Oyster
Culture Guide

Marine Science Department,
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Japan International Research Center for
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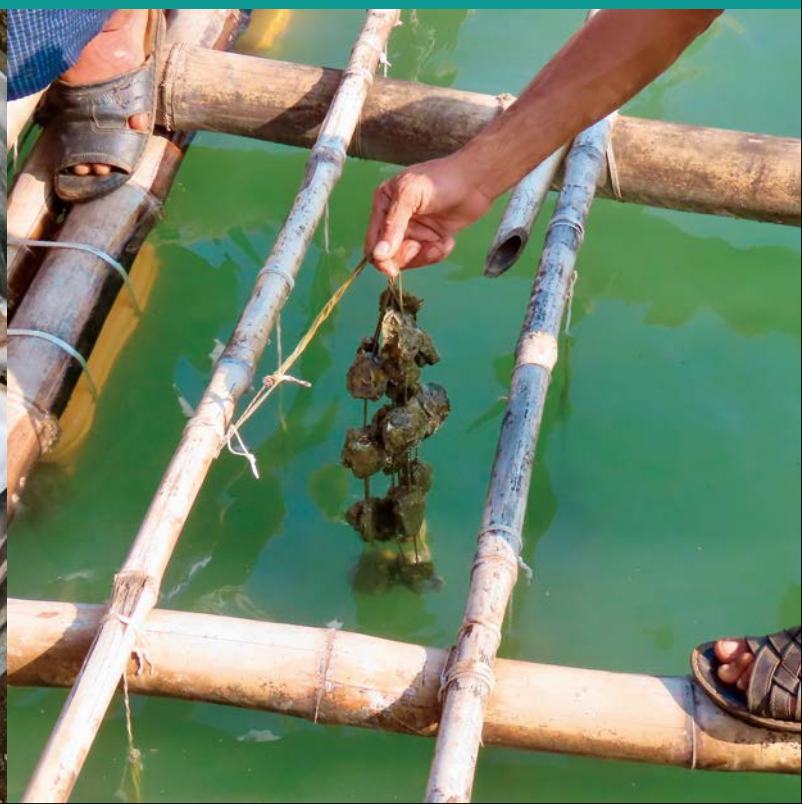
2021



Life cycle of the edible oyster, and its spat collection

The edible oyster *Crassostrea belcheri* (locally known as Ka-mar) is a popular and commercially exploited species in Southeast Asia. In Myeik, Myanmar, oyster diving fishery occurs along the Tha-moke River, near Pedaing Village, Pan Zin Village, and Sit-Bu Village. Near Pedaing, natural oyster resources have been heavily exploited and oyster divers must now travel further to harvest oysters.

To ensure the sustainable production of edible oysters, their culture should be encouraged, because it is easy, simple, and inexpensive, being free of feeding costs. However, for successful oyster culture, research is needed on spat collection and grow-out culture techniques.

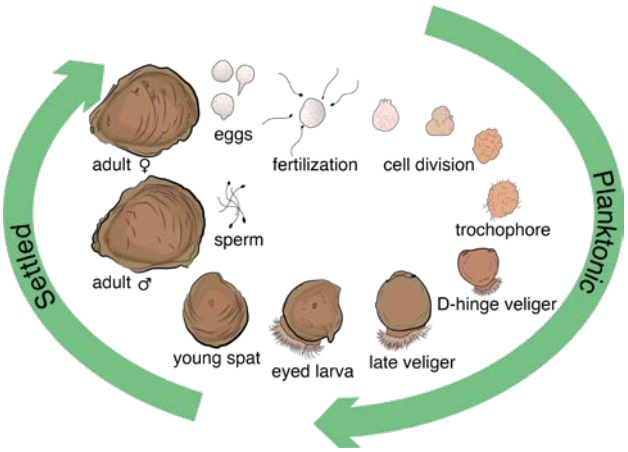


Fig. 1. Life cycle of edible oyster *Crassostrea belcheri* modified from Htwe Nyunt (1996)

After egg fertilization, the oyster spends several weeks as a small, free-swimming larva, which then settles on an appropriate substratum, attaches, and grows into an adult (Fig. 1). Therefore, an appropriate, hard substratum is needed to collect oyster spat.

Reproductive study of oyster

To collect oyster spat from natural sources, this species' reproductive cycle must be understood. Histology has accurately determined the oyster reproductive cycle, with maturation divided into five stages: immature (I), developing (II), mature (III), spawning (IV), and spent (V). These stages can be discerned (approximately) from the color or texture of gonad tissue: watery (immature, Fig. 2A), partially covered with cream (developing, Fig. 2B), fully cream (mature, Fig. 2C), and scattered brown cream (spawning and spent, Fig. 2D).

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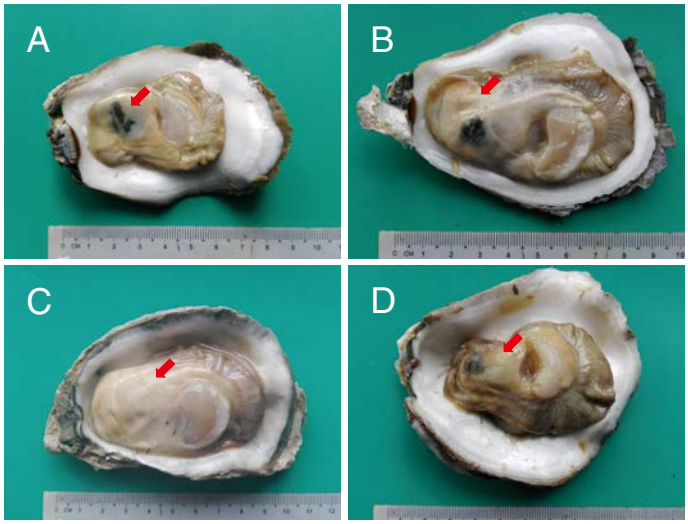

Fig. 2. *Crassostrea belcheri*. Gonad (arrows) developmental stages: A) immature, B) developing, C) mature (white gonad increases in size), D) spawning and spent.

Histology of gonads (from a single location and single year) reveals that spawning occurs throughout the year but stops or is reduced in the mid-dry season (January to March) and mid-wet season (June to July). Peak spawning occurs between October and November, and April and May (Fig. 3). Further study is needed to generalize these findings for the Tanintharyi region.

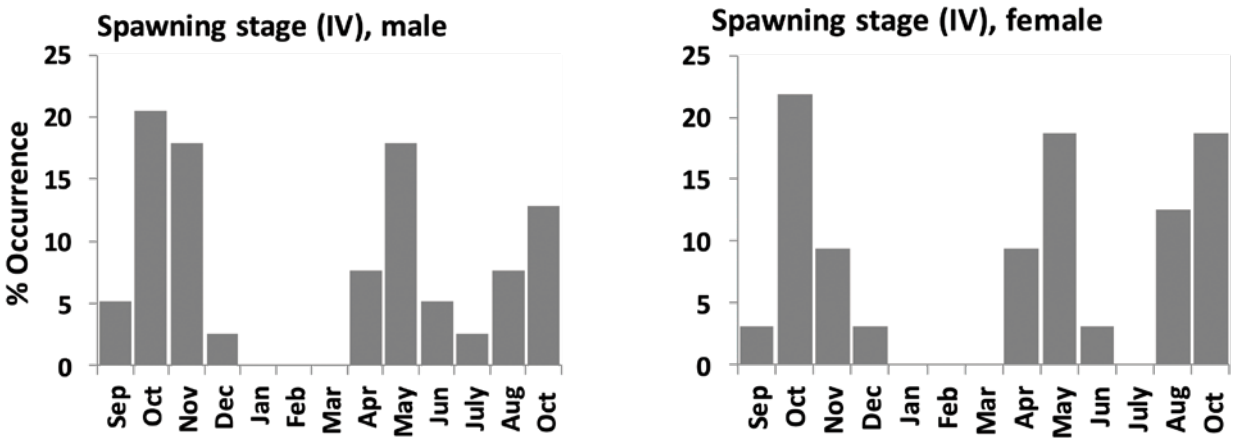

Fig. 3. Percentage occurrence of the spawning stage of male (left) and female (right) oysters sampled from September 2017 to October 2018.

Spat collection

Spat collection is an important stage in oyster culture. It involves collecting oyster larvae from artificial substrata. Of tested substrata, oyster shells, windowpane shells, and PET bottles have all proven effective as spat collectors. However, spat settling onto PET bottles more easily falls off than spat attached to shells. Windowpane shells are more practical than oyster shells because of their relative thinness and lighter weight. Windowpane shells are also much easier to drill for preparing spat collectors than are oyster shells, and more of their shells can be attached to a rope of spat collectors. From an environmental perspective, windowpane

shells are also preferable to PET bottles. Many windowpane oysters are harvested for food around Kywe ku Village in the Myeik area, and their discarded shells are free.

Site selection for oyster spat collection should be based on the presence of adult oyster stocks. The collection site should be sheltered from strong waves and currents that could damage collectors. We deployed our test collectors at three sites: Pedaing from December 2019 to November 2020, Panataung from March to November 2020, and Payel Kyun from May to November 2020. Windowpane oyster shells were drilled centrally and hung vertically from a 4.5-m-long string; batches of 5–10 shells were spaced at 0.5 meter intervals along this string from 1 m to 4 m depth (Fig. 4). Collectors were sampled monthly and replaced. The number of spat per shell was calculated.

Fig. 4. Installation of windowpane oyster spat collectors (upper), and oyster spats (lower).

Oyster spats generally occurred throughout the year, but this varied between sites (Fig. 5). Spats were most abundantly collected at Panataung. The lowest densities of newly attached spats occurred at Pedaing. Differences could be explained by the abundance of adult oysters nearby, or the distance from the nearest colony of adult oysters. Oyster spats were collected from each depth layer, with no obvious difference in abundance between layers.

Oyster spat 1 month in age can be easily recognized by eye. Spat collectors left submerged for more than 2 months became heavily biofouled (e.g., barnacles), smothering spats and weakening windowpane shells. We recommend removing spat lines just before 2 months from installation, because spats at this time are sufficiently strong to survive hand removal (small, young spats have very fragile shells) for transfer to the nursery stage of oyster culture.

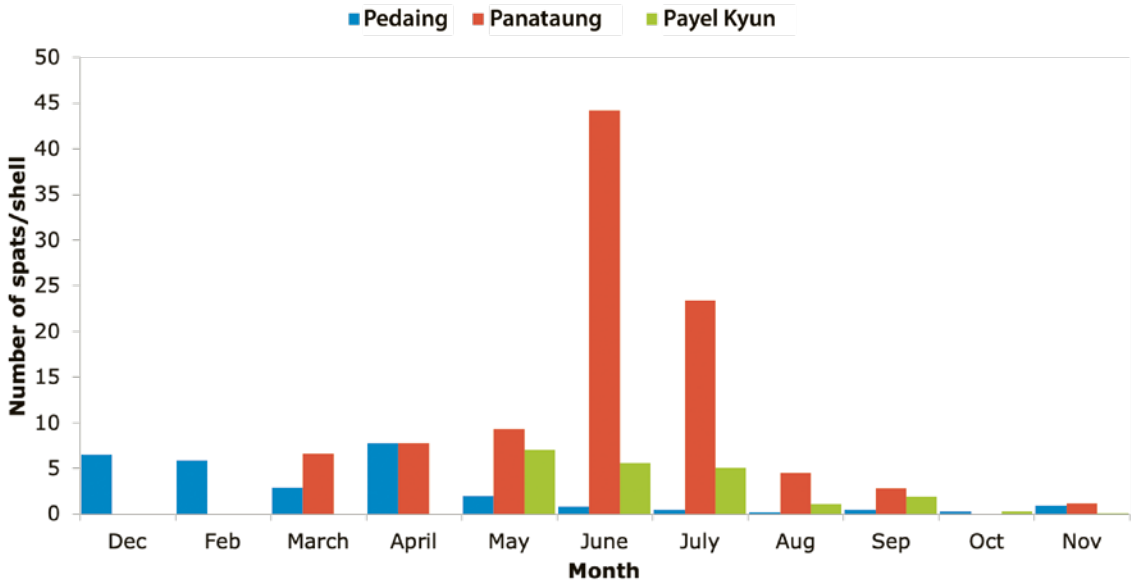

Fig. 5. Monthly abundance of oyster spats on windowpane oyster shells at three localities. Spat collection started in March at Panataung and in May at Payel Kyun.

Future of oyster culture in the Myeik area

Overall we demonstrate that coastal waters near Myeik have considerable potential to supply wild oyster spats for future aquaculture, independent of artificial seed production. Pioneers have commenced oyster farming in this area using creative techniques, collecting juveniles from wild sources such as the roots of mangrove trees or buying them from divers, cementing small oysters to ropes on floating cages. At present, production is not commercial. As long as wild oyster spat can be sustainably supplied, these farmers and those that follow will gradually develop a market and enlarge their business.

Suitable fishery grounds for oyster culture

Environmental conditions in coastal areas near Myeik are characterized by a mangrove delta, networks of creeks, discharge from the 300-km long Tanintharyi River (Fig. 6), a long rainy season from May through to October, and a large tidal range up to 6 m.

Tropical oyster fishery grounds around Myeik exist in mangrove creeks near Pedaing village, near the mouths of Thamoke and Kyaukpya rivers. Oysters also occur near Panataung and Payel Kyun villages. Areas near oyster natural habitats are likely to be suitable for their culture.

Of these areas, Kyaukpya River is a distributary of Tanintharyi River. During the rainy season this area is covered in freshwater (Fig. 7). However, 5 km upstream of the river mouth, saline water (>5) occurs near the riverbed at high tides even during spring tide period. This saline bottom water layer enables wild oysters on the riverbed to survive. During our survey, culture rafts had to be strong to tolerate the strong Kyaukpya River flow.

Fig. 6. Map of Myeik and nearby areas. Open circles identify locations of oyster fishery grounds. Closed circles show monitoring stations.

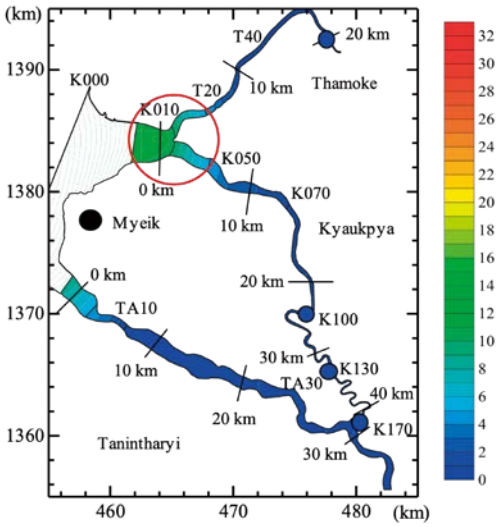

Fig. 7. Bottom layer salinity at high tide of spring tide in rainy season. The red circle indicates the location of oyster fishery grounds.

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In mangrove creeks separated from large river distributaries, salinity exceeding 10 is maintained during the rainy season (Fig. 8, top). Although the optimal salinity for growth and survival of tropical oysters is not yet fully understood, one study reported the larvae to grow in salinities ranging 12–30, with highest survival from 12–24 (Tan & Wong 1996). Adult oysters would tolerate lower salinity for short periods, but low salinities are not ideal for feeding.

Abundant phytoplankton (oyster prey) increases oyster growth implying accelerated harvest and more profitable oyster culture. Abundant food also increases glycogen accumulation and improves oyster palatability.

Phytoplankton production is generally low during the rainy season because river discharge renders water highly turbid. Our observations indicate chlorophyll fluorescence to be temporarily high at the beginning of the rainy season, but generally low thereafter (Fig. 8, bottom). The high bacterial abundance and organic matter that accumulates on the bottom of mangrove creeks in sediments could be resuspended by tidal currents and utilized by oysters for growth during the rainy season. One oyster farmer reported that oysters hanging from fish-cages took longer to reach market-size than wild oysters, which had settled on the bottom in mangrove creeks. Setting oyster-attached piles or oyster storage baskets on the creek bottom might improve oyster growth during the rainy season, if hypoxia does not occur. More growing techniques adapted to the local environments need to be investigated to improve oyster culture profitability.

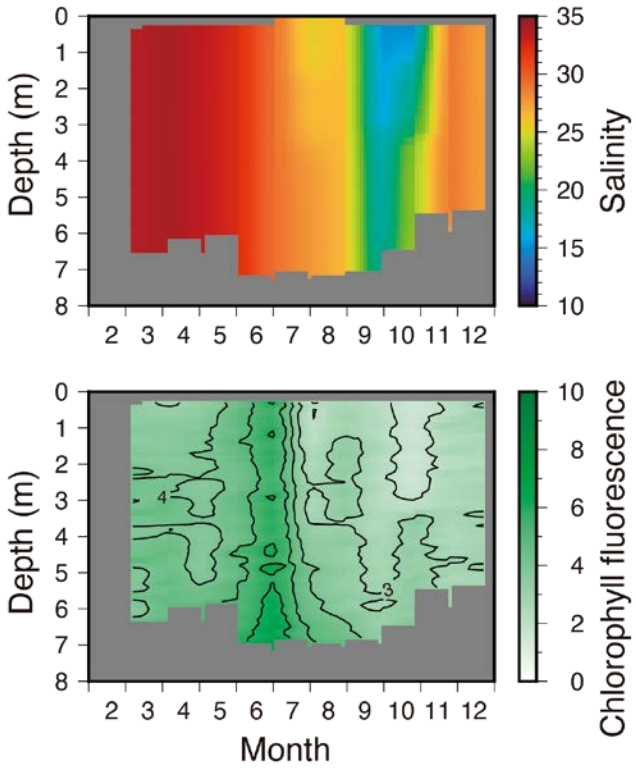
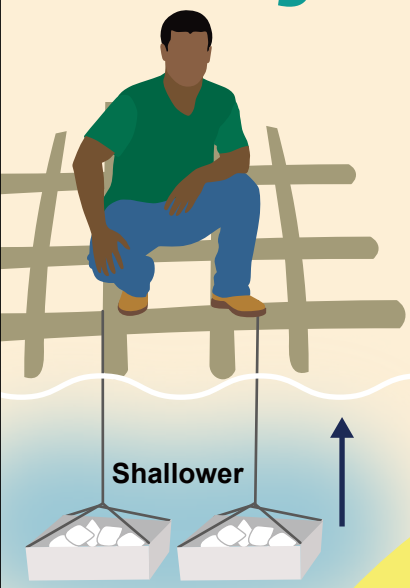


Fig. 8. Seasonal change of salinity (upper) and chlorophyll fluorescence (lower) at a monitoring station near Panataung village. The monitoring station locates in a mangrove creek and there is a habitat of wild oysters nearby.

In conclusion, oyster culture is possible anywhere in mangrove creeks near coastal Myeik. Low phytoplankton abundance during the rainy season could delay oyster growth and prolong maintenance before oysters reach market-size. Further investigation and trials are necessary to facilitate development of the oyster culture industry around Myeik.

Oyster culture calendar



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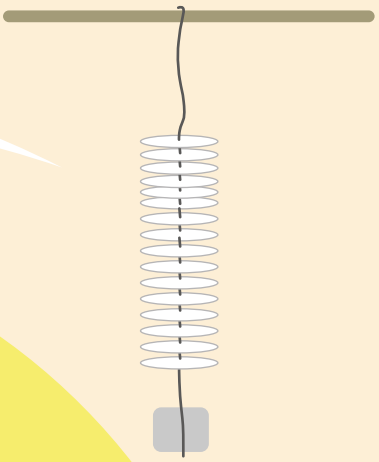

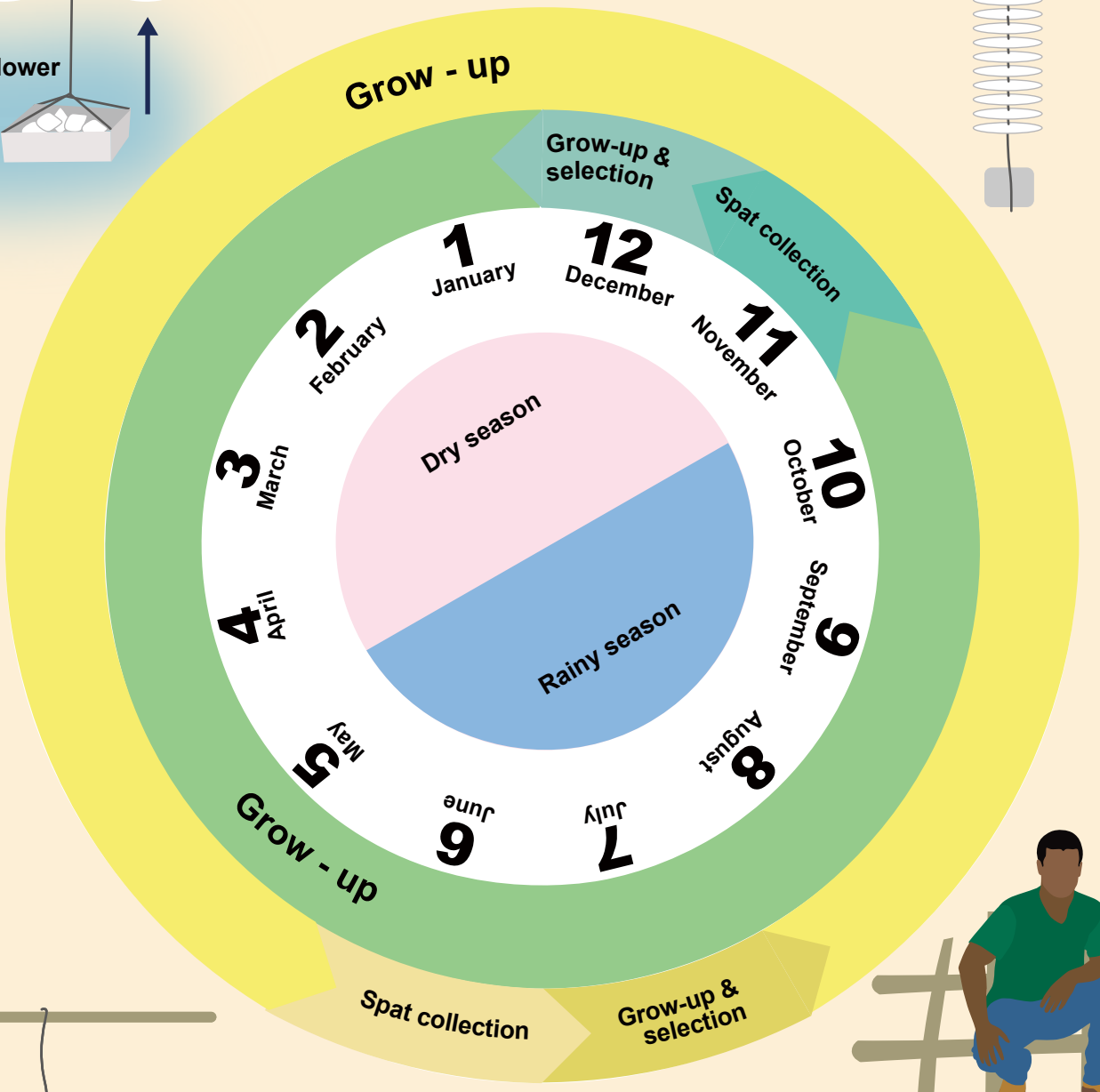

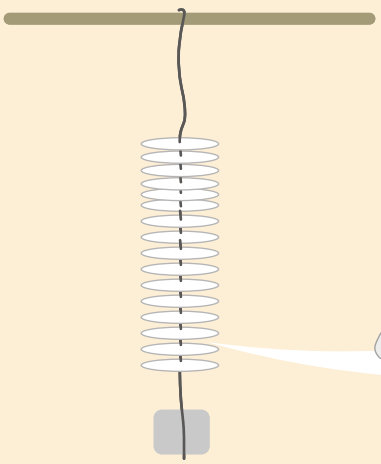

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