliurum*, *A. ahli*, and *A. bivittatum*. Aphyosemions with the same species name are often identified as coming from specific populations or locations. Different populations may or may not be genetically identical.

該屬別中最常見且適合入門者的品種就是黃金火焰鰷，牠是少數有俗名者--Lyretail，這種魚在漂浮的拖把布上產卵。市面上流通三種不同顏色的品系，巧克力色者原始自然種，金色與橘色是經過人工培育出來的水族品系。本屬別其他適合入門的品種有紅頰旗鰷（A. *calliurum*）、 阿氏旗鰷（*A. ahli*）與二線將（ *A. bivittatum*）。[3]琴尾鰷屬中常發生一個品種內包含被認定是來自不同族群或特定地方者，這些不同的品系可能具有相異的基因。

Fundulopanchax

底棲鰷屬

This genus contains several very colorful species that are suitable for beginners. These include the popular *Fp. gardneri*, *Fp. filamentosus*, and the emblem fish of the AKA, *Fp. sjoestedti*. Many of the strains of *Fp. gardneri* are relatively easy to maintain and breed as is *Fp. filamentosus*. *Fp. sjoestedti* is a little more challenging, although it can be hard to resist its charms. All of these species come in several strains. Some *Fp. gardneri* are top spawners, while *Fp. gardneri*

[3] 本手冊鰷魚中文俗名多引自威基百科：http://zh.wikipedia.org/zh-tw/%E5%81%87%E9%B0%93%E9%B1%82%E7%A7%91

nigerianus and *Fp. gardneri garderni* are switch (top/bottom) spawners. The other two species mentioned are bottom spawners.

該屬別中不乏表現華麗且適合入門的魚種，其中受歡迎的有藍彩鱂、絲絨琴尾鱂（*Fp. filamentosus*）和美國鱂魚協會的代表魚種－－三叉琴尾鱂。 藍彩鱂底下的諸多品系如同絲絨琴尾鱂一般，在飼養和繁殖上是相對容易的，三叉琴尾鱂則稍具挑戰性，然而牠有著令人難以抗拒的吸引力，上述魚種有來自不同產地的品系。部分藍彩鱂屬於上層型的產卵魚種，不過 nigerianus 品系和 garderni 品系就屬於變換型（上層/ 底層）產卵魚種。前面提到的絲絨琴尾鱂和三叉琴尾鱂則屬於底層型產卵魚種。

South American Annuals

南美一年生

There a several popular genera and species amongst the South American annuals. *Nematolebias whitei* is an excellent beginner's fish, easily bred and cared for in the aquarium. It is a truly elegant fish and its spawning behavior is fascinating. Perhaps its only disadvantage is that, like many other annuals, the beginner has to wait for some months between first spawning and first hatch.

南美一年生鱂涵蓋了幾款廣泛流通的屬別和品種。懷特氏珍珠鱂（*Nematolebias whitei*）是其中非常棒的入門魚種，很適合在魚缸中飼養和照顧，此魚優雅別緻，產卵行為相當迷人，也許僅有的缺點就像所有的一年生鱂魚一樣，入門者須耐心等待從第一次繁殖到第一次孵化間長達幾個月的時間。

Epiplatys

平額鱂屬

Species in this genus are surface fish, feeding on insects that fall into the water. They prefer to lay their eggs at the top of floating mops or plants. They are hardy, many are of good size, and many are easily bred and maintained in aquaria. Good examples, and good choices for beginners are *E. sexfasciatus* and *E. fasciolatus*. The genus also contains some challenging species. For example, the diminutive *E. annulatus*, although strikingly beautiful, would not be a good beginner's choice.

此屬別是表層活動的魚種，專吃掉落在水面的昆蟲。牠們偏好將卵產在漂浮毛線拖把或水草的頂端，卵的質地堅硬，大多數卵的尺寸適中容易尋找，該屬大部份的品種在魚缸中不難繁殖和維持，好比賽克斯鱂（*E. sexfasciatus*） 和帶紋扁鱂（*E. fasciolatus*）即適合做為入門的兩個選擇。平額鱂家族中也存在某些頗富挑戰性的品種，例如嬌小的斑節鱂（*E. annulatus*），此魚精巧奪目，但對入門者來說並不是理想的選擇。

Nothobranchius

偽鰓鱂屬

These East African annuals are among the most beautiful tropical fresh water fish in the world. *N. rachovii* is often referred to as *the* most beautiful fresh water species in the world, and deservedly so. Colors are brilliant in almost all species within this genus. Among these species, *N. guentheri* and *N. korthausae* are excellent beginner's fish. If you decide to try these fish, you should be aware that they are susceptible to the protozoal disease, velvet, and they should be maintained in water containing 1/2 to 1 teaspoonful of salt per gallon. Otherwise they do well in a variety of water conditions, including somewhat hard, alkaline water. Again, breeding them requires patience as the eggs require a prolonged dry period, although *N. korthausae* is among those with relatively short dry periods.

東非一年生鱂是世上最美麗的淡水熱帶魚之一，漂亮寶貝鱂常被認為是淡水中最美麗的魚隻，而牠確實不愧其名。本屬充滿著色彩斑斕的品種，貢氏紅圓尾鱂（*N. guentheri*）和高氏圓尾鱂（*N. korthausae*）是本屬極佳的入門選項。如果你決定踏入西非一年生鱂的飼養行列，你應該要知道本屬魚種極易受到絲絨病的感染，建議飼養時每加侖添加 1/2 到 1 茶匙粗鹽入缸。本屬魚種對水質有著廣泛的適應性，包含稍硬、偏鹼的水都不成問題。此外，繁殖上需要多一點耐心，因為本屬魚卵必須花費較長的乾燥期等待孵化，而高氏圓尾鱂的孵化期相形較短。

There are many other interesting genera, including the North American native killies, including the Desert Pupfish and the Florida Flagfish, *Jordenella floridae*, the genera *Rivulus*, *Rachovia*, *Austrofundulus*, and on and on. Many of these are discussed elsewhere on this site.

卵生鱂魚還有為數眾多且有趣的品種，像是北美原生鱂魚，其中包括沙漠異谷鱂（Desert Pupfish）、美國旗鱂（Florida Flagfish)和喬氏鱂（ Jordenella floridae），另外還有溪鱂屬家族（Rivulus）、劍鱂屬家族（Rachovia）和澳鱂屬家族（Asutrofundulus）等等，都在美國鱂魚協會網 站上被廣泛的討論著。

Hybrids

混種

As discussed already, it is easy to hybridize some of the killies species. *It is the policy of the American Killifish Association to discourage hybridization except for scientific and research purposes. The organization believes that the fishes should remain as they are in nature and that hobbyists should not intentionally change color patterns, form, or identity. Every member of the AKA is urged to maintain this policy.*

如同前面已經討論過的，某些鱂魚是很容易即可雜交混種的。除非是學術研究上的目的，否則美國鱂魚協會明文勸止雜交混種情況發生，本會相信各類魚種應被保有原始的風采，個人不應刻意改變其花紋、自然表現和特徵。每位美國鱂魚協會會員也被要求遵循此一政策

Quality

品質

Everyone is urged to maintain the highest standards in his fish keeping by maintaining optimum environmental standards for his or her fish and by only passing on fish to other hobbyists that meet the highest standards of good health and color.

每位飼養者都應該秉持最高的標準和提供最佳的環境來維護手上的魚種，交流時也應提供健康 狀態最好的魚隻。

Good luck with your hobby and may you have many years of success and enjoyment with killies. If you are not yet a member of the AKA, we look forward to having you join and meeting you.

希望你在此一愛好上進展順利，並祝福你可以長年在鱂魚飼養上獲得成功與愉悅。倘若你尚未成為美國鱂魚協會的一員，我們期待你的加入和討論。

General Maintenance

一般維護

Housing

空間

In general, killies are kept in small aquaria, often as small as 2.5 gallons. For breeding, in particular, small tanks are preferred. Besides allowing closer observation of the fish, small tanks allow the aquarist to separate pairs and trios of different species. Most killie enthusiasts soon acquire several species, and we may as well mention here that, for the purposes of breeding, it is essential that different species, and even different strains, be kept strictly separate. Closely related species can breed and produce hybrids, but serious killie keepers strive to maintain different species in the "pure" state. Furthermore, hybrids may be infertile. Obviously, tank size must match fish size and larger fish, like *Fundulopanchaxsjoestedti* (the Blue Gularis) require 5 or 10 gallon tanks. Larger aquaria, for example 10 or 15 gallon, or even larger, are used also for raising young fish.

一般而言，鱂魚常常是被養在水量僅 2.5 加侖（9.4 公升）的小缸子中。小缸子特別在做為繁殖使用時容易獲得青睞，除了便於觀察魚隻外，小的缸子適合讓玩家把每一品種的魚隻以成對或三隻的方式飼養。大多數的鱂魚發燒友很快地就會蒐集到許多品種，在此我們特別強調，在繁殖上必須將不同品種，甚至不同地方型嚴格地分開飼養。關係相近的品種間可能交配而產生雜交混種，嚴謹的鱂魚飼養者應該致力於保存各品種為「純種」的狀態。此外，雜交後代可能不具生育能力。很明顯地，缸子的大小必須符合魚隻的體型，大型的鱂魚例如三叉琴尾鱂 需要 5 到 10 加侖（19 到 38 公升）的缸子；更大的缸子，例如 10 到 15 加侖或更大者被用來飼養培育大量的年輕亞成魚。

As will be discussed later in this document, fry are often hatched in

smaller containers, such as plastic "shoe boxes" or other storage boxes. In a typical fishroom for killifish, therefore, you will usually see tanks and containers in a wide variety of sizes. How these are arranged is a matter of personal taste, but killiefishrooms often have racks of tanks with small breeding tanks on top and larger rearing tanks below. One advantage of a fishroom is that the whole room, rather than individual tanks, can be heated. The fishroom shown here is that of Norbert Dadaniak in Germany.

在後面將會提到，仔魚通常在小容器中孵化，例如塑膠鞋盒或保鮮盒。因此，在一個標準的鱂魚魚室中你將會看到各種不同大小的缸子與容器。雖然如何擺放因人而異，但大多魚室是小的繁殖缸設置在架子上層，大的培育缸放在下層。魚室的其中一個好處是整個房間都有加溫，而非單一個缸子。圖中展示的是 Norbert Dadaniak 在德國所擁有的魚室。

Plants and Aquascaping

植物與造景

Planted tanks are pleasing to view, and plants help to utilize organic wastes produced by the fish and, to some degree, in oxygenating the

water. However, many killie keepers avoid the use of plants in breeding tanks, and even in rearing tanks. Plants can make the collection of eggs, described later, difficult. Furthermore, bottom spawners may spawn in the gravel substrate, which is may be undesirable. On the other hand, one technique for spawning the "plant spawners" involves the use of a permanently planted tank and some breeders spawn bottom spawners over gravel. A common compromise is to use bare breeding tanks, and planted rearing tanks.

充滿植物的缸子令人賞心悅目，植物有助於吸收魚隻產出的有機廢物，某種程度亦可增加水中的溶氧。然而，很多鱂魚飼育者會避免在繁殖缸使用植物，甚至連一般飼養缸也避免使用，植物會讓收集魚卵（後面會提到）變得困難，更有甚者，底部繁殖的魚種可能會因此在碎石底砂上產卵，這是我們所不樂見的。但另一方面，一個使用在繁殖多年生魚種[4]的技巧則選擇使用常設、充滿植物的缸子，有些繁殖者會刻意把在底部繁殖的魚種放在有底砂的缸子。一個常見的折衷辦法是當繁殖的時候使用裸缸，而當平時飼養時使用有植物的缸子。

What plants to use is a matter of choice for the aquarist but, because killies often do best in tanks with relatively low lighting levels, plants tolerant of low light conditions are best. These include the cryptocorynes, Java moss, and Java fern. If gravel is used as a substrate it usually should be of a type that will not harden the water. A quartz sand or fine gravel favored by aquatic plant enthusiasts is #3 blasting sand, available at many hardware stores.

水族玩家要選擇什麼植物是個大問題，由於鱂魚常在低光照的缸子中表現得最好，所以最好選擇能在低光照存活的植物，包含椒草、默絲及鐵皇冠。如果有使用底砂做為介質，那麼應選擇不會讓水質變硬者，例如石英砂或水生植物狂熱者喜愛使用的礫砂，這些在水族硬體器材店都買得到，建議使用粗細顆粒為三號大小者。

Lighting

光照

Many killies, such as the Aphyosemions, come from forest streams that are protected from direct sunlight, and prefer subdued lighting. In

[4] 原文是 plant spawners，指在植物上面產卵的鱂魚，為翻譯的流暢故直接使用「多年生鱂魚」。

brightly lit aquaria, plants may provide some shading for killies that prefer low light conditions. Many killies appear at their best when light falls from above and to the front of the tank. Because of this, many killie enthusiasts illuminate their tanks, especially breeding tanks, by ceiling lights, with fixtures over only those tanks where more intense lighting is required.

許多鱂魚，例如琴尾鱂屬是來自於森林覆蓋的溪流中，不會直接受到日照而習於微弱的光線。在光照充足的魚缸，也許能透過植物遮蔽覆蓋來營造鱂魚喜愛的昏暗環境。許多鱂魚在光照來自上方與照射到缸子前側時表現得最好，因此，很多鱂魚狂熱者只用天花板的燈光來提供缸子照明，特別是繁殖缸，唯有那些需要強光照的缸子才會額外加裝夾燈等燈具。

Aeration and Filtration

打氣與過濾

Small aquaria, such as are often used for housing killies, are more easily polluted than large aquaria. The relatively small volume of water easily accumulates waste products, generating ammonia and nitrites, which are extremely toxic to fish. Most killie keepers, at least in the United States, therefore utilize some form of aeration and filtration. Air driven filters provide a home for aerobic nitrifying bacteria, which break down the harmful ammonia and nitrite to nitrate, a much less toxic end product.

常用來飼養鱂魚的小缸比大缸更容易受到污染，少水量容易累積魚隻排泄物，產生對魚隻有毒性的氨與亞硝酸鹽。多數的鱂魚飼養者會使用一些打氣與過濾設備，至少在美國是這樣的。氣動式過濾器提供硝化菌生長的空間，可以轉化有害的氨與亞硝酸鹽成為低毒性的硝酸鹽。

Various types of filters can be used, but for small tanks the most popular are simple box filters, containing filter "wool", or sponge filters. Both provide a large surface area for bacteria to colonize and filter particulate matter from the water. Sponge filters have the advantage of not entrapping fry, a potential problem with box filters. In larger aquaria where a substrate is being used, under-gravel filters may also be used.

各種過濾型式都可以被採用，但在小缸最受歡迎的是內含白棉的盒型過濾器以及生化棉過濾器（水妖精）。兩種皆能提供廣大的培菌表面積、

濾除水中微粒。相較於盒型過濾器，水妖精擁有不會困住仔魚的優點。對較大的魚缸而言，若有底砂介質則可以使用浪版過濾。

Temperature

溫度

Ideal water temperatures vary depending on the species, but for most killifish the temperature should be in the range of 72-75 °F. Conventional aquarium heaters may be used, but because serious killie keepers have several or many tanks, it is common for the whole room to be heated. Another advantage of this approach is that tank covers do not have to accommodate heater cables. Many killies are great jumpers and will exit the tank, and this life, through such small openings. The killie fancier, therefore, must ensure that tank covers are closely fitted.

「理想溫度」因魚隻品種不同而異，但大部分的鱂魚的飼養溫度應介於華氏 72 到 75 度間（攝氏 22.2 至 23.8 度）。固然可以使用傳統水族加溫棒，但由於認真的鱂魚飼養者會擁有眾多缸子，所以常見的方式是將整個房間加溫，此方式的另一個優點是不必在魚缸上蓋挖出讓加溫棒走線的洞。很多鱂魚都是跳高好手，容易從小孔隙中跳出缸子而害死自己，所以鱂魚迷務必要確保上蓋能緊密契合魚缸。

Water Conditions

水質

It is impossible to generalize about the water conditions required by killies. Some, such as *A. cameronense* come from soft, acid waters, while others come from harder, alkaline waters, and others from brackish waters. Some killies must have particular water conditions. Others, such as Nothobranchius species, can tolerate a range of water conditions. Naturally, no fish should be subjected to sudden changes in pH and hardness.

要把水質通則化到能夠一體適用各種鱂魚是不可能的任務，有些品種像是喀麥隆旗鱂（*A. cameronense*）來自軟、酸的水，另外有些品種則來自硬、鹼的水，還有來自汽水者（半鹹水）。有些鱂魚必須飼養在特

定水質中才能存活，但也有些如偽鯁鱗屬（N 屬）可以忍受廣泛的水質差異。即使如此，沒有鱗魚能承受突如其來而大幅度的酸鹼值、硬度變化。

pH

酸鹼值

The pH of water, or a solution, is a measure of the concentration of hydrogen ions (H^+) expressed on a negative logarithmic scale. Pure water is neutral, having a pH of 7.0. Acidic water has a pH less than 7.0 due to an increased hydrogen ion concentration, while alkaline water has a pH greater than 7.0. In both cases the change in pH is due to dissolved substances in the water. It is useful to have some means of testing the pH of the aquarium water. This may be done with test kits using indicator solutions, with pH papers, or most conveniently with an electronic pH meter. Small hand-held, battery powered pH meters are now available for relatively modest cost. Fish should never be exposed to sudden changes in pH. Thus, fish being newly introduced are usually acclimated by slowly mixing the water of the new environment with the "old" water.

水的酸鹼值是測量水中的氫離子濃度。純水酸鹼值為 7，屬中性。酸性水的氫離子濃度增加，酸鹼值低於 7；鹼性水則高於 7。酸鹼值的變化導因於水中溶解的物質。手邊有能夠測試水中酸鹼值的工具是很有用的，例如測試液、測試紙或最方便的酸鹼值電子測試筆，而供測試筆用的鈕釦電池現在也已經便宜很多了。魚隻不應該暴露在酸鹼值變化劇烈的水中，因此，對待剛買進的新魚應該緩慢地添加新水到原本袋中舊水中來讓牠們適應。

The pH of water may be changed using weak acids, such as sodium biphosphate (NaH_2PO_4) or weak bases, such as sodium bicarbonate ($NaHCO_3$, or baking soda). It is easy to change pH excessively using these chemicals, and the pH change produced may not be stable. A better way to reduce pH is to filter the water through peat moss. The peat moss is best boiled and rinsed then placed in a box filter between layers of filter wool. After a day or two the water will be amber and somewhat more acid. To increase pH it is best to include some form of calcium carbonate in the tank, such as a lime sand or gravel. Carbon dioxide (CO_2) released as a waste product by the fish dissolves in water to produce carbonic acid, which will react with calcium carbonate to

produce soluble calcium bicarbonate. The latter provides buffering capacity, helping to stabilize the pH of the water in the aquarium.

透過添加磷酸二氫納(NaH_2PO_4)等弱酸或碳酸氫鈉（$NaHCO_3$，即小蘇打）等弱鹼可以改變水的酸鹼值。然而，使用這些化學藥劑很容易會讓酸鹼值改變過大，且改變後的酸鹼值可能是不穩定的。比較好的降低酸鹼值方法是讓水流過泥碳土，泥碳土最好事先煮過並擠乾，然後放到盒型過濾器的白棉夾層中，經過一兩天後，水會變得昏暗如茶且變得較酸一點。若要增加酸鹼值，最好添加一些有碳酸鈣成分的東西到缸子中，例如珊瑚砂或大磯砂。由魚隻代謝物產生的二氧化碳溶解在水中與碳酸鈣反應會產生可溶的碳酸氫鈣，碳酸氫鈣將會提供緩衝作用，有助於穩定水中酸鹼值。

Water Hardness

硬度

Water hardness refers to the amount of calcium and magnesium salts, chiefly chlorides and sulfates, in solution. Hardness is measured in Degrees of Hardness (dGH) or as parts per million (ppm). It is common to see two types of hardness discussed, permanent hardness (calcium and magnesium salts other than bicarbonate) and temporary, or "carbonate" hardness (calcium and magnesium bicarbonate). The latter is a measure of the buffering capacity of the water, as previously discussed. Hardness can be measured using titration methods, and kits are available to measure both of these forms of hardness. However, for most purposes the conductivity of the water, as measure of total dissolved salts, is adequate. Small battery powered conductivity meters, which measure total dissolved salts in ppm, are available for this purpose. In most cases, the hardness of water is not as critical as pH. Water of 120-160 ppm is satisfactory for most killies, although there are some species that do best in very soft water, and some that do best in hard water. Water that is considered too hard can be diluted with rain water or artificially purified water. The latter can be produced using ion exchange resins or RO units. Ion exchange resins exchange sodium ions for calcium and magnesium. RO units remove calcium and magnesium ions through a process of filtration. Good RO water, therefore, is similar to distilled water. In recent years small, reasonably priced RO units have become available for use in the aquarium hobby and are seen in many fishrooms. Fish moved from hard water to soft should always be slowly acclimatized.

水中硬度指溶於水中的鈣、鎂鹽總量，主要是氯化鈣、氯化鎂、硫酸鈣及硫酸鎂。硬度以「德式硬度」（dGH）或「百萬分之一」（ppm）為測量單位。硬度常被分類為兩種形式，一種是永久硬度（鈣、鎂鹽類，不含碳酸氫鈣與碳酸氫鎂）以及暫時硬度，又稱碳酸氫鹽硬度[5]（碳酸氫鈣與碳酸氫鎂）。暫時硬度被拿來表示水的緩衝能力，如前面酸鹼值的末段所述。硬度可以用滴定法測量，有些套裝組同時包含測量永久與暫時硬度的試劑，不過，一般人使用上，用「導電度」做為測量水中總溶解鹽類的指標也就足夠了。由鈕釦電池供電的導電度測試筆可測出以 ppm 表示的總溶解鹽類，即可以此數據推估硬度。在大多數的例子，硬度不像酸鹼值那麼需要精確測量，即使有的品種在極軟水質中表現得較好，有的則在硬水中表現較佳，但 120 到 160ppm 的導電度適用於絕大多數鱂魚。當水質太硬時，可以雨水或人造純水稀釋之。後者可以使用離子交換樹酯或 RO 設備製造，離子交換樹酯以鈉來交換鈣、鎂離子，RO 設備則透過 RO 膜過濾掉鈣、鎂，因此，好的 RO 水類似蒸餾水。近年來，小型而價格實惠的 RO 設備開啟它被使用在水族上的可能性，現已常見於許多魚室中。當魚隻從硬水移到軟水時必須慢慢地讓牠們適應。

Feeding Killifish

餵食鱂魚

A varied and balanced diet is a practical necessity to achieve any degree of success with killifish, particularly in breeding them. Many killifish do really well only if supplied with livefood. Others do well on frozen foods and some, on dry foods. At any rate, exclusive use of a single food should be avoided, as this practice is likely to lead to nutritional imbalances and deficiencies. You will find useful information on foods on other sites, such as the Krib.

多元化且均衡的魚食是成功飼養鱂魚的必要條件，尤其在繁殖方面。許多鱂魚唯有用活餌才能養得好，部分鱂魚能用冷凍餌，一些鱂魚接受人工飼料。無論如何，應該避免使用單一食物飼養，這將造成營養上的不均衡以及缺乏。你在其他的網站能找到有用的餌料資訊，例如:Krifub (http://www.thekrib.com/)

Feeding Adult Killifish

[5] 或稱「碳酸硬度」，水族上一般以 KH 稱之

餵食成魚

Brine Shrimp

豐年蝦成蝦

This food is a staple of many killiefishrooms. In some areas live adult brine shrimp can be purchased. These are a good nutritional source and are eagerly taken by most killies. As they live in strong salt water, they are less likely to carry parasites and bacteria harmful to freshwater fish. Frozen brine shrimp are widely available and widely used. They are readily accepted by most fish but, as with any non-live food, care must be taken not to overfeed.

豐年蝦是許多鱂魚魚室的主食。在某些地區能夠買到活的成體豐年蝦，這些是很好的營養來源，大部份的鱂魚都會狼吞虎嚥地把牠們吃光。因為豐年蝦生活在高鹽的水中，所以對於淡水魚來說，攜帶較少的寄生蟲與有害的細菌。冷凍豐年蝦是容易獲得且被廣泛使用的，大部份的魚能夠快速地接受冷凍豐年蝦，但是如同餵食非活餌食物，要留心過度餵食的問題。

Daphnia

水蚤

This little crustacean is one of the most widely used live foods. Daphnia can be cultured artificially, at least in limited quantities, but most aquarists collect them from pools and ponds. A drawback to use of daphnia collected in this way is the danger of collecting other organisms potentially dangerous to aquarium fish. Daphnia are said to act as a laxative for fish and, like other foods, daphnia should not be fed exclusively.

這個小小的甲殼類動物是被廣泛使用的活餌之一。水蚤至少能少量地被人工方式飼養，但是大部份的水族玩家是從池塘或湖泊中採集，使用野外採集的水蚤有一個缺點，牠們可能會帶入其他有潛在危險的生物而危害觀賞魚。水蚤被稱之為魚的瀉藥，像其他食物一樣，不應該以水蚤做為鱂魚唯一的食物來源。

Mosquito Larvae

孑孓

This is an excellent live food for killies, although available only seasonally. They may be collected from standing water and ponds, either by swiftly passing a net through the water near the surface, or by collecting the egg "rafts", which can be allowed to hatch in a container of water in the fishroom. Many aquarists recommend culture of mosquito larvae by leaving out a container of water, which is allowed to become green with algae. The egg rafts or larvae are then collected under controlled conditions. Care must be taken to avoid allowing the larvae to complete the life cycle and become mosquitoes. That is a good way to make yourself unpopular with the neighbors and should be avoided because of the mosquito borne West Nile virus. As with the collection of other live foods, there is a risk of introducing fish enemies with the food.

孑孓對於鱂魚來說是一種極佳的活餌，雖然只能在某些季節取得。要在靜水或池塘採集孑孓，可透過一張細網放在水面上來回篩取採集，或者收集卵筏後可在魚房中孵化出孑孓。許多水族玩家建議培養孑孓可藉由放置一個含水容器在戶外，使其變成含有微藻的綠水，藉此在可掌控的條件下收集到卵筏或孑孓。必須要注意避免孑孓完成變態而變成蚊子，若是沒有掌控好孑孓變成蚊子，你可能會變成一位不受歡迎的鄰居，而且蚊子是傳播西尼羅河病毒的媒介，所以要極力避免走完完全變態流程。如同採集其他活餌一般，有不速之客混在採集活餌中的風險。

Tubifex Worms

絲蚯蚓

Tubifex worms are small worms that live in filthy places, such as sewage run-offs and the like. They can be collected from such sites, or purchased from some stores. Tubifex are an excellent food for killifish, but they carry the reputation of transmitting a variety of diseases. This risk may be reduced somewhat by holding the worms for a time in a shallow tray through which cold water runs. In this way evacuated matter and detritus from dead worms are washed away.

絲蚯蚓是生活在如水溝般較骯髒的環境，可在這類地方採集或從某些店家購買。絲蚯蚓對於鱂魚來說是很好的食物，但是絲蚯蚓也以傳布疾

病而聞名，可以藉由將絲蚯蚓暫時畜養在流動的冷水淺盤中來降低染病風險，這樣的畜養方式能夠將殘渣雜質及死掉絲蚯蚓等穢物給洗掉。

Blackworms

黑蟲

Blackworms are similar to, but distinct from, tubifex worms and are also an excellent food. They can be purchased, either from a store, or directly from companies that grow them for profit. Some of these producers are associated with fish farming operations. Others are dedicated purely to growing blackworms. Those associated with fish farms may be more likely to transmit fish diseases. Like Tubifex, blackworms carry a reputation for transmitting diseases. However, some breeders swear by them. Blackworms may be maintained for some time under running, cold water or refrigerated in dishes with enough water to barely cover them.

黑蟲類似但不同於絲蚯蚓，也是一種極棒的餌料。能從水族店或直接向以飼養黑蟲公司購買到牠們。有的黑蟲生產業者本身也是魚場，另一種生產業者是單純生產黑蟲而已，那些兼營魚場所生產出來的黑蟲可能會傳染魚病。如同絲蚯蚓，黑蟲有著傳染疾病的壞名聲，然而某些繁殖者則替牠們的安全掛保證。黑蟲能夠在低溫的流水或者冷藏在深度蓋過它們的淺盤水中畜養一段時間。

White Worms

白蟲

White worms (*Enchytrae*) are another excellent live food for killies. Possibly they too can carry parasites or pathogenic bacteria but, because they are cultured, this is less likely than it is for tubifex and blackworms. It is said that white worms are fatty, and that they should not be fed exclusively for that reason. There are many methods for culturing white worms. Starter cultures can be obtained from other hobbyists and they are often listed in the Fish and Egg Listing of the AKA's *Business Newsletter*. Typically, these worms are cultured in a mixture of potting soil and peat moss, usually about 50:50. However, some hobbyists use garden soil, leaf mold, etc. It is best to sterilize the substrate before starting the culture. One way to do this is to place the mixture in a plastic bag and heat it in a microwave for a few minutes.

After cooling the substrate is placed in a box, allowed to cool, sprinkled with water until thoroughly damp, and the starter added. The worms may be fed baby cereal or boiled oatmeal, but the most commonly used food is break soaked in milk or in yeast water (a milky suspension of yeast in water). These worms do not like high temperatures, the ideal being about 50 °F. Worms may be collected by picking them out, if the culture is a good one, or by placing some of the substrate in a strainer over a container of water. A light bulb is positioned over the strainer, which drives the worms through the strainer and into the water. The worms can be washed, then fed to your killies.

白蟲是另一種對鱂魚極佳的活餌。牠們可能會攜帶寄生蟲或是致病的細菌，但因為牠們是人工培養出來的，因此帶病菌的可能性低於絲蚯蚓與黑蟲。有一種說法: 白蟲具高脂肪，應該避免過度餵食。培養白蟲的方法有很多種，能夠從其他的玩家獲得蟲種來開始培養白蟲，這些玩家時常被列在 AKA's Business Newsletter 魚與卵清單中。白蟲多被培養在以腐植土與泥炭土 1:1 混合的土壤中，也有些玩家使用園藝土或腐葉土壤等其它的介質。在開始培養前最好將這些介質土滅菌，一種方式是利用塑膠袋裝著混合土，然後使用微波爐加熱數分鐘，冷卻後的的土放入培養盒內，灑上水直到完全受潮後就能放入蟲種。可使用嬰兒米精或者煮過的燕麥片餵食白蟲，但是通常是使用土司泡牛奶或酵母菌水（酵母粉泡在水中呈牛奶般）。這些蟲不喜愛過高的溫度，理想溫度約 50°F (10°C)。如果培養的好，可以透過直接拾取的方式收蟲，或者放置含蟲的土在篩網裡半浸置於水中。在上方放上燈泡，以驅趕白蟲穿過篩網進入水中。白蟲能夠被清洗，然後餵食你的鱂魚。

Fruit Flies

果蠅

Two fruit fly (Drosophila) mutants, vestigial wing and flightless, make excellent food for killies. By virtue of the mutations they bear, they cannot fly. They can crawl, though, so it is advisable to feed just enough that the fish will eat them immediately. These flies are usually cultured in some sort of bottle into which a fruit fly medium, with a sprinkle of dry yeast, has been placed. The bottle is plugged with a piece of plastic sponge, or some such thing, after the flies are added. After some days larvae will appear, which then pupate, and eventually adult flies will emerge, at which stage they can be fed to the fish. Fruit fly medium can be cooked, but this is a time consuming and messy business. Instant

medium can be obtained from biological suppliers such as Carolina Biological, and is much easier to use. A starter culture of flies can be purchased from similar sources, or obtained from other hobbyists. Starter cultures, again, are often listed in the F&EL.

兩種突變品系的果蠅適合做為很好的鱒魚活餌--殘翅與不能飛的果蠅。由於基因突變，牠們是不會飛的，但牠們仍能夠爬，所以餵食量最好是魚隻能馬上吃完的量。這些果蠅通常被培養在裝有果蠅培養基的瓶子中，加入果蠅後，用塑膠海綿或類似的物品塞住瓶口。幾天過後，蛆將會出現，而後化蛹，最後羽化出果蠅成蟲，就能將牠們餵魚。果蠅培養基能夠用煮的自製，但這不僅耗時也費工，可以從生物產品供應商，如科羅耐生物科技(Carolina Biological) 購買已經處理好的培養基，這樣比較輕鬆。有關果蠅的蟲種取得，可向相關的來源購買，或者從水族玩家取得，這些玩家也常被列在魚隻與卵清單（(F&EL）中。

Beef Heart and Paste Foods

牛心與膏狀餌料

Beef heart, trimmed of fibrous tissue and fat, can be frozen, then grated to produce "worm-like" pieces. Many hobbyists use beef heart as the basis for a prepared food containing vegetable matter, vitamins and other additives. Others prepare similar paste foods based on shrimp and fish. These are fed as small pieces or gratings. Care must be taken to feed only as much as will be eaten immediately, as remnants of this type of food can quickly foul the water. Here is a recipe for a (non-beef heart based) paste food. Recipes can also be found on the Krib.

剔除纖維組織與脂肪的牛心先被冷凍，經絞碎研磨，之後塑形成蟲狀碎片。許多玩家會使用牛心當基礎，添加植物性的營養素、維生素與其他添加物。有些人則使用蝦肉與魚肉製作膏狀飼料，這些膏狀飼料以撕成小碎片或磨碎後餵食。必須注意的是，只能餵食馬上吃完的量，這類殘餌會很快污染水質。這裡有一份非牛心膏狀飼料的配方超連結。[6]相關的配方也能在 Krifub 查詢的到。

Dry Foods

人工飼料

[6] 原始英文中超連結有問題。

Many quality dry foods are available in the hobby today. Killies have a reputation of being reluctant to eat dry foods. However, some will eat them readily, and others can be trained to do so. The advantage of commercial dry foods is that they contain a balance of nutrients, including vitamins.

現已能在市面買到許多高品質的人工飼料。鱂魚以厭惡吃人工飼料聞名，但是有一些鱂魚能輕易接受人工飼料，其他的則能夠被訓餌。商業販售的人工飼料其好處是它們含有均衡的營養素，包含著維生素。

Foods for Newly-Hatched Killifish Fry

新生鱂魚苗的食物

Newly-Hatched Brine Shrimp

豐年蝦苗

Virtually every breeder of killifish uses newly hatched brine shrimp (nauplii of Artemia) as a food for fry. Many killie fry can eat them as a first food, and even small fry can eat them after a few days on infusoria. Artemia eggs are available commercially, from aquarium stores and other suppliers. Essentially, the aquarist hatches these eggs by incubating them in a salt solution (6-8 tablespoonfuls per gallon). A number of methods have been described. One method is to hatch the eggs in a tray, using a light to attract the newly hatched shrimp. Others hatch the fry in jars, aerating the salt solution. A popular variation today is to use inverted clear plastic soda bottles (2 liter), from which the bottom has been cut. A piece of tubing is glued into a hole drilled in the cap and used to aerate the solution. The inverted bottle can be held in some sort of frame, often one holding two bottles. A useful advance in hatching brine shrimp, especially those of lower grade, is dechorionation, in which the "shells" of the eggs are removed before hatching. Again, methods vary, but the one described here is used by a number of aquarists. A cup of cool water is placed in an inverted soda bottle hatchery (as described above) and one teaspoonful of brine shrimp eggs is added. This is allowed to bubble gently for about an hour. One cup of concentrated bleach (such as Chlorox) is added and the solution bubbled vigorously for 6 minutes. During this time the suspension of eggs will turn from brown to orange. The suspension of eggs is then run off the hatchery and strained through an ordinary white handkerchief.

The eggs are rinsed thoroughly with cool water, then returned to the hatchery, in which the salt solution for hatching has been placed. This suspension is bubbled at a moderate rate. The eggs will hatch after 24-36 hours, depending on temperature. Temperatures of 72 to 80 °F are suitable. The hatched shrimp are collected by straining through a handkerchief. The advantage of this method is that very high hatch rates are almost always achieved, even with brine shrimp eggs that give only modest hatches without dechorionation.

事實上，每一個鱂魚的繁殖者都會使用豐年蝦苗當作魚苗的食物。許多仔魚能夠以蝦苗做為牠們的第一餐，更小的仔魚在吃草履蟲幾天後也能吃得下蝦苗，豐年蝦卵可以從水族店或者其他的供應商購買。孵化這些卵必須以鹽水的方式培養（每 1 加侖，6 至 8 湯匙的鹽巴）。許多孵化方法流傳久矣，其中一種方法是在淺盤中孵化卵，然後利用光線吸引剛孵化的蝦苗。另一種是透過打氣的方式在瓶中孵化蝦苗，最普遍的方式是利用透明塑膠汽水瓶（2L）切除瓶底後倒置，用一小段的打氣管黏住瓶蓋小洞，對瓶內鹽水打氣。倒置的瓶身以架子固定，通常一個架子固定兩瓶。一個提高豐年蝦孵化效率的方法是將豐年蝦卵在孵化前去除掉殼，特別適用於等級較低的蝦卵。去殼的方法有很多，其中一種被許多水族玩家所採用，即將一杯冷水放置於倒置的汽水瓶中(如先前描述)，並且加入一湯匙的蝦卵，以柔和的出氣量打氣 1 小時。加入 1 杯濃縮的漂白水（如：Chlorox 品牌），然後劇烈地打氣約 6 分鐘。在漂白水處理過程中，懸浮的蝦卵將會從棕色轉變成橘色，此時將懸浮的卵從孵化器倒在一般白色的手帕方式過濾收集。用冷水清洗已去殼的蝦卵，然後放回孵化器中，再用鹽水孵化。用中等打氣量使卵殼懸浮翻滾，依據不同的溫度 ，蝦卵孵化時間大約 24～36 小時 ，孵化溫度以 72 ～ 80 ˚F(22～26˚C) 最為適當。孵化好的豐年蝦苗能夠用手帕過濾收集，這種方式的好處是總是能有非常高的孵化率，即使是未去殼、只有中等孵化率的蝦卵。

Microworms

微蟲（麵包微蟲）

Microworms are another excellent first food for killifish fry. Starter cultures are often listed in the F&EL. To culture them, baby cereal is added to a suitable plastic container (say a one pint translucent container of the type often used to sell food). Water is added to make a paste. A little dry yeast is sprinkled onto the paste and the starter added. After some days microworms can be seen crawling up the sides of the

container. They can be scraped off with a finger or a small stick and fed directly to the fry. After some time the culture will begin to sour, at which time a new one should be started.

微蟲是另一種極佳的鱒魚開口食物，可向魚隻與卵清單中的玩家取得蟲種。將嬰兒米精放在適當的塑膠容器中（一般販售食品用的約 1 品脫的透明容器），加入水使其成膏狀來培養微蟲。灑入少量的乾酵母粉，並加入蟲種，數天後就能見到微蟲爬上容器壁，可用手指或小棍棒將微蟲刮下直接餵食仔魚。過一段時間，整個培養環境會酸敗，此時就是重新培養的時候了。

Vinegar Eels

醋蟲（汽水微蟲）

These tiny worms are also an excellent starting food for fry. They have the advantage of staying suspended in the water, where they can live indefinitely. They are easy to culture, but more difficult to collect that microworms. To culture a large jar, such as a one gallon pickle jar, is almost filled with a 50:50 mixture of cider vinegar and water. A small piece of apple is added, and the stared culture added. After some days thousands of tiny worms can be seen suspended in the vinegar. These cultures will go on for many months with little or no attention. To feed, the worms must be strained through a fine material such as filter paper and rinsed several times to remove the vinegar, which would otherwise acidify the hatch water.

醋蟲亦為極佳的魚苗開口餌料。牠們擁有能在水中懸浮，且在水中持續存活的優點。牠們能夠很簡單地被培養，但是比微蟲要難以採集。準備一個培養用的大型廣口瓶（例如 1 加侖醬菜罐），裝盛蘋果醋與水的混合液（1:1 混合）至快滿，再放入一小片的蘋果，並且加入蟲種，數日過後即能看見數以千計的小蟲在醋液內。這個培養方式能數個月不用照顧。用來餵食魚時，醋蟲必須要經過細網的過濾，如濾紙，並且用水潤洗數次來去除醋，以免酸化魚苗的孵化環境。

Infusoria

原生生物

Infusoria is the collective name given to a host of tiny organisms that live in naturally conditioned water. Green water, for example, contains such creatures. For feeding newly hatched fry that are too tiny to take the foods described above, green water may be cultured, or cultures of paramecium may be maintained. Paramecium starter cultures may be obtained from biological suppliers, or again through the F&EL. To maintain a culture, a large jar, such as a one gallon pickle jar, is nearly filled with chlorine free water (tap water allowed to stand to remove chlorine), and a few dry peas and a sprinkle of baby cereal added. After a couple of days the water will become cloudy due to bacterial growth. The paramecium starter is then added. Over several days the paramecium will increase in number. They can be seen as tiny white "splinters" suspended in the water. The culture is fed a few dry peas every week or two. To feed to fry, some are drawn off with a baster and added to the fry hatchery. Paramecium cultures often smell quite bad for the first week or so. After that they become less objectionable. This author prefers not to use a culture until the "bad" smell, which is due to bacterial growth, has passed. Other hobbyists use corn husks to culture paramecium.

原生生物是一個集合名詞，代表許多微小、生活在天然水域中的生物，例如綠水中就含有這些牠們。為了餵食剛孵化而太小、無法吃下前述餌料的魚苗，持續培養草履蟲或培養綠水是必須的。草履蟲的蟲種能夠從生技公司所提供，或者如前面餌料一般，從魚隻與卵供應清單的玩家獲得。為了培養牠們，需要一個大型的廣口瓶，例如 1 加侖的醬菜罐，加入幾乎全滿的去氯自來水，添些乾碗豆與撒些嬰兒米精。數日過後水會變的混濁，因為細菌長起來了，此時就可以加入草履蟲種。經過幾天，草履蟲將會大量地增值，它們能被肉眼觀察得到，看起來就像白色細小的碎片懸浮在水中。每 1～2 週投餵少量的乾碗豆於培養罐中。可用滴管吸取放入魚苗孵化容器中餵食魚苗。通常在第一週培養草履蟲時，其氣味相當不好，之後惡臭味將大幅地減少。作者並不會使用聞起來惡臭的草履蟲來餵魚，因為屆時還處於細菌的生長期，要等惡臭散去才能使用。其他玩家是使用玉米殼來培養草履蟲。

Grindal Worms

格林蠕蟲

Grindal worms are an excellent food for young fish, that is for partially grown fry. They are cultured in a similar manner to white worms, but

prefer higher temperatures, about 70 °F being ideal. To culture them, prepare a bed of 50:50 potting soil and peat moss (sterilized by microwaving and allowing to cool). The mixture is thoroughly dampened with water until it is not quite wet. The starter is added and the worms are fed with a sprinkle of baby cereal daily. A piece of glass is laid on the surface of the culture and the box closed with a lid. As the culture develops the worms congregate on the glass sheet, and can be scraped off with a finger to feed. An alternative method for culturing grindal worms is to use plastic foam ("sponge") as the substrate. A suitable type is the "egg crate" foam often sold as mattress pad. A piece of this material is placed in a plastic food storage box, and water added such that the foam is damp at the surface. The starter culture is added and the culture fed with a sprinkle of baby cereal. The lid is placed on the box. Ideally, the inner surface of the lid will just touch the surface of the foam. The culture is fed lightly each day. After some days, worms will be seen congregating on the lid, where they can be collected for feeding to the fish. The advantage of this method is that there is no soil contamination and the cultures do not become invaded by house mites, which are a common problem in conventional grindal worm cultures, as well as white worm cultures.

格林蠕蟲是亞成魚的極佳餌料，牠們的培養方法類似白蟲，但是偏愛較高的溫度， 70°F （10°C）以上較理想。使用園藝土與泥碳土 1:1 混合培養（混合的土可用微波爐殺菌，然後放涼），混合土通常會灑上水，且不會太溼。加入蟲種後，每天撒些嬰兒米精餵食蠕蟲，放一片玻璃在土壤表面，並將盒子蓋好。當蠕蟲培養起來後，牠們會聚集在玻璃片上後，可以用手指刮取蟲來餵食魚隻。另類的蠕蟲培養法是利用塑膠泡綿（海綿/菜瓜布）當作基質。「蛋架」泡綿，通常是被當作墊板所販售就是一種適當的基質。放置一片這種材質於塑膠食物儲藏盒，加水讓泡綿潮濕，再放入蟲種並且灑上嬰兒米精。將盒子加蓋，理想的話，蓋子內面會剛好接觸到泡綿的表面。每日少量地餵食，幾日後即可見到蠕蟲聚集在蓋子，能在蓋子上採集餵魚吃。這個方法的優點是沒有泥土的污染，並且不會被家蟎入侵。家蟎是培養蠕蟲中的通病，還有養白蟲時也是。

Breeding Killifish

繁殖鱂魚

In nature, killifish have adapted to biotopes in which other fish often cannot survive. In particular, many species can survive in areas where the water in ponds dries up during the dry season. In the aquarium environment, therefore, the hobbyist sometimes has to mimic these conditions in order to breed particular species. Some species of killifish lay their eggs in floating plants near the surface of the water, some prefer to spawn in deeper water, some do either or both; other killies spawn in the bottom substrate, some even diving deep into the substrate, disappearing from sight. The period and conditions required for development of the eggs also varies greatly. Some develop in water, others require a period of partial drying. Some require only a week or so to develop, others require more than a year and a half. One consistent factor in the spawning behavior of killies is that they generally lay only small quantities of eggs daily.

在自然中，鱂魚適應了其他魚類無法生存的環境，最特別的是牠們可以在那些乾季時水塘會乾枯的區域存活，因此，有時愛好者必須在自己的魚缸仿造出這種環境以繁殖特定品種。有些品種的鱂魚在靠近水面的漂浮植物上產卵；有的則偏好在底部的介質上產卵；有的甚至會深鑽進介質中到整隻埋入不見身影的地步。鱂魚卵發育所需的時間與條件有很大的差異，有些品種的卵在水中發育，有的則需要稍微乾燥一段時間；有的只需要大約一週即可發育，有的則需要花上一年半。一個在繁殖上共通的特點是大部分鱂魚都會每天持續地產出少量的卵。

Based on spawning behavior, killies have been categorized into three groups: plant spawners (top and bottom, including switch spawners); soil spawners; and soil divers.

根據不同的繁殖方式，鱂魚被分類為三個種類：植物產卵型（在水表與底部，也包含轉換繁殖型）、淺土產卵型以及深鑽土型。

I. Plant Spawners

I.植物產卵型

The plant spawners lay their eggs on floating or submerged plant thickets. They include many genera, such as *Aphyosemion* (most), many *Fundulopanchax*, *Aphanius*, *Aplocheilus*, *Epiplatys*, *Pachypanchax* ,*Fundulus* (most) and *Rivulus* (except for *Rivulusstellifer*). In the

aquarium there are several techniques that can be used to spawn these fish.

植物產卵型鱂魚在漂浮或沈水植物茂密處產卵，此類鱂魚包含大部分的琴尾鱂屬、許多底棲鱂屬、祕鱂屬(*Aphanius*)、鰕鱂屬(*Aplocheilus*)、平額鱂屬、粗皮將屬(*Pachypanchax*)、大部分的底鱂屬(*Fundulus*)及溪鱂屬（*Rivulus stellifer* 除外）。有許多技巧可以使用在魚缸中繁殖這些魚種。

The Mop Method

拖把法

The most popular method of breeding plant spawners is the use of mops constructed from nylon or 100% acrylic yarn. The fish deposit their eggs on the strands of yarn. Organic yarns, such as wool or cotton, should not be used as they deteriorate in the water. The color of the mop does not seem to be very important, although some killie breeders claim that their fish prefer certain colors. Dark colors, particularly dark green, are often used. In all cases it is necessary to boil the mop before use.

最普遍被使用於繁殖這些植物產卵型鱂魚的方法是使用尼龍或百分百的晴綸紗[7]編成拖把狀。魚隻會將卵產在線股上，[8]天然的線例如羊毛線或棉線不應該被使用，因為它們會腐敗而惡化水質。拖把採用何種顏色不是那麼重要，但一些鱂魚飼養者宣稱他們的魚隻偏好特定的顏色，深色的線，尤其是深綠色最常被使用。無論如何都必須在使用拖把線前先把它煮過。

Construction of mops is not difficult. A cork, approximately 1.5 " diameter and 3/4 - 1 inch thick, is used for floating mops. A narrow groove is cut around the entire circumference of the cork. Next, the yarn is wrapped 30-50 times around a rigid piece of cardboard, or a book, of suitable size. The width of the wrapping should approximately equal the circumference of the cork. Several strands of yarn are then cut and threaded beneath the wrapped strands at one end. The whole thing is then slipped off and tied to the cork, adjusting the distribution of the strands uniformly around its circumference. Finally the strands are cut opposite the cork such that each strand hangs individually. This type of mop is generally better, and easier to search, than mops made by tying a bunch of strands into a knot at one end.

整個拖把的構造並不複雜。使用一個直徑約 4 公分、高度 2~2.5 公分的軟木塞來讓拖把漂浮，先沿著軟木塞周圍割出一條凹槽，再把線纏繞厚紙板或大小適中的書本 30 到 50 圈，讓線陀寬度跟軟木塞圓周相近。將其中幾個線股的一側切斷並穿越其餘線股將它們串起後，把整個線陀綁在軟木塞上，調整使每線股長度一致。最後將另一側垂下的線股末端剪斷，變成每個線股都是獨立的。這種型式的拖把比單純把一堆線股的一側打個節的型式要更好且更方便找卵

For bottom spawning killies, mops are made by simply tying at one end, without the cork. When thoroughly wet, these mops sink to the bottom of the breeding tank.

針對底部產卵的鱂魚，只要把拖把一側束起即可，無須綁在軟木塞上，當拖把濕透即會沉入繁殖缸的底部。

For breeding the mop is placed in a tank housing the breeders. The breeding tank is usually devoid of substrate, as many killies would

[7] acrylic yarn，即人造毛線，或被稱為人造纖維、人造羊毛等。
[8]「 線股」意味兩條以上的細線被交互搓成較粗的線。

choose to lay their eggs in the substrate. As many species of killifish will lay their eggs in either a floating or a bottom mop, one or each, or a long mop whose strands reach and lay on the bottom of the aquarium, may be used.

要繁殖時，將拖把放置在種魚繁殖缸中，繁殖缸通常不會有底砂等介質，否則，許多鱂魚會選擇將牠們的卵產在這類介質中。使用拖把法時，鱂魚會在漂浮的拖把或底部的拖把上選擇一個產卵，或兼產卵於二者上。一個夠長、從水面垂到缸底的拖把可一網打盡。

Harvesting Eggs, Incubation and Fry

收卵、下水與孵化

The Water Incubation Method

水孵法

Every two or three days the mops should be removed from the aquarium and the eggs harvested. Excess water is removed by gently squeezing the mop and then rolling it in an absorbent towel. After several minutes, the mop is ready to pick. Examination should be under a strong light. A plastic container containing clean water from the breeding tank can be used to incubate the eggs. A fungus preventative, such as acriflavine can be used. Often the eggs will develop and remain healthy without the use of a bactericide, but a little caution may pay off. The eggs can be removed from the mop with tweezers or fingers. It is best to remove eggs by placing fingers or tweezers behind the eggs, rather than by grasping it directly, and lifting outward from the mop. Newly laid eggs may be too soft for harvesting, as it takes a few hours after being laid for the eggs to harden. If this is the case, the mop should be returned to the breeding tank for a few more hours. Eggs that are cloudy in appearance and eggs that collapse when touched, should be discarded as they are presumably infertile and will be attacked by bacteria. Clear eggs are placed in the incubation dish. They should be examined daily and any which have fungused should be removed. Fertile eggs will gradually darken until the shape of the soon-to-hatch embryo is clearly detectable, the most prominent feature being the eyes. In fact, you will often hear killie breeders talk of "eyed-up" eggs, meaning that the iris of the embryo is clearly visible and that the eggs

are ready to hatch. Eggs of most plant spawners will hatch from 10 - 21 days after harvesting.

應該每兩、三天拿出拖把收卵。輕柔地擠壓拖把並在吸收力佳的毛巾上滾動以去除多餘水分，幾分鐘後即可開始收卵。找卵適合在強光下，先準備塑膠容器裝盛原繁殖缸的水來存放卵，可以使用諸如吖啶黃等抗菌劑來避免發黴，就算沒有抗菌劑，大多的卵仍會健康發育，但多一分小心沒什麼不好。用鑷子或手指來從拖把線上收卵，最好能以手指或鑷子從卵的旁邊拾取，避免直接擠壓到卵。剛被產出的卵可能過軟而不適合被撿拾，卵被產出後幾個小時才會變硬化到適合被撿取的程度，若發現卵有過軟的情況，應該連拖把線一起放回原缸中，數個小時後再行撿取。那些表面白霧或一碰就破的卵應該被丟棄，這種卵多未受精而容易感染細菌。乾淨的卵應被放置在前述裝原缸水的容器中，每天檢視卵是否發黴，若有則須儘快移除。受精卵將隨發育由透明轉變為深色，可從即將孵化的卵中清楚看出仔魚形體，最明顯的特徵是牠們的眼睛。你常會聽到鱂魚飼養者提到魚卵「發眼」，這意謂仔魚的虹膜清晰可見，牠們已蓄勢待發要破卵而出了。多數在植物上產卵的鱂魚，其卵在採收後 10 到 21 天孵化。

As the eggs hatch the fry are removed (a large dropper or baster works well for this job) and placed into small growth tanks. The water should be the same chemically in the rearing container as in the incubation chamber, and the temperatures equal. Aeration or filtration is recommended, but not essential. First food is normally newly hatched brine shrimp or microworms. Many aquarists add a small amount of salt to the rearing tanks, which cuts down the growth of bacteria and keeps the baby brine shrimp alive longer. Caution is necessary to avoid putting in too much salt as it could kill the fry. As the fry are likely to hatch at different times, several growth tanks should be provided to insure that the fry in the same container are of similar size. Larger fish are likely to look upon the smaller ones as food!

卵孵化後，應將仔魚移至小的成長缸（用大的滴管吸取比較方便）。成長缸的水應與孵化時的水質、溫度相同。打氣或過濾非絕對必要，但一般是被推薦的。可使用剛孵化的豐年蝦或微蟲作為仔魚一開始的餌料，許多水族愛好者會添加一點鹽到成長缸，這可以降低細菌的生長並讓豐年蝦可以活得久一點，要注意的是，鹽分不能添加太多，否則會殺死仔魚。由於同一批仔魚破卵而出的時間不盡相同，必須使用多個成長缸以確保同缸中的仔魚體型相近，因為較大的仔魚可能會將小魚當成食物吃掉。

On occasion eggs that appear to be fully embryonated (eyed-up) will not hatch. If left in this condition, the embryo will eventually die and the egg turn a gray color. Under these conditions it is advisable that the eggs be forced to hatch. This is accomplished by placing the eggs in a container (a small vial) with a small amount of water (about 1/4 full). In some cases simply walking around with the vial in one's pocket will cause the eggs to hatch, presumably due to the agitation. One can also blow into the container and quickly cap it. This increases the concentration of carbon dioxide and causes the eggs to hatch. An alternative is to place some fast decomposing food in the water, but the fry must be rescued quickly or they become the victims of the pollution. One other method is to place a small quantity of microworms in the hatching container. This will often force the eggs to hatch, either due to movement or to increased CO_2 concentration.

明明卵已經完全發育（發眼）但仔魚卻始終沒有破卵而出的情況偶爾會發生，這種情況下，仔魚最終會死在卵殼中，卵則會變成灰色，因此建議遇到時應採強制孵化。強制孵化有幾個方法：將卵放在容器（例如小藥瓶）裝四分之一滿的水，將該容器裝在口袋中來回走動有時即可導致孵化，這可能是晃動導致；或者對容器吐一口氣然後快速蓋上瓶蓋，這將增加二氧化碳濃度而促使魚卵孵化；另一個方法是在水中放入一點會快速分解、腐化的食物，但必須在仔魚孵化後迅速將牠們移出，以避免牠們成為水質污染的受害者；最後一個方法是放少量的微蟲到孵化容器中。這些方法可以強制魚孵化導因於它們製造晃動或增加二氧化碳濃度。

The Vaporizing Method

乾孵法（濕孵法）

Another problem that frequently occurs is that the eggs seem to go bad no matter what is done, even though the eggs are initially fertile. When this happens many hobbyists have achieved success by using an alternative to the water incubation method, namely the vaporizing method of eggs storage. Eggs are placed upon wet peat moss (some use a sponge). The peat moss is placed (after boiling and cooling) in a container with a tight fitting lid and the eggs are taken off the mop and placed on the surface of the peat moss. The peat should be quite damp and it may be necessary to add water to it from time to time. Bad (white) eggs should be removed daily. This method takes somewhat longer for the eggs to develop than does the water incubation method, but it sometimes works when the standard method fails. Eggs that go bad

have less chance of infecting the good ones as the bacteria are less able to move about. One other advantage of this method is that the eggs can be hatched *en mass* thus allowing a batch of fry of similar size to be raised.

另一個常發生的問題是無論我們怎麼做，卵的狀況就是會變糟，即使牠一開始是受精的。發生這種狀況時，許多飼養者透過另一種異於水孵法的保存方式獲得成功，可稱其為乾孵法（濕孵法）。[9]採這種方式時，卵是被放在潮濕的泥碳土上（也有人會使用海綿），泥碳土經煮沸與冷卻後被放置在有緊密加蓋的容器內，從拖把線取下卵放置於泥碳土表面，泥碳土應保持足夠潮濕，須常常添加點水進去。壞掉、白化的卵應被移除。相較於水孵法，乾孵法會某種程度延長卵的發育時間，但在標準作法水孵法失敗時，乾孵法有時反而獲得成功。由於乾孵法讓細菌的移動受到限制，那些變糟的卵感染其他好卵的機率將因此降低。乾孵法的另一個好處是卵會在同一時間孵化，因此同一胎的仔魚大小將比較相近。

The Permanent Set-Up Method

原缸法

Another successful way of propagating the plant spawners is to use a method similar to the one employed by nature; let the fish spawn in the tank and, when the fry appear, take them out for raising. Many species of *Aphyosemion* and such species as *Epiplatysannulatus* have been bred in this manner. Another alternative is to move the parents to a new breeding tank after a suitable period, allowing the fry to hatch and grow in the original tank.

另一個成功繁殖植物產卵型鱂魚的方式是採用自然的方式--讓親魚在缸子中產卵，當仔魚出現時就把仔魚移出飼養。許多琴尾鱂屬的品種以及例如斑節鱂等品種都適用此方法；類似的手法則是將親魚移出到另一個繁殖缸足夠的時間，讓仔魚能在原缸中孵化並在原缸中成長。

When using a permanent set-up, it is best to use a fairly large aquarium (10 gallons or more). The aquarium should be densely planted from top to bottom. A thick plant covering at the top is especially important for the fry. This method does not always produce large numbers of fry but the ones that do survive are usually very robust. There is the added

[9] 雖然英文原文使用 Vaporizing，但若直譯為「蒸發」或「氣化」都將扭曲此孵化方法的原意，因此仍按照該方法的意涵翻譯為「乾孵法（濕孵法）」。

advantage of having a beautiful display tank and of not having to pick eggs. Many of our European friends use this method exclusively, insisting that the resulting fry are of far greater quality than are those raised using other methods.

採用原缸法時最好使用夠大的魚缸（10 加侖以上，約為 38 公升），缸中應從上至下都分布有濃密的植物，水面必須要有很厚一層植物，這對仔魚尤其重要。此繁殖方式不見得能帶大大量仔魚，但存活下來的仔魚將十分強壯。原缸法的額外優點是充滿植物的缸子非常美觀，而原缸法也可以免除繁瑣的收卵工作。許多歐洲的朋友只選擇這種繁殖方式，他們強調原缸法產出的仔魚具有遠勝於其他繁殖方式產出的品質。

The Peat Moss Method

泥碳土法

For several years the use of peat moss as a spawning medium was thought to be useful only for soil spawners. Many aquarists, however, have found that many non-annual species of killifish will readily spawn into a substrate of peat moss. It is simply a matter of collecting the peat moss and placing it into a plastic bag (first allowing it to drain of excess water) and waiting from three to four weeks, after which the peat moss is placed in aged aquarium water. The fry will then hatch, frequently in large numbers.

多年來以泥碳土作為淺土產卵型鱂魚產卵介質的繁殖方法一直很成功，然而，不少玩家發現許多非一年生鱂魚也會很快地在泥碳土介質中產卵作法法十分簡單，將帶卵的泥碳土蒐集起來放到塑膠帶中（必須事先去除多餘水分），等候三到四周，再把泥碳土放到處理過的老水中，仔魚就會孵化了，這個方式常可收到大量的魚苗。

II. Soil Spawners

II.淺土產卵型

In examining the breeding techniques applicable to the soil-spawners, the South American "diving" species will be set aside and described under "Peat Divers". The balance of the soil spawners will be divided into two basic categories. Group "A" includes those killies that must undergo a drying period during incubation, this drying period being a clear-cut requirement for successful propagation. Such killifish are

regarded as true "annual" fishes as the areas they inhabit dry up annually; when the rains come and the dry pools and streams fill again with water, the eggs which are embedded in the mud and silt hatch into fish that will mature, reproduce and die in less than one year! The genus *Nothobranchius* is the most common aquarium constituent of this group.

在檢視淺土產卵型鱂魚的繁殖技巧時，我們先把南美深鑽土型的放到一邊，稍後再提。淺土產卵型鱂魚可被分為 A、B 兩大類，A 類包含那些一定要經過乾燥期才能成功繁殖的魚種，這些鱂魚被認為是真正的「一年生鱂魚」，其原生環境每年都經歷乾季，當雨季來臨，乾涸的窪地與河道重新住滿水，那些被埋在泥巴中的卵就會孵化並快速成長、繁殖，然後在一年內死亡，最常出現在水族店家中的偽鰓屬就屬於這類。

Group "B" includes killies whose eggs may also undergo a drying period, but this drying period is not a requirement for successful propagation; full-term water incubation in also acceptable. Many of the*Fundulopanchax* species follow this pattern, e.g. *Fp. walkeri*, *Fp. filamentosus*, *Fp. sjoestedti* and *Fp. fallax*. For the most part, this second group has a slightly extended life span and, in some cases, matures at a slower rate than do the true annuals.

B 類包含那些卵可經過一段乾燥期，但有無乾燥期並非成功繁殖必要條件的品種，牠們即使只用水孵一樣可以成功。許多底棲鱂屬的鱂魚就依循這種模式，例如艾克氏琴尾鱂（Fp. *walkeri*）、絲絨琴尾鱂（Fp. *filamentosus*）、三叉琴尾鱂（Fp. *sjoestedti* ）及紅點底鰕鱂（Fp. *fallax*）。B 類鱂魚大部分壽命較長，有的比一年生鱂魚成熟得慢。

The most frequently used spawning medium for Group "A" is peat moss. In addition, silica sand, green sand, crushed walnut shells and glass beads also have been used successfully. Eggs are laid directly over the medium and a strong flip of the male's caudal fin buries the egg just beneath the surface. The chief advantage of using one of the non-peat media is that the eggs are easily harvested and one can know exactly how many eggs are being stored. The disadvantage is that the eggs are sometimes damaged while being harvested. All that is necessary for harvesting the eggs is to sift the spawning medium through a net that is large enough to let the substrate fall through but still small enough to keep the eggs within it. Also of significance, especially for silica sand, is that due to the fact that the eggs are "packed" beneath the surface of

the medium, little of the oxygen available in the water reaches the eggs, thus inhibiting any significant development. When the eggs are collected, almost all of them are in a similar stage of development. Rosario LaCorte is credited with introducing crushed walnut shell as a spawning medium for killifish. It has the advantage of containing lignin, a substance that stimulates spawning - also found in peat moss.

最常被使用在 A 類鱂魚的產卵介質是泥碳土。除此之外，石英砂（silica sand 或稱矽砂）、綠砂、碎果殼及玻璃珠都曾成功地被當作繁殖介質。A 類鱂魚直接在介質中產卵，公魚用尾鰭搧動介質表面並將卵埋入其中。使用泥碳土以外介質的優點是收卵變得輕鬆，飼育者得藉此清點，知道究竟多少卵被收起保存，缺點是有時收卵會損傷到卵。由於收卵是使用一張孔隙足以讓底砂被篩出而又能留住卵的網子來做砂卵分離，泥碳土以外的介質較容易被篩除，另外特別像矽砂這種介質在卵埋於其中時由於矽砂過密，導致水中的氧氣難以接觸到卵，進而限制卵的發育，所以收到的卵多處於相同發育程度。Rosario LaCorte 極推薦使用碎果殼做為鱂魚產卵介質，其優點是富含可以刺激鱂魚產卵的木質素，泥碳土亦含有此物質。

Despite the advantages of the other media, peat moss is recommended for group "B". This group of killies does not display quite the same ability to bury the eggs as do the true annual species. Consequently, a percentage of the eggs are laid simply to float freely, exposed to fungus spores and decaying food or waste materials. Peat moss will provide a far more penetrable medium. Another factor, certainly worth consideration, is that a good many of the species in Group "B" lay eggs that are light sensitive to some degree. Certainly a dark medium such as peat moss would be more protective to such eggs. Furthermore, the majority of Group "B" species prefer acid water conditions. The use of peat moss favors such a condition.

儘管其他的介質有上述好處，泥碳土仍最被推薦使用於 B 類鱂魚。這類鱂魚不像真正一年生有能力將卵埋在介質中，有一定比例的卵會到處飄著，暴露在充滿黴菌孢子、腐敗食物和代謝物的環境。使用泥碳土能讓卵輕易穿透進入土中。另一個值得考量的優點是許多 B 類鱂魚產的卵對光有某程度的敏感，像泥碳土這類深色介質有助於保護對光敏感的卵。此外，多數的 B 類鱂魚偏好較酸的水質，使用泥碳土有助於營造這種環境。

Many of the species in Group "B" will lay their eggs in bottom mops. If this method is employed it is recommended that the eggs be picked from the mop and placed on damp peat moss for incubation (the water vaporizing method, described earlier. This method has worked quite successfully with such species as *Fp. monroviae*, *Fp. sjoestedti* and *Fp. filamentosus*, to name a few.

許多 B 類鱂魚會將卵產在底部的拖把上，建議將卵從拖把上撿拾起來，放在潮濕的泥碳土上等候發育（就像前面提到的乾孵法）。此繁殖方法使用在諸如 *Fp. monroviae*[10]、三叉琴尾鱂與絲絨琴尾鱂上都獲得很大成功。

For several of the soil spawning fishes, many specialists who raise large quantities of killies prefer to condition numerous males and females in separate containers and, on pair at a time, place them in the spawning tank. Due to heavy conditioning, the female is quite round with eggs when introduced with the male, but after 12 to 24 hours becomes "spawned out" and appears considerably thinner. This pair is then removed and a new pair introduced. This method has its merits as no feeding is done in the breeding tank, thus eliminating the chance of fungus due to decaying food and waste (especially important for*Fp. occidentalis* and *Fp. toddi*). The female, being quite uncomfortable with eggs, is receptive to the demands of the male, thus reducing any chance of severe disagreement.

許多飼養大量鱂魚的玩家們偏好將淺土繁殖型的公魚和母魚分開飼養，只有欲繁殖時才會成對放在繁殖缸中。由於先採取單性高密度飼養，母魚跟公魚放在一起前肚子會充滿著卵而呈現肥圓的模樣，但跟公魚在一起 12 到 24 小時後會排完卵而看起來瘦很多。此時即可將對魚分開放回，並放入新的對魚。此模式的優點是在繁殖缸的時候不用餵食，因此排除食物腐敗與魚隻代謝產生黴菌的機會（這對黃尾肉桂將 *Fp. occidentalis* 和 *Fp. toddi* 尤為重要）。母魚肚中有大量卵時會不太舒服，故對公魚求歡的接受度很高，這可降低因為拒絕求偶而導致嚴重打鬥的發生機會。

Harvesting Eggs, Incubation and Fry

收卵、下水與孵化

[10] 沒有中文譯名。

There are numerous ways in which eggs can be separated from silica sand, glass beads or crushed walnut shell. The method most common in practice is to vigorously agitate the medium, which quickly sinks while the lighter eggs swirl freely in the water. A fine-mesh net is passed through the water in a figure-eight pattern thus catching the floating eggs. This is repeated several times until most of the eggs are collected. It is best to immerse the eggs in a tray of shallow water containing a fungus preventative before placing in peat moss for incubation. The eggs are allowed to water incubate for several days giving opportunity to remove any eggs which are infertile or contaminated by fungus. When this short period period of water incubation is complete, a handful of peat moss is boiled and rinsed several times. The cool peat is placed in a towel and squeezed lightly to remove excess water. The peat should remain moist, but not so wet as to be able to easily squeeze water from it. The eggs are removed from the tray and placed in the peat being careful to distribute the eggs throughout. The peat is then placed in a plastic bag and sealed for the prescribed incubation period. For most species of *Nothobranchius* this period is from 60 - 75 days.

有許多可以將卵從石英砂、玻璃珠或碎果殼中分離的方法，最常被採用的是劇烈攪動介質，此時介質會快速地沈澱，而卵還會在水中旋轉，拿張細目的網在水中畫八字型即可收集到尚漂浮的卵，重複上述方次數次直到卵都被收起。最好先將卵放於淺水的小盤子並添加抗黴菌的藥物後再放入泥碳土中等待孵化，將卵放在水中幾天給予飼養者機會移除那些未受精或感染發黴的卵。短暫泡水完成後，把一把泥碳土煮過並擰乾，將冷卻的泥碳土放到毛巾上並輕輕擠壓移除多餘水分。泥碳土應該是潮濕的，但又不至於能被輕易擠出水。將卵從淺水盤子撈出，小心地將卵遍布在泥碳土中，最後把泥碳土放在塑膠帶中封起等候發育。大部分的偽鰓屬鱂魚的發育時間是 60 到 75 天。

If peat moss is used as a medium, the peat is simply netted out, gently squeezed, and placed between two thick layers of newspaper. After a few hours, the newspaper will have absorbed most of the moisture from the peat. The peat may then be sealed in a small plastic bag. The bag should be clearly labeled with the name of the species, the date collected and, if desired, the hatching date. Storage can take place between 70 ° and 75 °F, although some breeders of *Nothobranchius* prefer to incubate eggs at close to 80 °F. Too high a temperature (over 80) will probably have an adverse effect on the eggs and any fry that hatch.

若以泥碳土為介質，只要把泥碳土用網撈起，再輕輕擠壓，用厚報紙將土包覆，過幾小時報紙會吸收大部分泥碳土濕氣，最後將泥碳土密封在小塑膠帶內，在袋上標明鱂魚品種名、卵收集的時間以及預估的孵化時間。將袋子連土存放在華氏 70 到 75 度（攝氏 21.1~23.9 度）環境，也有些偽鰓鱂屬的飼養者偏好將卵存放在華氏 80 度（26.7 度）。過高的溫度（超過華氏 80 度）有可能對卵或仔魚有負面的影響。

When the prescribed hatching date arrives or when sufficient embryonic development is noted in most of the eggs, hatching is achieved by placing the peat in a shallow tray or bowl. The water should be relatively soft and as close as possible to the chemical water conditions required by the fish that are to be hatched. A uniform hatching can be stimulated by vigorous agitation of the water and/or with the addition of a pinch of dry or liquid food. Many hobbyists use microworms to force hatching, as mentioned earlier.

當預期的孵化時間到來或察覺大部分的胚胎已發育到足夠程度，連土帶卵放到淺盤或淺碗，加入軟水，水質參數應與該鱂魚品種所需環境儘可能接近。可透過大力攪動容器中的水或加一小撮乾飼料或液體飼料刺激以促使卵在相同的時間孵化。不少飼育者採用前面曾提過的方法，添加微蟲以強迫魚卵孵化。

Joe Ricco has shown that it is possible to speed up the development of annual eggs, especially those in the genus *Nothobranchius*. The eggs are placed in water and allowed to incubate at temperatures just below 80 °F, until the embryo is clearly seen. At that point the eggs are stored in peat moss and given a dry period from 3 - 6 weeks. After the dry period, the peat moss and the eggs are hatched in the usual way. The resulting fry are perfectly healthy. It is possible to cut down the incubation period by many months using this method, but many eggs go bad along the way and the number of fry obtained is less than is the case when the regular storage method is used.

Joe Ricco 已經證明可透過提高溫度加速一年生鱂魚卵的發育，尤其適用在偽鰓鱂屬。將卵放在逼近華氏 80 度的水中持續至卵中胚胎可被清楚看見，之後把卵放在泥碳土中保存三到六週，歷經乾燥期再將泥碳土與卵按照一般的方式孵化，藉此方式孵化的仔魚是相當健康的。上述方法可以將孵化期縮短數月，但不少卵會在過程中會損失，收到的仔魚量比一般保存方法要少，這是必需要付出的成本。

As soon as the eggs have hatched, the fry immediately begin to feed on the micro-organisms that are present in the water. Soon newly hatched brine shrimp can be offered. Growth of the young fish is phenomenal. In a short time the fry must be removed from their cramped quarters and placed into larger growing tanks. In approximately two or three weeks they are able to take sifted brine shrimp or daphnia. Even freshly chopped tubifex worms are relished. Almost without exception, in 6 - 12 weeks, the fry have grown to maturity ....the females fill with eggs, males fight .... and nature's cycle has again begun.

當卵一孵化，仔魚就開始攝食存在水中的微生物，很快地飼養者即可提供豐年蝦餵食。幼魚的成長可謂一眠大一吋，短時間內就必須把仔魚從夾窄的空間移到更大的成長缸。孵化約兩、三週，牠們就可以補食篩選過大小的豐年蝦中蝦或水蚤，甚至切碎的絲蚯蚓。六到十二週，牠們幾無例外都發育成熟，母魚開始抱卵、公魚間開始打鬥，自然的循環又再次開始了。

III. Peat Divers

III.深鑽土型

Perhaps the most interesting and unique breeding behavior of all is displayed in the spawning behavior of certain South American species. Their behavior is unique in that a pair will completely burrow or "dive" into the bottom soil during the spawning process. These fishes are true annual species with eggs capable of surviving extremely long dry seasons. Development of the eggs is far from uniform; significant development of many eggs may be postponed for many months. There have been numerous reports that such eggs (called "resting" eggs) have incubated for as long as 24 months before full development had taken place. Perhaps this indicates the enormous capacity given to these fishes in order to survive extended dry periods.

也許最有趣、最獨一無二的繁殖行為就屬南美鱂魚的了。在繁殖過程中，對魚會完全鑽入或潛入土的底部，牠們是貨真價實的一年生，卵歷經極長的乾季仍然存活。同批卵的發育速度差異極大，許多卵的發育可能慢上數個月。許多報導指出這些卵（被稱為「休眠卵」）歷經 24 個月的時間方發育完全，或許這就是即使牠們遇上野外某年乾季特長仍能存活的原因。

Preparing the Breeding Aquarium

準備繁殖缸

The most important factor in preparing the breeding aquaria for the peat-divers is the presence of a sufficient amount of spawning medium such that the fishes are able to burrow deeply. Peat, of course, is the best spawning medium. It should be boiled and rinsed thoroughly before use. The peat should cover the entire bottom of the breeding container. A 2 gallon drum-shaped bowl will serve admirably. The bottom, which tapers to a small area, required less peat that say a 3 gallon tank. If a larger aquarium is employed, a shallow bowl or dish filled with the prepared peat can be used. The pair, seeking the peat, will spawn in the confines of the dish or bowl. This container can be removed at intervals and the eggs collected without disturbing the fish.

準備深鑽土型鱂魚繁殖時最重要的就是要提供足夠厚度的介質讓魚隻能深深鑽入其中，泥碳土無庸置疑是此時最佳的的產卵介質。泥碳土使用前應該先經煮沸並擰乾，泥碳土的量應足以覆蓋整個繁殖容器，2 加侖（約 7.5 公升）大的鼓形缽碗會非常適用。一個口大底小的容器所需泥碳土量較少，可使用在 3 加侖大的缸子；若使用更大的缸子，則可以拿一個淺的缽或盤子裝滿處理好的泥碳土。對魚會游至裝盛泥碳土的容器並在裡頭產卵，這個方法的好處是每隔一段時間可以把容器連土取出收集而不至於打擾到魚隻。

Peat divers are best spawned in pairs or trios. Many successful breeders of these species condition males and females separately for four or five days, then place them together for two or three.

要繁殖深鑽型鱂魚最好成對或三隻飼養。[11]許多成功的繁殖者刻意將公魚跟母魚分開飼養四、五天後再將牠們放在一起兩、三天以促使繁殖。

Harvesting Eggs, Incubation and Fry

收卵、下水與孵化

Harvesting the eggs of the peat divers is rather standard to all soil spawners. The peat is netted out and placed between the layers of newspaper. Normal incubation is just slightly extended in relation to

[11] trios，有可能是一公兩母，亦可能是兩公一母，不一定是何者。

other soil-spawners. However, as mentioned before, it can continue for as long as two years before "resting" eggs are ready to hatch. After 75 - 90 days the peat may be examined and the eggs that show advanced development may be removed and hatched. Such eggs show a clearly defined eye on the embryo and are quite dark in color. The familiar "resting" eggs, still clear or translucent, can be left to incubate and to be checked at regular intervals for development.

收集深鑽型鱂魚的卵跟收集一般淺土層產卵的方式差不多，使用網子將泥碳土撈起並夾在報紙間吸收多餘的水分。深鑽型鱂魚卵的乾燥期會比且淺土層產卵型要長，就像前面提到的，深鑽型鱂魚卵甚至會休眠達兩年。每 75 到 90 天應該檢視一次泥碳土與卵的狀況，檢查卵是否有發育或應該下水。發育的卵呈深色，卵中胚胎眼睛清楚可見；仍然澄清透明的休眠卵應放回土中繼續乾燥期，定期檢查發育進度。

Perhaps the most important advice that one can heed to ensure a successful hatching is this: collect the peat moss frequently, at least once every two weeks. The longer the peat moss is in the spawning tank the more decomposed food and waste the peat will contain. Eventually the eggs will become victims of this pollution. Relatively clean peat moss is of great importance to the successful development of annual eggs.

確保成功孵化的建議：頻繁地收集泥碳土，至少每兩週一次，收卵的間隔越久，土夾帶腐敗食物與排泄物就越多，土中的卵將成為污染下的受害者。相對乾淨的泥碳土對於一年生鱂魚卵發育的成功有重大的幫助。

Hatching procedure are followed as explained for the other soil spawners. The fry are relatively large and can begin consuming newly-hatched brine shrimp immediately.

下水孵化的流程跟前面談及淺土層產卵型鱂魚雷同，深鑽土型鱂魚的仔魚較大，一出生即可食用剛孵化的豐年蝦。