Otolith Asymmetry and kinetotic Behaviour of Fish in Parabolic Flights and under simulated Parabolic Flight “Micro”Gravity - a Drop-Tower Experiment

M. Knie, R. Hilbig, **R. Anken**

Zoological Institute, University of Stuttgart-Hohenheim, Garbenstr. 30, D-70593 Stuttgart, Germany

We have shown earlier that some fish of a given batch reveal motion sickness (a kinetosis) at the transition from earth gravity to diminished gravity. The percentual ratios of the various types of behaviour (normal swimming and kinetotic swimming; kinetotic specimens revealed looping responses/LR or spinning movements/SM), however, highly differed depending on the quality of diminished gravity (Anken and Hilbig, Microgravity Sci. Technol. 15: 52-57, 2004). Whereas kinetoses were exhibited by some 90 % of the individuals who had experienced flights at high quality microgravity (HQM, 10-6g, ZARM drop-tower), only some 15-25% (depending on the batch) of all animals had shown a kinetotic behaviour during parabolic aircraft flights (PFs; low quality microgravity, LQM, 0.03-0.05g). Probably, LQM is sufficient for most fish to be perceived - in relation to the individual shape or weight of otoliths and thus the performance of the vestibular system - and used as a cue for postural control. In striking contrast to the results gained using PF specimens, according to which otolith asymmetry (differences in the size and calcium incorporation of the inner ear stones between the left and right side of the body) was significantly higher in kinetotic specimens as compared to normally swimming fish, a comparable asymmetry between the kinetotically and normally swimming drop-tower samples could statistically not be verified (Anken et al., Adv. Space Res., submitted). The present study was designed to further elucidate the role of otolith asymmetry concerning an individually different susceptibility to kinetoses. In order to test, whether the differing results between the PF and the drop-tower experiment were based exclusively on the differing quality of diminished gravity, or, if further parameters of the PF and the drop-tower environment (e.g., vibrations and changing accelerations during PFs or the brisk compression of the drop-capsule at its release) need to be taken into consideration to explain the earlier results, drop-tower flights were performed at LQM. This simulation of PF “micro”gravity was carried out in housing larval cichlid fish (Oreochromis mossambicus) within a centrifuge at 0.03-0.05g during the drop-tower flights. The percentual ratios of the swimming behaviour at drop-tower LQM ranged between those of PF LQM and (drop-tower) HQM. This indicates that many normally swimming fish during PFs use cues other than the residual gravity (e.g., vibrations detected by the lateral line organ) as a cue for orientation. Details as well as data on otoliths will be communicated at

the meeting. Acknowledgement: This work was financially supported by the German Aerospace Center (DLR) (FKZ: 50 WB 9997/50 WB 0527).