

## Conclusions Relating to Harbor Seal Pup Rehabilitation from the Case Studies

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At this stage of so few case studies, conclusions can only be in the form of strengthened or weakened hypotheses.

Some information pertinent to question 1, regarding the postrelease behavior patterns and survival of pups released at four months of age, was gained from the studies of the four pups released from the Exploris facility. The outcome in all four cases was different, leading only to the conclusion that successful adjustment to the wild cannot be taken for granted following this rehabilitation time. Although the pup who stranded postweaning did behave apparently normally within the local population after release, similar success was unable to be confirmed in the cases of three pups taken into rehabilitation shortly after birth.

Question 2 on whether it is possible to develop a high-fat, liquid formula so that the pup growth rate in rehabilitation may approximate that in the wild, was answered by pups 10 and 11 with some optimism. The high-fat formula with digestive enzymes fed to these pups did indeed enable them to grow only slightly more slowly than their wild counterparts. Their growth rate enabled them to be released within one to two weeks of the weaning period of the wild pups. However, the most critical features of the feeding—whether the fat content, enzymes, volume of frequency of feed—were not established and further improvements to the formula may be possible.

Question 3—Can pups, stranded at the nursing stage and released at four to five weeks of age, survive?—was answered with a resounding "Yes" by pups 10 and 11. After an initial week in shallow water in the vicinity of their release site, these two pups dispersed

to local foraging areas in the same areas as their wild counterparts. The evident attachment of one of the pups (pup 10, Tara) to her caregiver and release site did not prevent her developing normal foraging behavior and eventual social integration, and therefore appeared not to be maladaptive.

Question 4—Can pups rehabilitated in the postweaning period be successfully returned to the wild after only brief veterinary treatment or nutritional boost?—was answered in the affirmative by pup 9, despite her subsequent untimely death due to accident trauma. However, pup 13, stranded as a postweaning pup and retained in the aquarium until about four months of age, also survived and integrated socially after her release. It is possible that pups who have had a natural nursing period in the wild and perhaps some wild postweaning experience before stranding have a postrelease advantage over pups who have experienced only the rehabilitation environment since stranding shortly after birth.

### Thoughts for Discussion

Use of such a high-fat liquid formula should eliminate the necessity of training young pups taken into rehabilitation at an estimated age of six to seven weeks or younger to eat hand-fed dead fish. This practice, though nearly universal in seal rehabilitation facilities, is clearly unnatural and probably maladaptive. Wild seal pups are not fed solid food by their mothers after weaning and probably never consume prey they have not themselves caught live. Rehabilitated pups at Exploris fed on dead fish seem to gain weight so slowly that there would be no prospect of their release during the first 10 weeks of rehabilitation (see the weight gain for pups 12 and 13).

Furthermore, the pups will, at best, have to unlearn their learned response to dead fish while acquiring appropriate predatory skills. At worst they may try to put into effect their response to dead fish by following fishing boats, as apparently was the case of the pup reared by Picken (1978), or by raiding fishing nets, with potentially fatal outcome (I. Robinson, pers. comm.; Morgan et al. 1993). Although many rehabilitation facilities do introduce pups to live prey before their release, such experiences, although undoubtedly helpful to some degree (as perhaps in the case of pup 8, Pop), would be unable to re-create the realistic circumstances of fishing in deep water for small benthic prey in the natural environment.

There is most probably a problem of maladaptive positive buoyancy in pups released after three to four-plus months of rehabilitation, owing to inevitable excessive blubber accumulation coupled with inadequate muscle development. This could result in difficulty for the pup in accomplishing effective foraging dives at normal depths of up to 30 m. The diving times of pup 7 of this study were abnormally short (and therefore probably shallow); pup 8 successfully circumvented the problem by taking up residence for two months in a commercial harbor where she needed only to dive a few feet to catch her prey. Rehabilitator intuition to the effect that the heavier the pups are at their release, the better their chances of survival, may therefore be a misapprehension. The finding by Corpe et al. (1995) that bigger pups in the wild are better divers is unlikely to be directly relevant to rehabilitated pups, whose balance between blubber accumulation and muscle development will probably be abnormal.

Pup 10's weight drop from 19 kg to 15 kg over 13 days (at six to eight weeks of age) following her final formula feed represented a 21% weight loss, which is apparently normal (Muelbert and Bowen 1993). Her diving behavior from that time in a normal foraging area and subsequent rapid weight gain suggested that she (in common with 70% of the pups studied by Muelbert and Bowen [1993]) had begun to feed effectively within two weeks of weaning. However, to allow for rehabilitated pups being amongst the bottom 30% of slower-learning pups, it might be wise to retain a 18–19 kg pup for an additional week on the high-fat diet, to be released at 20–21 kg and thus allow a wider safety margin for "slow learners." A longer period than this might be counterproductive, since the pups would merely acquire the impediment of surplus blubber while missing the important postweaning developmental stage of inshore orientation and catching of diminutive prey.

Finally, it should be noted that some earlier follow-up studies of harbor seals released from rehabilitation or longer-term holding in captive facilities have found poor survival or abnormal behavior (Picken 1978; Harvey et al. 1983, Harvey 1987). However, a California radio-tagging study of rehabilitated pups indicated known (i.e., minimum) survival of 44% at 100 days (Morgan et al. 1993), and participation in local haul-outs by at least some pups. In contrast, Tougaard (1996) emphasizes that rehabilitation environments are totally unnatural and also claims that radio-tagging research in Denmark (details and sources not given) has shown that rehabilitated pups do not behave normally when compared to wild pups. Stranded harbor seal pups in Denmark are now euthanized, partly as a precautionary measure against the hypothetical spread of pathogens by rehabilitated pups after release (Tougaard 1996). However, an alternative approach might be to rethink and possibly consider some redesign of rehabilitation procedures for young

pups according to developmentally valid criteria.<sup>1</sup> Three of the case studies reported here have suggested that a revised approach might incorporate a much shorter time in rehabilitation and an exclusively liquid, high-fat diet during this period. The success of both old and revised approaches should continue to be tested with follow-up studies after release.

#### Endnote

<sup>1</sup>Although this discussion relates specifically to harbor seal pups, similar consideration might be given to the rehabilitation of pups of the grey seal and other phocid species, with due regard being paid to differences between species in natural preweaning and postweaning developmental parameters.

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